Société de Calcul Mathématique SA
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# The battle against global warming: an absurd, costly and pointless crusade

White Paper

drawn up by the

Société de Calcul Mathématique SA
*(Mathematical Modelling Company, Corp.)*

*The mastiff Liberty growls and shows its sharp teeth.*
*Victor Hugo: Les Châtiments (Castigations)*

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## Summary

*From the Seine's cold quays to the Ganges' burning shores,*
*The human troupe skips and swoons with delight, sees not*
*In a hole in the ceiling the Angel's trumpet*
*Gaping ominously like a black blunderbuss.*

*Charles Baudelaire: La Danse Macabre (The Dance of Death),*
*in Les Fleurs du Mal (The Flowers of Evil)*

All public policies, in France, Europe and throughout the world, find their origin and inspiration in the battle against global warming. The initial credo is simple: temperatures at the surface of the planet have been rising constantly for the past thirty years, and human beings are to blame.

This is leading to all sorts of discussions, conferences and regulations, which are having an enormous impact on our economy. Every area of activity is affected: transport, housing, energy – to name just a few. Why do we need to save energy? It is quite simple: we have to reduce human impact on the planet. This is the fundamental credo.

The impact on the entire field of scientific research is particularly clear and especially pernicious. No project can be launched, on any subject whatsoever, unless it makes direct reference to global warming. You want to look at the geology of the Garonne Basin? It is, after all, an entirely normal and socially useful subject in every respect. Well, your research will be funded, approved and published only if it mentions the potential for geological storage of $CO_2$. It is appalling.

The crusade has invaded every area of activity and everyone's thinking: the battle against $CO_2$ has become a national priority. How have we reached this point, in a country that claims to be rational?

At the root lie the declarations made by the IPCC, which have been repeated over the years and taken up by the European Commission and the Member States. France, which likes to see itself as the 'good boy of Europe', adds an extra layer of virtue to every crusade. When others introduce reductions, we will on principle introduce bigger reductions, without ever questioning their appropriateness: a crusade is virtuous by its very nature. And you can never be too virtuous.

But mathematicians do not believe in crusades; they look at facts, figures, observations and arguments.

This White Paper is divided into three parts:

# Part 1: The facts

## Chapter 1: The crusade is absurd

There is not a single fact, figure or observation that leads us to conclude that the world's climate is in any way 'disturbed'. It is variable, as it has always been, but rather less so now than during certain periods or geological eras. Modern methods are far from being able to accurately measure the planet's global temperature even today, so measurements made 50 or 100 years ago are even less reliable.

Concentrations of $CO_2$ vary, as they always have done; the figures that are being released are biased and dishonest. Rising sea levels are a normal phenomenon linked to upthrust buoyancy; they are nothing to do with so-called global warming. As for extreme weather events – they are no more frequent now than they have been in the past. We ourselves have processed the raw data on hurricanes.

We are being told that 'a temperature increase of more than 2ºC by comparison with the beginning of the industrial age would have dramatic consequences, and absolutely has to be prevented'. When they hear this, people worry: hasn't there already been an increase of 1.9ºC? Actually, no: the figures for the period 1995-2015 show an upward trend of about 1ºC every hundred years! Of course, these figures, which contradict public policies, are never brought to public attention.

## Chapter 2: The crusade is costly

Direct aid for industries that are completely unviable (such as photovoltaics and wind turbines) but presented as 'virtuous' runs into billions of euros, according to recent reports published by the Cour des Comptes (French Audit Office) in 2013. But the highest cost lies in the principle of 'energy saving', which is presented as especially virtuous. Since no civilization can develop when it is saving energy, ours has stopped developing: France now has more than three million people unemployed – it is the price we have to pay for our virtue.

We want to cut our $CO_2$ emissions at any cost: it is a way of displaying our virtue for all to see. To achieve these reductions, we have significantly cut industrial activity and lost jobs. But at least we have achieved our aim of cutting $CO_2$ emissions, haven't we? The answer is laughable: apparently not. Global emissions of $CO_2$ have continued to rise, including those generated by France in designing and manufacturing its own products, as the Cour des Comptes clearly states. Quite simply, manufacturing that is held to be environmentally damaging has been relocated. So the same products are now being manufactured in countries that are far less respectful of the environment, and we have lost all the associated jobs. As Baudelaire says, 'Nature's irony combines with our insanity'.

### Chapter 3: The crusade is pointless

Human beings cannot, in any event, change the climate. If we in France were to stop all industrial activity (let's not talk about our intellectual activity, which ceased long ago), if we were to eradicate all trace of animal life, the composition of the atmosphere would not alter in any measurable, perceptible way. To explain this, let us make a comparison with the rotation of the planet: it is slowing down. To address that, we might be tempted to ask the entire population of China to run in an easterly direction. But, no matter how big China and its population are, this would have no measurable impact on the Earth's rotation.

French policy on $CO_2$ emissions is particularly stupid, since we are one of the countries with the cleanest industrial sector.

International agreements on the subject began with the Kyoto Protocol, but the number of countries signing up to this agreement and its descendants are becoming fewer and fewer, now representing just 15% of emissions of greenhouse gases.

This just goes to show the truth of the matter: we are fighting for a cause (reducing $CO_2$ emissions) that serves absolutely no purpose, in which we alone believe, and which we can do nothing about. You would probably have to go quite a long way back in human history to find such a mad obsession.

## Part 2: Scientific aspects

Having looked at the facts and their social impact, we now look at some more or less well-established scientific knowledge.

### Chapter 1: The natural variability of the climate

There have already been innumerable variations in the climate in the past, some of them enormous (such as glaciations). The main causes are linked to the Sun and the albedo of the cloud layer (does sunlight penetrate right to the ground, or is it reflected back by the clouds?). Human beings obviously have a role to play, but the natural causes of climate variations are never taken into account by the crusaders, who put all the blame on human activity.

### Chapter 2: Are human beings influencing the climate?

One might wonder whether human beings are influencing the climate, with their buildings, transport networks and very civilization. The answer is that their influence is tiny, quite negligible in comparison with natural causes. Nature makes major changes, human beings make small ones, which our natural arrogance lends a significance they simply do not have.

Insurance companies know what is what: the cost of natural phenomena (such as tornadoes, earthquakes and volcanic eruptions) is ten times greater than the cost of any man-made disaster.

Another vital question here: do human beings have the technological ability to change the climate? The answer is no: human beings can do nothing about solar activity, the state of the oceans, the temperature of the Earth's magma, or the composition of the atmosphere. On the other hand, human beings are very capable of getting worked up about all sorts of things, of 'skipping and swooning', as Baudelaire put it.

We should like to suggest here an especially interesting and original measure, which is akin to 'circulation alternée'[1]: to increase the Earth's albedo and thereby counter the greenhouse effect, only bald people should be allowed to go out on sunny days; people with a full head of hair should be allowed to go out only at night or on rainy days.

### Chapter 3: The consequences of so-called global warming

One might wonder about the potential consequences of so-called global warming for human beings and the natural world. The answer is very simple: the natural world will adjust very well, as it has always done. Plants, in particular, would enjoy an increase in $CO_2$ concentrations. In France, the positive effects would far outweigh the negative ones. If there were such a thing as global warming, then we should celebrate. And if it does not exist, then we shall simply have to carry on switching on the central heating nine months a year.

## Part 3: The IPCC

We are not in a position to question the composition of the IPCC, or its legitimacy and policy decisions, and we shall not do so. However, as mathematicians, we have every right to respond to the following question: if the IPCC's work were to be submitted for publication in a reputable scientific journal, would it be accepted? This decision is the task of a referee, in a procedure that is common practice in the sciences.

The answer is very simple: no sensible, high-quality journal would publish the IPCC's work. The IPCC's conclusions go against observed facts; the figures used are deliberately chosen to support its conclusions (with no regard for the most basic scientific honesty), and the natural variability of phenomena is passed over without comment.

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[1]This is a French measure whereby a ban is imposed on city-center traffic during periods of heavy pollution, with cars whose registration plates have even numbers and those with odd numbers being barred from the roads on alternate days.

The IPCC's report fails to respect the fundamental rules of scientific research and could not be published in any review with a reading panel.

## Conclusion: *"The mastiff Liberty growls and shows its sharp teeth"*

(Victor Hugo: *Les Châtiments* [Castigations])

In a democracy, there is an opposition, and this opposition has a right, in principle, to express its views: this is what distinguishes democracy from dictatorship. But when it comes to the questions about global warming that we are talking about here, the opposition – people who do not believe in global warming – have been told to shut up: no public debate, no contradictory discourse, no articles in scientific journals. They have simply been told that the case is proven and it is time to take action.

In law, there is a fundamental principle known as the 'adversarial principle'. A case can be thrown out of court if the defense is not informed of every known element of the accusation. Even if twenty people have witnessed the abominable criminal commit his offense, if the defense has not had access to blood-sample analyses, the case will be thrown out. In the case of global warming, a number of bodies are telling us they have all the evidence, but refuse to tell us what it is. The data have been processed, but how? Time series have been altered, but why? Some phenomena have been left out of the equation, but on what grounds? We do not know, and we are simply required to keep quiet and do what we are told. No second opinion is permitted.

It is on the debris of the fundamental principles of the law and of democracy that this White Paper has been written.

Bernard Beauzamy

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## Acknowledgements

Our previous work on these issues dates back to 2001, when we wrote a Note to the General Secretariat for National Defense (Prime Minister), entitled "Global warming: mystifications and falsifications" (in French). Other publications are available on our web site, at: http://www.scmsa.eu/rechauff0.htm (some are in French, some are in English).

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**About our Company** : SCM SA is a private company, established in 1995. We are doing mathematical models, mostly for decision help. SA means "Société Anonyme", which is the French equivalent to "Corp.". So a proper traduction of our name might be "Mathematical Modelling Company, Corp.". Please see our web site in English for further information about our activities :
http://www.scmsa.eu/accueil_e.htm

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Please send comments to contact@scmsa.com

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Comments received about this White Paper are available at:
http://www.scmsa.eu/archives/SCM_rechauffement_commentaires.pdf
(both in French and in English)

A second volume of the White Paper, entitled:
"The battle against global warming: social consequences"
is available in French:
http://www.scmsa.eu/archives/SCM_LBRC_vol2_2015_11_14.pdf

and in English:
http://www.scmsa.eu/archives/SCM_LBRCV2_2015_12_EN.pdf

# Part 1

# The facts

*The honest man steps back and stands aside*
*Victor Hugo: Les Châtiments (Castigations)*

# Chapter 1

## The crusade is absurd

## I. Temperatures

Before looking at modern temperature recordings and their limitations, we shall begin with a brief history of the subject.

### *A. History of measurement technologies*

#### 1. The historical development of measurement technologies

The history of meteorology, and particularly of the measurement of atmospheric temperatures, begins in ancient times, with the publication of Aristotle's *Meteorology* (in the fourth century BC). However, advances in scientific method and in the understanding of the physical variables associated with meteorology date from the seventeenth century, with the invention of the mercury thermometer and the barometer [see Civiate and Mandel].

The first really usable measurements in Europe date from the 1850s [see Info-Climat], with a hundred measurementsites spread throughout the continent, while the US has been relatively well provided with sensors since 1880. This information will be important later.

The technology for measuring temperature at ground level is fairly basic: the thermometers used more than a hundred years ago can be considered reliable.

Land-based measurement stations (also known as weather instrument shelters) comprise an array of sensors measuring various physical variables (including temperature, pressure and rainfall). These stations comply with the standards set by the World Meteorological Organization (thermometer between 1.25 and 2 meters above the ground, box painted white to reflect the sun, and so on).

Vertical exploration of the atmosphere was developed using hot-air balloons. On the first hot-air-balloon flight for scientific purposes, organized by the Académie des Sciences (French Academy of Science) in 1804, Jean-Baptiste Biot and Louis Gay-Lussac measured atmospheric pressure and temperature up to an altitude of 4,000 meters.

In 1892, Gustave Hermite invented the sounding balloon, which carries recording instruments that are recovered when they fall to the ground.

In the second half of the twentieth century, the use of satellites made it possible to establish a global database, particularly of atmospheric temperatures (at altitude). Since 1978, the data gathered by infrared sensors on National Oceanic and Atmospheric Administration (NOAA) satellites have been measuring both surface temperatures (using advanced high-resolution radiometers) and atmospheric temperatures at various altitudes (upper-air soundings). There are two types of weather satellite: geostationary satellites and polar-orbiting satellites.

Geostationary satellites always cover the same area (rotating at the same speed as the Earth). They locate cloud masses and identify the main clouds, operating at an altitude of approximately 36,000 km. The area covered by these satellites (orbiting at the level of the Equator) is adequate, except at the level of the Poles.

Polar-orbiting satellites have an almost circular orbit around the Earth, at much lower altitudes than geostationary satellites (about 850 km), and they pass close to the Poles. Unlike geostationary satellites, they do not allow for the monitoring of a specific area over time, but they do make it possible to monitor cloud masses at the Poles.

Temperature cannot be measured directly by satellite. In the case of a geostationary satellite, and in clear weather, temperature is obtained by applying Planck's law, which links the radiation emitted by a black body (on the surface – land and oceans) to temperature.

To determine the temperature at altitude, polar-orbiting satellites (orbiting at a lower level) use the absorption band of carbon dioxide, or of oxygen in cloudy weather. In both cases, the measurements are indirect.

Satellite measurements are inaccurate: parameters such as atmospheric pressure or wind speed are difficult to estimate by satellite, and the interaction of clouds with radiation is even less well understood. Infrared radars detect the highest clouds, but not those below them. Microwave sensors can see through cloud, but are poor at estimating distances.

This means that satellite measurements are reliable only in clear weather, and estimated temperatures must take into account the uncertainties associated with other parameters, which can be only poorly estimated.

The technologies used to measure temperature at sea are the same as those used on land, with weather buoys constantly measuring the temperature at sea level, as well as atmospheric pressure, wind speed and direction, and so on.

The most commonly used buoys are called drifting buoys, which can operate independently for a year, and are very light and easy to put in place. They have been used since the 1970s and transmit measurements by radio. They follow ocean currents and therefore never measure the temperature twice at the same point.

The other type of weather buoy is the moored buoy, which is very heavy and held in place by an anchor on the seabed. The advantage of moored buoys is their fixed position, which makes it possible to confirm and calibrate satellite data. However, they are extremely expensive and difficult to put in place, and there is not at the moment a global network of moored buoys.

As on land, weather satellite radiometers make it possible to measure the temperature at the surface, but they are dependent on local conditions.

To measure the temperature at sea, use is also made of research vessels, though they have an error margin of about 0.6°C (because the ship's sensor is close to the engine room).

### 2. Development of measurement station networks

At the end of the eighteenth century, the Société Royale de Médecine (French Royal Society of Medicine) was the first body to develop a network of observers to measure the temperature at various places in France (including Haguenau in Alsace, Dijon and La Rochelle). The monthly averages were published in the journal, *Histoire et mémoires de la Société Royale de Médecine* (History and Memoirs of the French Royal Society of Medicine) [see CNRS].

In 1849, the Smithsonian Institute, under the leadership of the physicist Joseph Henry, began to set up a network of weather observation stations in the US. The observations were quickly broadcast, thanks to Samuel Morse's invention of the telegraph in 1837.

Following the storm of 14 November 1854 that destroyed the French, British and Turkish fleets in the Black Sea, the director of the Paris Observatory created a measurement network to warn sailors of imminent storms. This meteorological service was gradually extended to Europe, with 59 measurement stations across the continent by 1865. The French service was named the Bureau Central Météorologique de France (French Central Meteorological Office) in 1878.

In 1873, the International Meteorological Organization (IMO) was founded in Vienna by countries with a meteorological service.

According to the Global Historical Climatology Network (a database managed by the National Climatic Data Center), 226 stations have been recording data for more than 150 years, mostly in Europe, and 1,656 stations have been in use for more than 100 years.

The map below shows the distribution and age of temperature stations. Europe has been well provided with sensors for more than 150 years, and the distribution of stations in the US has been satisfactory for more than 110 years.

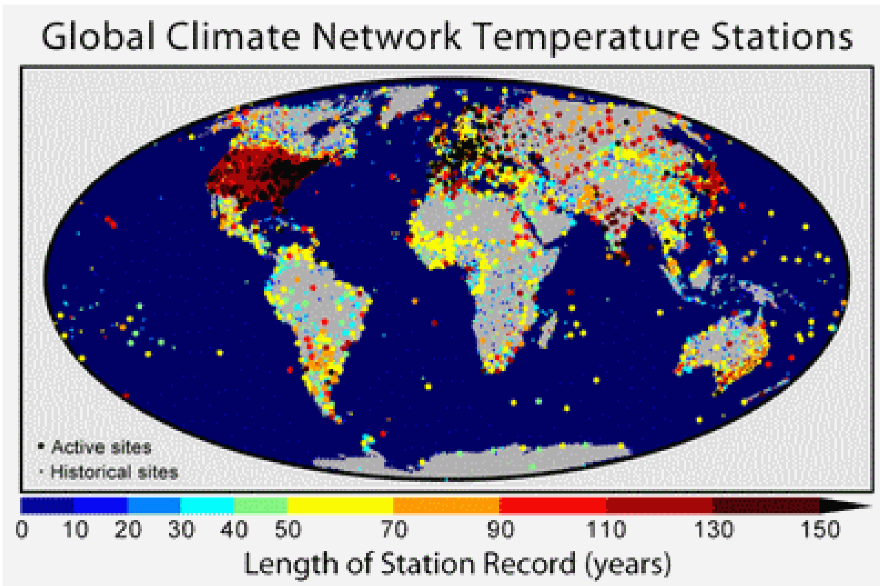



*Figure 1. Distribution and age of temperature stations*

## *B. Distribution of measurement stations*

### 1. Distribution of measurement stations in France

The Météo-France network of professional weather stations, which is known as the Radome network, comprises 554 stations in mainland France (one every 30 km) and 67 in the overseas territories. These stations automatically measure basic parameters (temperature and humidity under shelter), precipitations and wind (speed and direction) at a height of 10 meters.

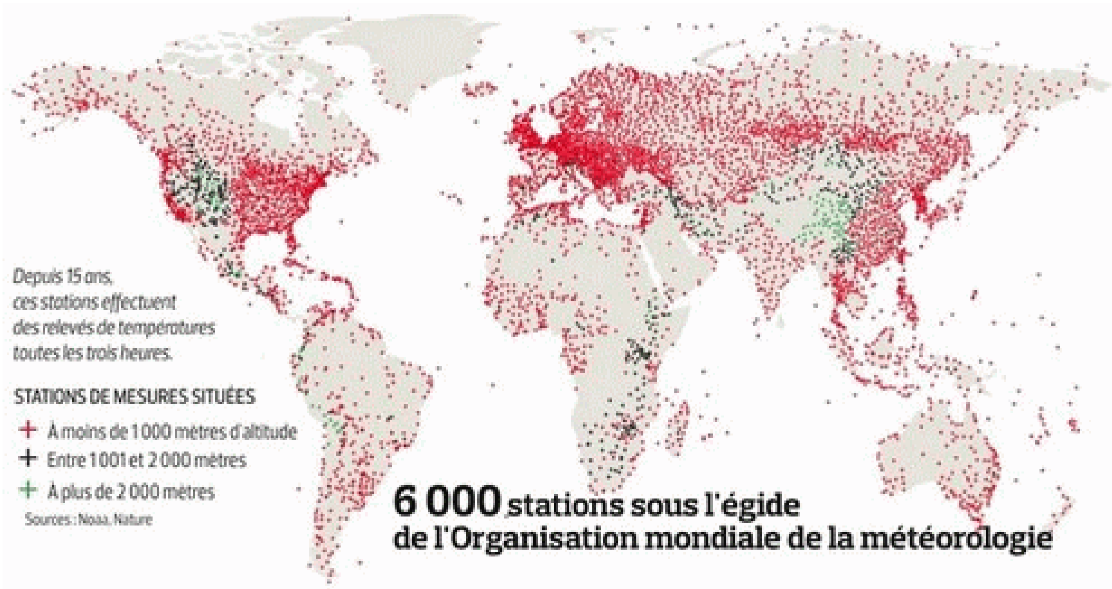
About fifty stations are part of the World Meteorological Organization's (WMO) World Weather Watch (WWW), with their data being fed into databases of model inputs for all countries.

*Figure 2. Map of measurement stations in France*

The map above shows the current distribution of measurement stations in France [see Météo France]. In our opinion, the stations used by Météo France (all points) are quite well distributed, while those used by the WMO (in blue) are poorly distributed.

It is not reasonable, today, to be using just 50 stations to cover a country as large and readily accessible as France. Why not use all existing stations? There is a strange story here, which we shall come back to later.

2. Globally (land-based)




Key

*For the past 15 years, these stations have been taking temperature readings every three hours.*

**LOCATION OF MEASUREMENT STATIONS**
+ At an altitude of less than 1,000 meters
+ At between 1,001 and 2,000 meters
+ At more than 2,000 meters
Source: NOAA Nature

**6,000 stations under the aegis**
**of the World Meteorological Organization**

*Figure 3. Global distribution of ground-based measurement stations in 2010*

The map in Figure 3 shows the distribution of the 6,000 measurement stations used by the WMO [see NOAA and Nature]. Europe (excluding France, Spain and Norway), the US and eastern China are well supplied with sensors, but this is by no means the case for the majority of land masses [see Surface Stations]. There are very few sensors in areas such as Greenland, northern Canada, central Africa and Australia. Globally, areas that are difficult to access, such as high mountain areas, deserts and forests, have few land-based measurement stations.

As we have seen, satellites measuring temperature using infrared make it possible to estimate surface temperature, but this technology is hugely dependent on local conditions (clear weather at the time of reading, absence of trees, etc.).

But remember: the NOAA says it is currently using just 1,500 of the 6,000 stations on the map, which is only a quarter. The NOAA explains this as follows: 'the number of land-based stations being used has fallen because of improvements in technology and the fact that data from old stations are no longer accessible in real time'. Which makes the inadequate sampling even more shocking.

The NOAA's argument that 'data are not accessible in real time' is not justifiable. A study of global warming does not require data in real time. It is enough for stations to submit their data once a year.

### 3. Globally (at sea)

As explained earlier, weather buoys are the most commonly used method of measuring temperature at sea.

According to the NOAA, there are currently 1,285 buoys operating in the world's oceans. The map in Figure 4 shows their distribution.

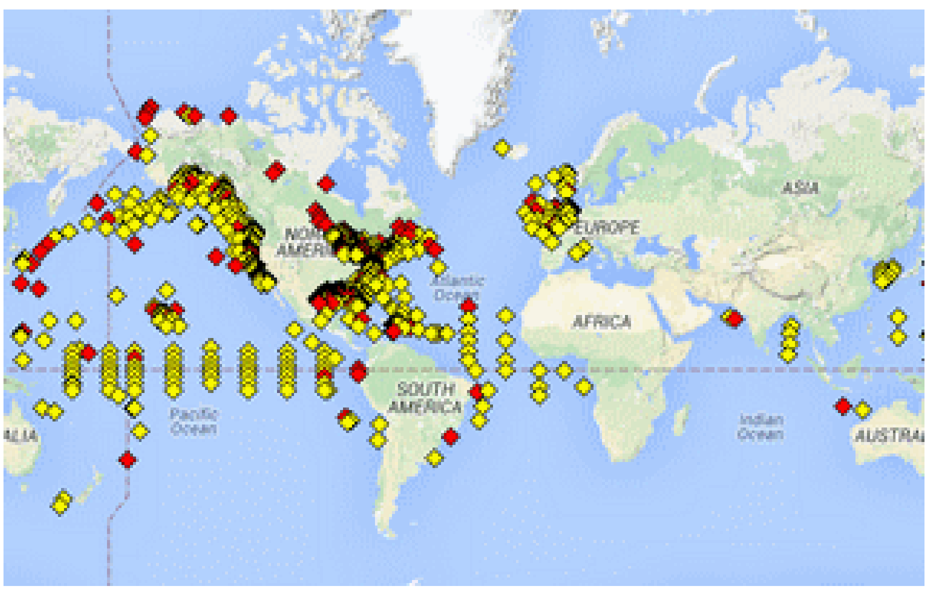



*Figure 4. Distribution of weather buoys*

The Gulf of Mexico and the west coast of the US are well provided with sensors. The distribution of stations in the Pacific Ocean is uneven, and is very inadequate in the Atlantic and Indian Oceans and at the Poles.

### 4. Critical analysis

Measurement instruments are not evenly distributed throughout the world. There are areas that are very well provided with both land-based and marine measurement stations, such as the UK and the US. Other areas are well supplied with land-based stations but have no readings at sea (East Asia and the Mediterranean coast). Alaska is well provided with marine sensors but has very few land-based sensors. Lastly, huge areas (the Indian Ocean, Australia, the North Pole, the North Atlantic and Canada) have very few sensors, on land or at sea.

Furthermore, the NOAA is using fewer and fewer stations to establish a global temperature profile, justifying this by technological advances and the difficulty of accessing data from old stations.

Let us make a rough analysis of how well stations are distributed. Let us say that the information provided by a sensor is representative of weather conditions in the surrounding 100 $km^2$.

The Earth has a total surface area of approximately 500 million $km^2$; this means that a reliable global analysis would require at least five million sensors, which is 1,600 times more than the 3,000 stations being used at the moment. And that is simply for the calculation of surface temperatures. This distribution would have to be repeated at every layer of the atmosphere and every depth of the seas.

This simple calculation clearly demonstrates that there are not enough stations to model the surface temperature of the globe, and satellites cannot replace surface stations. The reduction in the number of sensors being used is fundamentally unsound: temperature varies from one place to another, from one hour to the next, and this natural variability can be tracked only by a very dense network of sensors.

## *C. Recent temperature trends*

### 1. Data sources

Average annual temperatures are given on the NOAA site, in climate information sheets on the 'Climate Monitoring' page.

The annual figures published by the NOAA are mostly data in the form of 'temperature anomalies' (this is explained later, in section D,'Methodology: thinking in terms of temperature anomalies'). A temperature anomaly is the difference between the average temperature for the year in question and a long-term average (from 1880 to 2000), which serves as the baseline. According to NASA and the NOAA, these data are more appropriate for calculating averages over space and time because they are representative over much larger areas and longer periods than absolute temperatures (the explanation provided by the NOAA is given later).

However, these data are not very clear for the reader because these annual anomalies are calculated in relation to a 'sliding' baseline which changes every year. For example, the anomaly given for 2005 is in relation to the average between 1880 and 2004, the anomaly for 2006 is in relation to the average between 1880 and 2005, and so on. Worse still, data are sometimes referenced in relation to the period 1961-1990. Although using a baseline to establish long-term comparisons might initially seem to be a good idea, it loses all meaning if the baseline itself is variable.

It is fascinating to see that, on such a heavily debated subject, nowhere on the American Government site is there any mention of a simple, global figure: for year N, the averagetemperature is so much. This in itself is enough to set off alarm bells for any mildly curious scientist.

The data on global annual averages are very difficult to obtain, even for recent periods, because of the varied formats of NOAA information sheets.

## 2. Recent temperatures

The format of the NOAA's information sheets varies from one period to another, and it is difficult to find equivalent information. In fact, the absolute average temperature is almost never given explicitly, and all the values are anomalies in relation to the 'sliding' baseline we mentioned earlier.

We did manage to find, on the CRU website (the Climatic Research Unit, which is part of the University of East Anglia), an information sheet giving annual average temperatures since 1850. The temperatures are given in the form of anomalies in relation to the reference period 1961-1990. On the WMO website, we find that this reference average is 14°C.

Below is the histogram of annual average temperatures for the past 20 years.

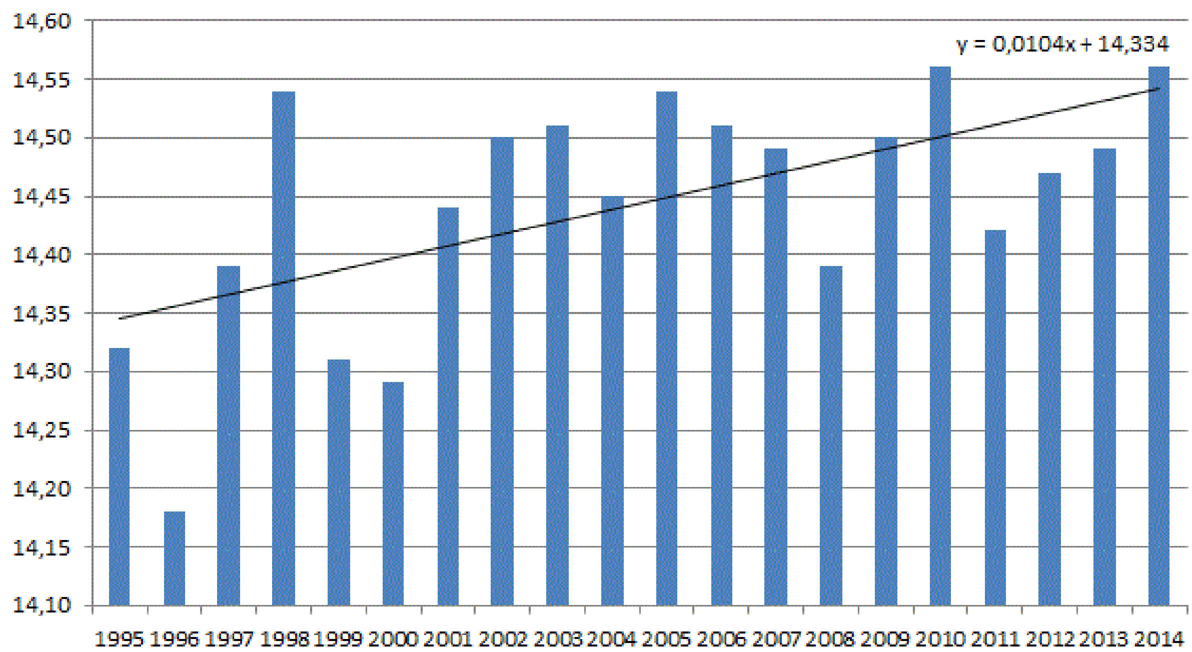



*Figure 5. Histogram of annual mean temperatures for the past 20 years (source: CRU)*

A linear regression gives us a slope of 0.0104°C per year, which is a rise of 1.04°C over 100 years.

There is something in this graph that is really interesting for scientists: you can see that, from one year to another, the calculated average temperatures are different. Now, the action of the Sun and geothermal energy are fairly constant. These inequalities are to do with the fact that sensors are unevenly distributed and that, from one year to another, it is hotter in one place or another. What we have here then is evidence that the number of sensors is inadequate. So, in these conditions, one cannot come to any conclusion about climate change in any sense. All that we are recording (today and even more so in the past) are variations that derive simply from inadequate observations.

This simple observation – the average temperatures recorded vary from year to year. Why? – is never analyzed by the scientists responsible for these matters.

## *D. Thinking in terms of temperature anomalies*

### 1. Introduction

Most websites on global warming provide data on temperatures. However, the parameter considered is not the temperature itself but an ‘anomaly’, that is to say a discrepancy in relation to an average temperature.

This average is for a so-called reference period, which serves as a basis for temperature comparisons. This reference period is 1951-1980 for NASA, and 1961-1990 for the NOAA.

The temperature anomaly is therefore the difference between the temperature recorded and theaverage temperature over the reference period.

## 2. Why think in terms of anomalies?

Here is the NOAA's explanation for its decision to use temperature anomalies rather than absolute readings [NCDC]:

*'Absolute temperatures are difficult to use for several reasons. Some areas have only a few measurement stations, and interpolations have to be made over vast expanses. In mountainous areas, most observations come from inhabited valleys, so altitude has to be taken into account in average temperatures for a region. For example, a summer month might be colder than usual, both at the top of a mountain and in a nearby valley, but the absolute temperatures will be very different on the mountaintop and in the valley. The use of anomalies in such a case will show that temperatures are below average in both places.*

*So large areas are analyzed using anomalies rather than absolute temperatures. Anomalies give a more accurate picture of climate variability over a large area than absolute temperatures would, and make it possible to compare areas more easily.'*

The word 'anomaly' is loaded in itself and not very scientific; it gives the reader the idea that there is going to be something abnormal, whereas it simply concerns the difference in relation to a reference period.

## 3. Flaws in the thinking

The NOAA explains that thinking in terms of anomalies makes it possible to 'smooth out' temperature discrepancies from one place to another. This implies having measurement stations in both places – in this case, to use our earlier example, at the top of the mountain and in the valley. So why not use absolute temperatures? Thinking in terms of anomalies is simply a method of processing raw data and, if there is an error in a temperature value, then this will necessarily affect the anomaly.

Also, a temperature anomaly in relation to a reference period implies careful consideration of the choice of reference period. NASA and the NOAA use averages over 30 years (1951-1980 for NASA, and 1961-1990 for the NOAA).

NASA's data cover only the US, giving temperature anomalies between 1880 and 2010 in relation to the 1951-1980 average. But we have already seen that there have been a large number of evenly distributed measurement stations in the US since 1880.

A question immediately comes to mind: if there has been a reasonable amount of good-quality data since 1880, why use the reference period 1951-1980 instead of the period 1880-2010? It seems logical to choose the longest possible reference period, and the quality of the American system means this can go back as far as 1880.

We find a similar situation in Europe, which has access to good-quality data dating back to 1850, yet the NOAA chooses to use the reference period 1961-1990.

There is a contradiction on the NOAA website, in the 'Warming Climate' section of the 'Global Climate Change Indicators' page. In this section, temperatures are now given as absolute temperatures rather than in terms of anomalies.

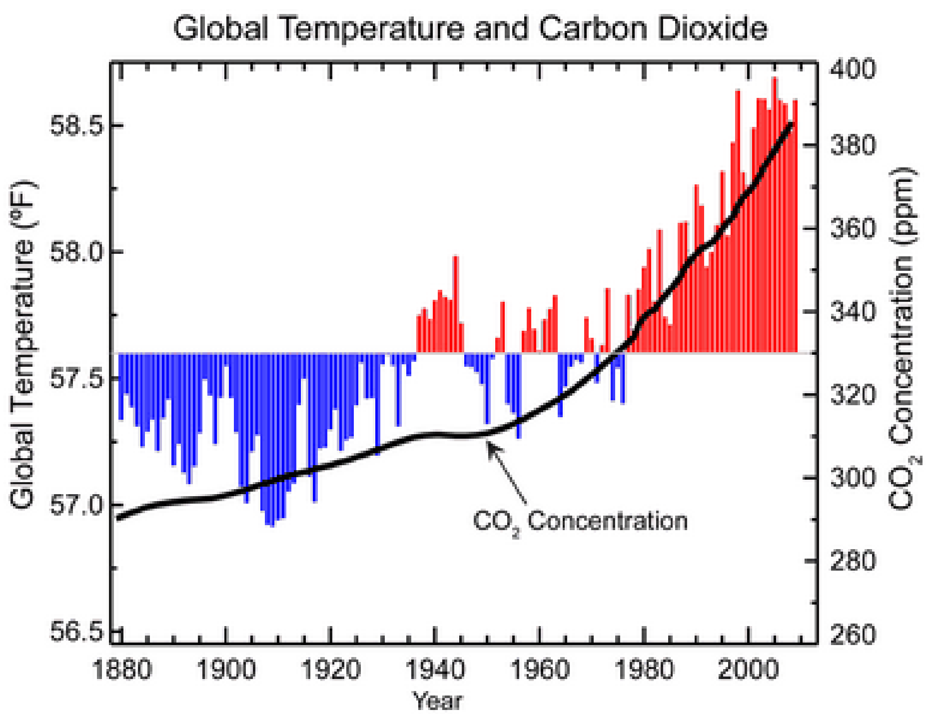



*Figure 6. Graph of temperatures between 1880 and 2010 (in °F)*

Here too, a reference period is used as a standard, but using an arithmetic mean for the period 1901-2000. This reference temperature is 57.6°F, or 14.2°C. There is reason to question the choice of this reference temperature, which involves using a color code to interpret the graph, when a comparison with 0°C would have been more logical.

So the format of this graph (color-coded 'reverse histogram') encourages the reader to interpret it as showing a recent rise in temperatures. The graph also shows the $CO_2$ profile, and the graph's format might lead to a misreading: the reader will be tempted to see a correlation between temperature and $CO_2$, when in fact the two profiles are different between 1880 and 1980, and a simple change in the scaling of the axes would alter the shape of the $CO_2$ curve, destroying the visual link the reader has been tempted to make.

As we said earlier, thinking in terms of anomalies makes no sense if the reference period varies from one organization to another (and even within an organization, as in the case here of the NOAA).

Let us state this clearly: there is absolutely no scientific justification for presenting data in terms of anomalies. It is tendentious and encourages conclusions concerning global warming. One has every right to expect to be given a simple, global figure, which would simply be the average of values recorded locally. This figure would not have any particular practical value (since, as we have seen, there are not enough sensors in some areas), but one could at least compare values from one year to another.

However, on a totally different note, we shall see that the very definition of a global temperature for the Earth poses some serious problems.

How do you define an 'average temperature'? There are, of course, several types: arithmeticmean (sum of values divided by number of readings), geometric mean (less sensitive to extreme values), and thermodynamic mean(more complex, based on thermodynamic equations). We are going to look at the various possibilities. The astonishing thing is that none of the organizations with any kind of responsibility for global warming has ever asked this question!

## 4. How do you define and calculate an average temperature?

The competent organizations use anarithmeticmean, adding up all the temperature readings available and dividing the total by the number of sensors. But this poses some serious problems, as we shall now see.

First of all, let us imagine a simple situation: two sensors, each monitoring an area of 1 $km^2$. The first gives a reading of 10°C, while the second gives a reading of 12°C. One is tempted to say that the overall average (covering 2 $km^2$) is 11°C. We shall see later that this simple reasoning is not correct.

Now let us imagine that one of the sensors covers 1 $km^2$, while the other covers 5 $km^2$. The sensors are still giving readings of 10°C and 12°C. How are we going to calculate the average temperature? Nobody knows!

Now let us imagine a more difficult situation, which is what happens in reality: one of the sensors is monitoring 1 $km^3$ of the atmosphere, while the other is monitoring 3 $km^2$at the surface. How do you calculate the average temperature of this surface-atmosphere combination?

Nobody can answer these questions, and nobody even dares to ask them. Let us go back to the basics of physics, to try to understand what a temperature is.

a. Definition

A system comprises particles (atoms, molecules and ions) which are in perpetual motion (chaotic motion in the case of fluids and gases; oscillations around a point of equilibrium in the case of a crystal lattice).

Temperature is a macroscopic measurement of the molecular agitation of the system. It represents the average energy of a molecule. The higher the temperature, the greater an atom's oscillations around its average position. But this definition is not quantitative.

The basic unit of the international system is the Kelvin (K). Zero Kelvin (absolute zero) is the temperature that corresponds to the weakest molecular agitation.

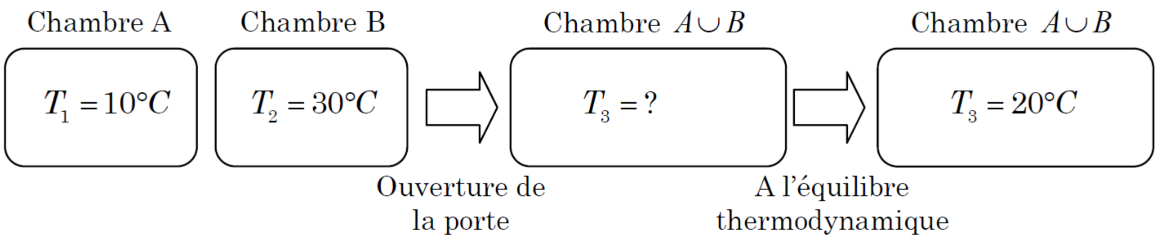
Temperature is an intensive variable: it does not depend on the quantity of material present and it is the same throughout the system. Let us take the example of two rooms, A and B, separated by a door, in which the temperature is respectively 10ºC and 30ºC. When you open the door, the temperature in the $A \cup B$ system is not 40ºC, but an intermediate temperature throughout the space.

By contrast, volume is an extensive variable, dependent on the quantity of materialpresent. Let us take rooms A and B again and suppose that their volumes are respectively 10 $m^3$ and 20 $m^3$. The volume of the whole space, the $A \cup B$ system, is 30 $m^3$.

b. Pertinence of an average temperature

As explained earlier, temperature is an intensive variable. Therefore, if we once again use the example given above, it is impossible to add together the temperatures of the two rooms.

Let us imagine that, before we open the door, rooms A and B are adiabatic systems (no heat source, no heat sink, and no heat exchange with the outside) in thermodynamic equilibrium: this means that in room A (and respectively room B), the temperature is the same throughout and is 10ºC (or respectively 30ºC). When the door is opened, heat exchanges take place until equilibrium is reached. Once thermodynamic equilibrium has been reached, the temperature is the same throughout the two rooms, and the 'average' temperature can be measured (there are variations, but only at the microscopic level).

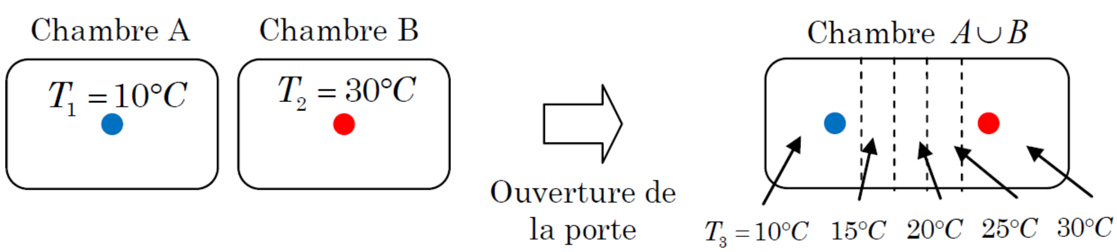



Key: Chambre = Room; Ouverture de la porte = Door opens; A l'équilibre thermodynamique = Dynamic equilibrium reached

The Earth is not an adiabatic system: it has heat sources and heat sinks. Thermodynamic equilibrium is never reached. Let us return to the two rooms:

- room A contains an air-conditioning unit cooling the room to 10ºC;
- room B contains a radiator heating the room to 30ºC.

Heat exchanges occur when the door is opened, with the system stabilizing itself by forming a temperature gradient between the cold source and the heat source. If we calculate the average temperature of the $A \cup B$ system, we get 20ºC. But this average temperature is not representative of the temperature everywhere in the room.




Key: Chambre = Room; Ouverture de la porte = Door opens

Determining an average temperature for a system as complex as the Earth has no physical meaning. Unfortunately, this question, fundamental though it is, has never been tackled by organizations involved in meteorology. For them, the answer is simple: you take all the sensors and calculate the average!

Quite apart from the question of the significance and pertinence of global temperature, it is also reasonable to question whether this variable can actually be calculated with any reliability.

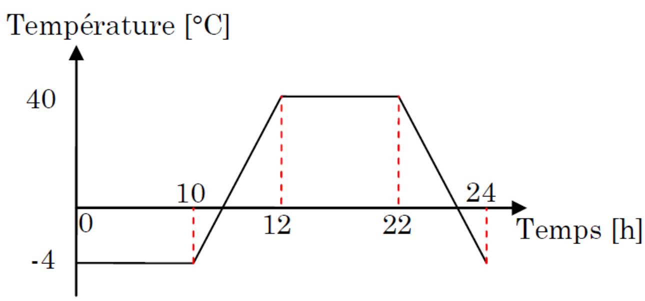
To explain more clearly the error in calculating an average for an intensive variable, let us take the example of speed. When a hare moves at a speed of 9 km/hr and a tortoise moves at a speed of 1 km/hr, the average is as follows:

- arithmetic mean: $\frac{(9+1)}{2}$ =5 km/hr for the hare-tortoise system;
- harmonic mean: when they travel a distance of 1 km, the hare will take about 6 minutes and 40 seconds, and the tortoise will take an hour. This means that the hare-tortoise system takes 1 hour 6 minutes and 40 seconds to cover a distance of 2 km. Their average speed is 1.8 km/hr.

The method used to calculate the average affects the result.

Now let us take the example of a room with a temperature that fluctuates over time as follows:

- -4°C from 0.00 hrs to 10.00 hrs;
- a temperature rise from -4°C to +40°C between 10.00 hrs and 12.00 hrs;
- 40°C from 12.00 hrs to 22.00 hrs;
- a temperature drop from 40°C to -4°C between 22.00 hrs and 24.00 hrs.




Key: Température = Temperature; Temps (h) = Time (hr)
Arithmetic mean: $T_{average} = \sum T/n$ ; or 13.6°C
Integral: $T_{average} = \frac{1}{24} \cdot \int_0^{24} T(t) \cdot dt$; or 18°C

We can see again from this example that the method used to calculate the average has an influence on the result. According to the integration method, the average is 18°C, which is a comfortable temperature for people. However, this average temperature of 18°C occurs during a short period (twice a day) and the periods of high and low temperatures would prevent any normal life in this environment. So the average temperature is of no practical significance.

None of the methods enable us to represent the actual temperature of the room over a day.

The term 'average temperature' isa scientific aberration, and all the more so when this variable is being calculated for a system with enormous disparities over time and space. The average temperature does not correspond to any immediate, local, perceptible reality. There are two factors to be taken into account: time and space.

c. Calculation of average temperature

Several methods have been suggested for determining the Earth's temperature. We are going to present two of them here, and comment on them.

- **Thermal mean**

All bodies, whatever their state (solid, liquid or gas) emit electromagnetic radiation, which travels in a straight line at the speed of light and is made up of rays.

The Stefan-Boltzmann law enables us to link the luminosity emitted by a black body with a surface area of $A$ [$m^2$] with temperature and the constant $\sigma = 5.67 \cdot 10^{-8}$ [$W.m^{-2}.K^{-4}$], according to the equation:

$$\Phi = A\sigma T^4$$

By definition, a black body absorbs all the radiation it receives. However, the Earth is not a black body, because some of the Sun's rays are reflected by the oceans and ice sheets, and also by land masses. It is impossible to use this method to determine global temperature.

- **Thermodynamic mean**

As we explained earlier, temperature is a representation of the oscillation of molecules. It is possible to use statistical models to find a correlation between temperature and energy. The difference between the two is that temperature is an intensive variable, while energy is an extensive variable. This means it is possible to add the energies together and obtain an average. The difficulty is in taking account of the many relations that make it possible to link temperature and energy, which vary depending on the system being studied (solid, liquid or gas).

For example, the internal energy, U, of a system is:

- for a monatomic ideal gas: $U = \frac{3}{2} nRT$
- for a polyatomic ideal gas: $U = nC_{Vm}T$
- for a condensed phase: $U = nC_{Vm}T + Ep_{\text{int}}$ or $dU = nC_{Vm}dT$

The different variables are defined in the following table:

| | |
|---|---|
| $T$ | temperature [K] |
| $U$ | internal energy [J] or [$kg.m^2.s^{-2}$] |
| $n$ | molar quantity of atom [mol] |
| $R = 8.314$ | constant of ideal gases [$J.K^{-1}.mol^{-1}$] |
| $C_{Vm}$ | molar heat capacity at constant volume [$J.K^{-1}.mol^{-1}$] |
| $Ep_{\text{int}}$ | constant energy because volume is constant [J] |

Although it is possible to make an energy assessment of the planet and determine an average energy, it is, by contrast, impossible to reach a temperature value without making an aberrant hypothesis: 'Earth is an ideal gas'.

d. The averages currently being used

With regard to these explanations, we have looked into what is being done in practice. International bodies all seem to be using the arithmetic mean to establish the average for the reference period. In Canada, for example, the average is, 'an arithmetic mean over the period in question'. According to the British Met Office, 'The global average temperature is the arithmetic mean of the northern hemisphere average and the southern hemisphere average.'

This type of reasoning is being used by all the international bodies, and one might legitimately question its validity. The thermodynamic mean, for its part, is too complicated to apply and requires the use of models (with all their limitations and uncertainties).

We might, however, wonder why the arithmetic mean is also being used in areas that are less well provided with sensors or have very high or very low temperatures. If we content ourselves with an unweighted arithmetic mean, then areas with the highest density of sensors are going to be over-represented!

Our conclusion here is very clear:

- to calculate the arithmetic mean for the entire planet makes no sense and can only lead to errors;
- you can calculate the arithmetic mean for areas well provided with sensors (Europe and the US), and compare the values from one year to another. This might provide information on local climate variation.

## *E. Disinformation*

### 1. Study of NASA data

A publication by Hansen et al, 1999 [Hansen 1], which is available on the NASA website, analyzes temperature changes on the Earth's surface for the period 1880-1999. This analysis is based on measurements recorded by weather stations.

We are interested in a graph (Figure 6, page 37 of the publication), which shows temperature anomalies in the US between 1880 and 2000, in relation to the reference period 1951-1980.

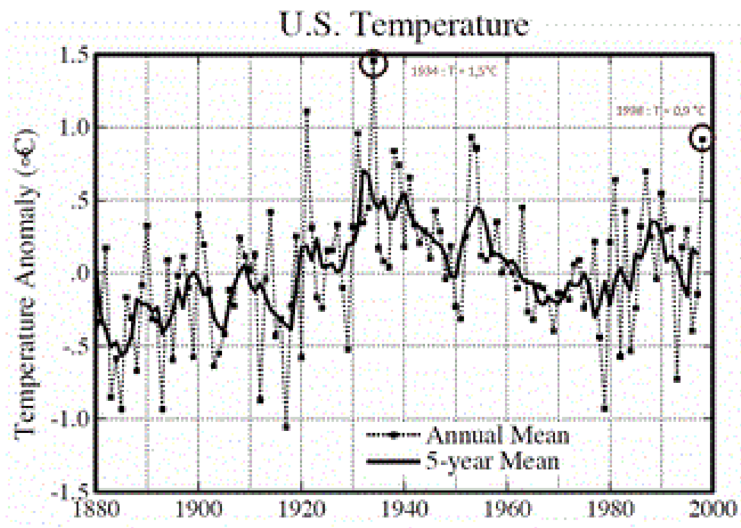



*Figure 7. Annual mean and five-year mean temperature anomalies for 48 US states, in relation to the reference period 1951-1980 (1999 version)*

Between 1880 and 1930, temperatures rise by 0.8°C, with a peak of 1.5°C in 1934. Between 1930 and 1970, temperatures fall by 0.7°C. Lastly, from 1970 to 1990, temperatures rise by 0.3°C, with a peak of 0.9°C in 1998.

The 1999 data were later corrected by NASA in 2001 because, at the time, they had failed to take account of the movement of weather stations (we have no idea what ‘movement’ they are talking about!) and changes in observation periods (idem). After correcting the databases, NASA obtained the following graph [Hansen 2]:

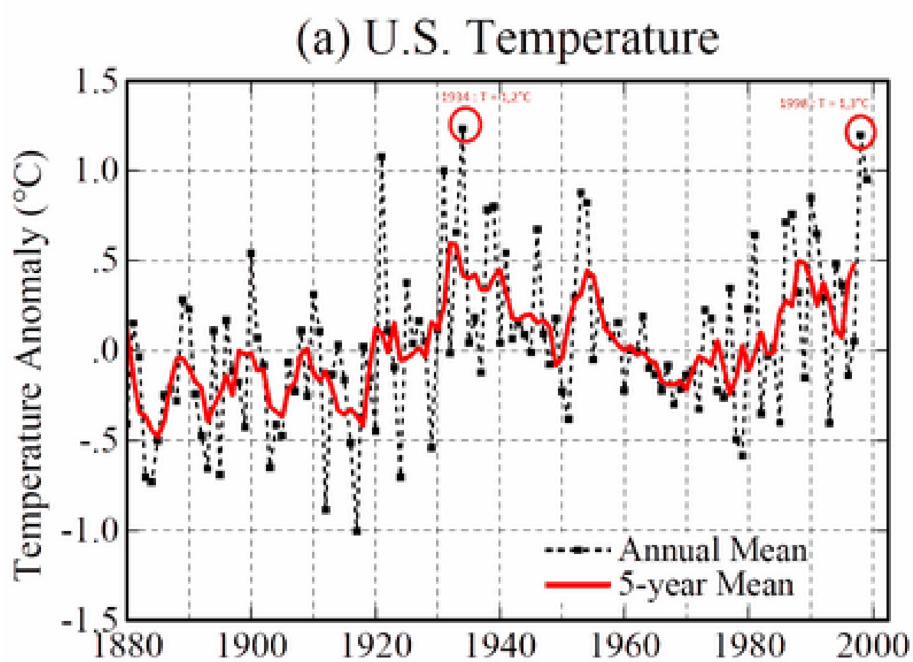



*Figure 8. Annual mean and five-year mean temperature anomalies for 48 US states, in relation to the reference period 1951-1980 (after corrective updating in 2001)*

Temperatures rise gradually from the 1880s to the 2000s. The corrections mean that the peak anomaly of 1934 is reduced from 1.5°C to 1.2°C, whereas the 1998 temperature peak rises from 0.9°C to 1.3°C after the adjustments.

## 2. Study of corrections made by NASA

The new publication by Hansen et al, 2001 [Hansen 2], which is also available on the NASA website, uses changes in the analyses of the Goddard Institute for Space Studies (GISS) and the United States Historical Climatology Network (USHCN) to explain the corrections made to the 1999 data.

The adjustments made by the USHCN are shown in Figure 9.

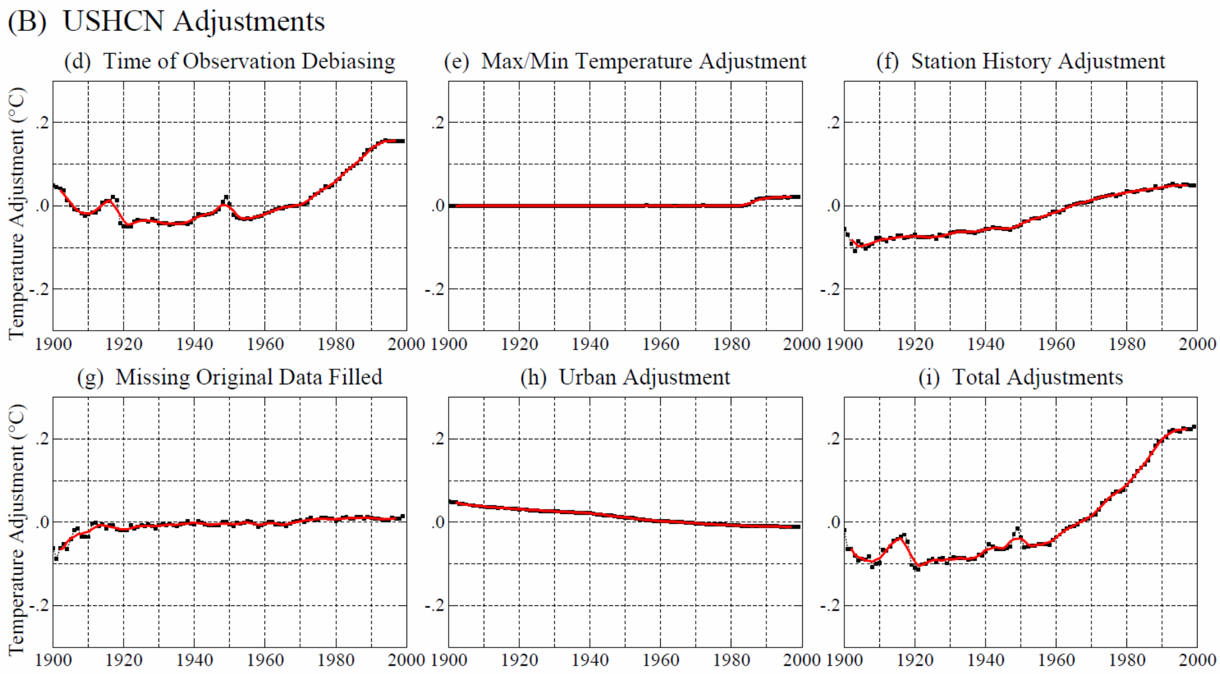



*Figure 9. USHCN corrections (2001)*

The adjustments made by the GISS are shown in Figure 10.

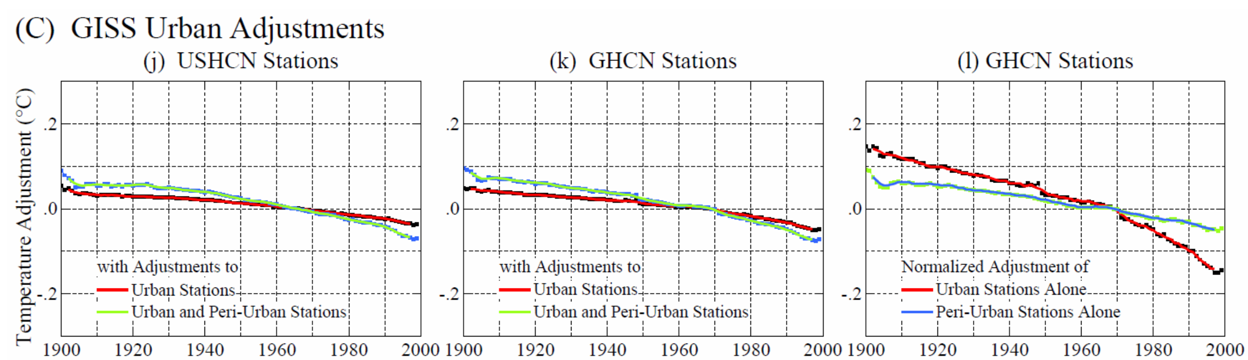



*Figure 10. GISS corrections*

Lastly, using raw data, Figure 11 gives the picture following the various corrections:

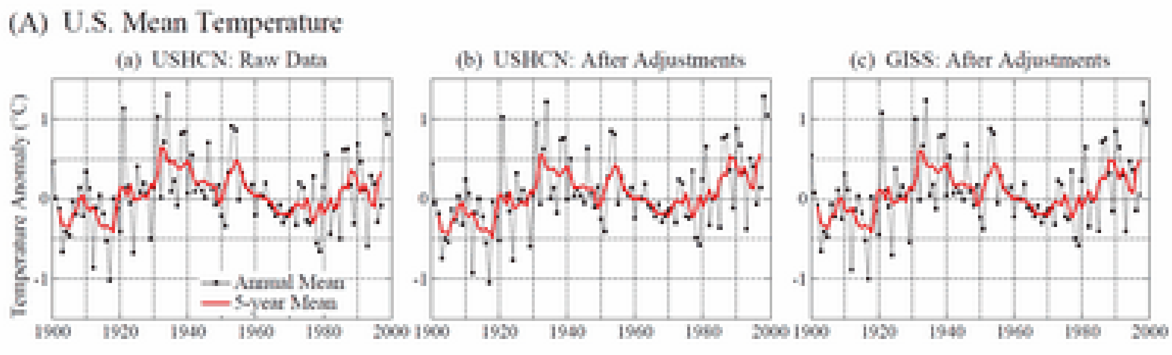



*Figure 11. Summary of USHCN and GISS corrections*

After the corrections, the general trend of the curve peaks is less severe between 1900 and 1970. The peaks for 1920 and 1934 are smaller. By contrast, the general trend of peaks after 1970 is accentuated, with steeper peaks for 1990 and 1998 in particular.

As we have said before, it is legitimate to correct a set of data only if the corrections are applied to all the data; if you make corrections only from a certain date onwards, then you falsify comparisons.

**3. Study of EPA data**

The United States Environmental Protection Agency (EPA) recorded annual heat waves (Heat Wave Index) in the US between 1895 and 2013 [see EPA].

A heat wave is a prolonged period during which it is abnormally hot. According to the EPA, there is no universal definition of a heat wave. The EPA defines a heat wave as a period lasting at least four days with an average temperature that would only be expected to occur once every ten years (based on the historical record).

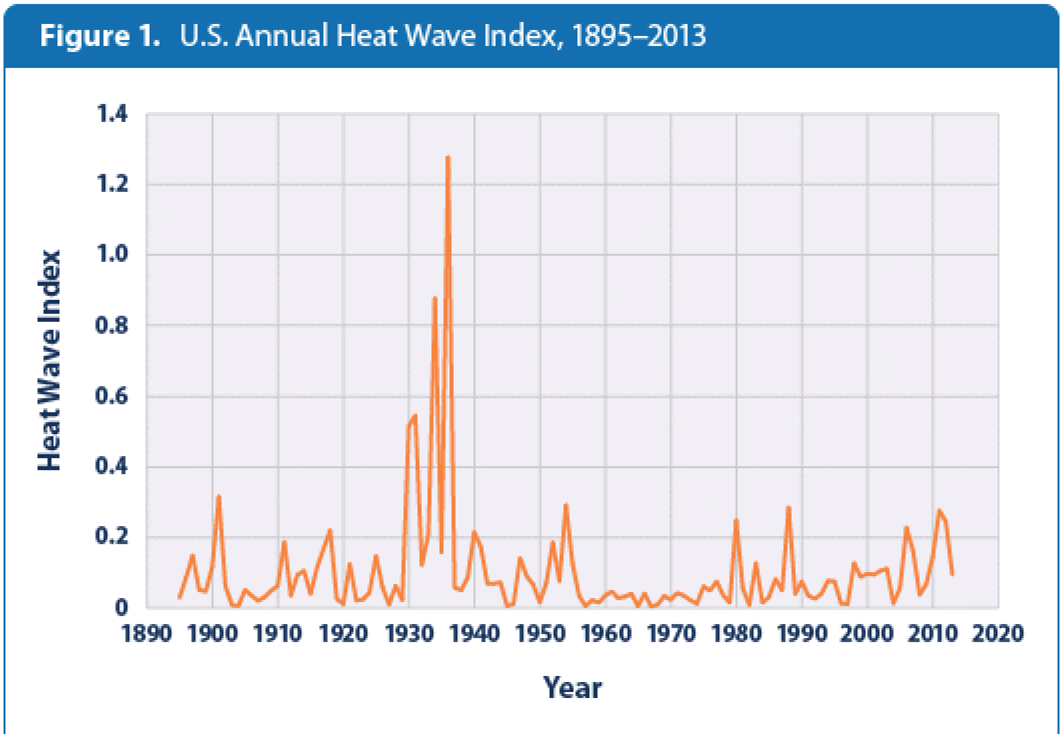



*Figure 12. US Heat Wave Index, 1895-2013*

The biggest heat wave occurred between 1930 and 1940 (with an index variation of 0.6 to 1.3). There is almost no variation in the index between 1940 and 2013 (it fluctuates between 0 and 0.3).

## 4. Inter-organization comparison

We might question the corrections made by NASA, particularly when these data are compared with the EPA's data.

Figure 13 provides three graphs of temperature anomalies in the US, drawn up in 1999, 2001 and 2014 respectively [see NASA].

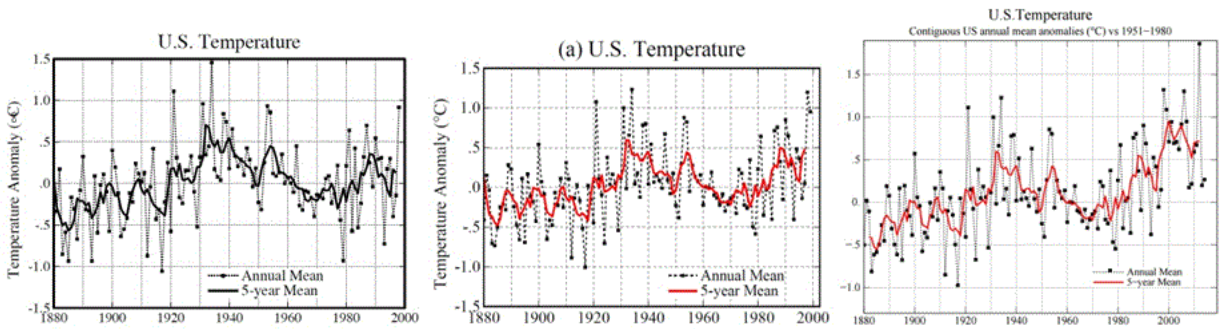



*Figure 13. Temperature anomalies in the US – 1999 version (left), 2001 version (center) and 2014 version (right)*

The general trend of the five-year mean curves changes from 1999 to 2014:

- in 1999, we have an increase in the five-year mean curve, with a peak of 1.5°C in 1934, followed by a drop in anomalies through to 1980. There is a slight increase from 1980 to 2000, with a peak of 0.9°C in 1998;

- in 2001, the corrections have reduced the 1934 peak to 1.2°C, and increased the 1998 peak to 1.3°C. This means the general trend of the five-year mean curve is that of an upward curve;

- in 2014, the corrections accentuate the upward trend even further. Indeed, between 2001 and 2014, the shape of the curve has changed for the period 1880-1900, with the upward trend being clearly accentuated in the 2014 version of the graph. At 2°C, the 2012 peak accentuates the effect of a constantly rising curve for five-year temperature anomalies.

If we make a comparison with the heat waves observed by the EPA, we find that NASA's data corrections (showing significant peaks in 1998, 2006 and 2012, and a smaller peak in 1930) no longer agree with the EPA's data (showing a heat wave in the US between 1930 and 1940, and relative stability during the periods 1895-1930 and 1940-2013). The 1999 version of NASA's graph (peak in 1930, followed by smaller anomalies) is much closer to the observations made by the EPA.

## 5. Critical analysis

None of the information on global temperatures is of any scientific value, and it should not be used as a basis for any policy decisions. It is perfectly clear that:

- there are far too few temperature sensors to give us a picture of the planet's temperature;

- we do not know what such a temperature might mean because nobody has given it any specific physical significance;

- the data have been subject to much dissimulation and manipulation. There is a clear will not to mention anything that might be reassuring, and to highlight things that are presented as worrying;

- despite all this, direct use of the available figures does not indicate any genuine trend towards global warming!

# II. $CO_2$

## *A. Introduction*

Many scientists are having doubts about the influence of greenhouse gases on the climate. Earth's atmosphere is composed mostly of atoms of nitrogen, oxygen and argon, and the three main greenhouse gases are water vapor, carbon dioxide ($CO_2$) and methane ($CH_4$). We shall be looking at the composition of the atmosphere more closely in Part 2 (Chapter 1, Section IV).

The particular feature of a greenhouse gas is its ability to heat up by absorbing the infrared rays coming from the Sun and the Earth. The factors that cause a gas to affect global warming are its capacity to absorb infrared rays, its life span, and its concentration in the atmosphere.

In this chapter, we shall be looking only at $CO_2$, because this is the gas deemed to be responsible for global warming. The infrared-absorption capacity of $CO_2$ is a quantifiable factor that can be measured in the laboratory, which is not true of its life span or concentration in the atmosphere. In fact, $CO_2$ is part of the carbon cycle (see Figure 14), with carbon atoms from $CO_2$ being transferred to various 'reservoirs'. There is a constant flow of exchange between reservoirs. During these transfers, reservoirs that release $CO_2$ into the atmosphere are called 'sources', and those that consume it are called 'sinks'. The sea, for example, is both a source and a sink.

The carbon cycle makes it difficult to determine the life span of $CO_2$ in the atmosphere, which is why scientists focus more on its concentration.

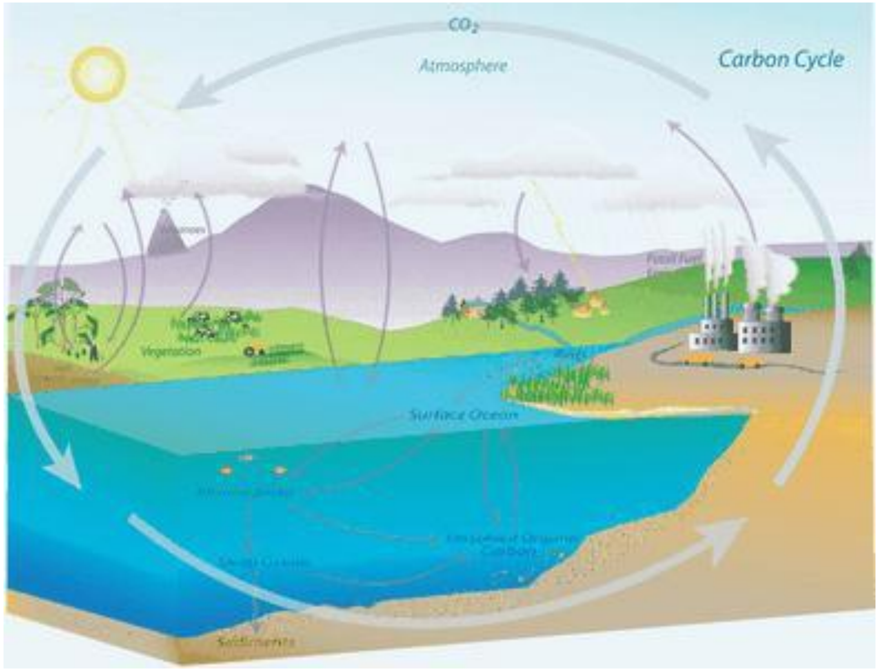



*Figure 14. The carbon cycle (source: Barb Deluisi, NOAA)*

The gross concentration of $CO_2$ does not make it possible to identify a trend as regards the gas, because the composition of the atmosphere depends on pressure, temperature and the dilution of other gases in water vapor. To obtain a measurement that is not dependent on these parameters, you have to measure the number of $CO_2$ molecules in one million molecules of dry air. This measurement is expressed in ppm (parts per million) and is called a mole fraction [see Tans and Thoning].

Several types of measurement are taken at the moment. In most cases, they reflect a local concentration of $CO_2$ and are taken at a certain altitude. We are going to demonstrate the variability of the values and the lack of standardization of the measurements.

## *B. Infrared measurements*

The infrared measurements presented in this report come from the National Oceanic and Atmospheric Administration (NOAA), which gathers data from a network of more than 100 sites around the world. Samples are taken at variable intervals. The NOAA's aim is to create a 'map' of the concentration of greenhouse gases in the world, at various altitudes.

### 1. Sampling methods

Four methods are used to collect the samples analyzed by the NOAA:

1) <u>Surface measurements</u>

Air samples are taken weekly and contained in flasks. They come from various laboratories around the world (see Figure 15). These measurements make it possible to determine the concentration of greenhouse gases, and variations (both short- and long-term) at the sampling site. These samples are taken on the surface.


*Figure 15. Location of laboratories taking flask samples. The red points are active sites, the yellow points are inactive sites, and the orange points are ship-based.*

2) <u>Air-based program</u>

The air-based program makes it possible to take seasonal samples of air at various levels of the troposphere (over 8,000 meters). Sampling is concentrated mainly in North America (see Figure 16).


*Figure 16. Location of air-based program measurement sites.*
*Aircraft in yellow represent inactive sites.*

3) <u>Tall tower measurements</u>

A network of tall towers provides daily $CO_2$ measurements for altitudes of about 500 meters. At this altitude, the air is mixed, and it is possible to measure an atmospheric 'footprint'. Once again, sampling is concentrated mainly in North America (see Figure 17).


*Figure 17. Location of towers. The yellow icon represents an inactive site.*

4) <u>Baseline observatories</u>

Baseline observatories are laboratories that are isolated from civilization. Their location means they can take daily measurements of an atmosphere that is not 'falsified' by external pollution. There are six of these observatories, in Barrow (Alaska), Summit (Greenland), Trinidad Head (California), Mauna Loa (Hawaii), American Samoa, and the South Pole (Antarctic).

Of these observatories, the one in Mauna Loa is known for its $CO_2$ measurements, which are taken only in the high atmosphere. The results presented by the NOAA come mainly from this observatory, which is located in the US, in the south-west of the island of Hawaii (Big Island), the largest island in the archipelago and state of Hawaii.

In an article [see Eschenbach], Willis Eschenbach justifies the selection of this measurement station as representative of world concentrations as follows:

The local influence of $CO_2$ releases from vegetation and human activity on measurements has to be eliminated. This is why the laboratory is isolated on an island on a volcano at an altitude of 3,397 meters above sea level, and is surrounded by kilometers of volcanic land, with no plant life anywhere nearby.

The influence of gas releases associated with volcanic activity can be limited because there is an updraught during the day, and a downdraught at night. These air currents are created by the temperature difference between the island and the sea. During the day, the land heats up more quickly than the sea. So the air at ground level heats up more quickly and creates a rising current because hot air, which is less dense, rises into the atmosphere. The problem is that, during the day, this current carries the air from the land and sea (which is influenced by plant life and humans) up to the level of the laboratory's sensors. In these conditions, the concentration measured is no longer a global concentration because it is affected by the local environment [see Eschenbach].

Conversely, at night, the island is colder than the sea, and a falling air current is created (see Figure 18). This makes it possible to measure air coming from very high altitude.

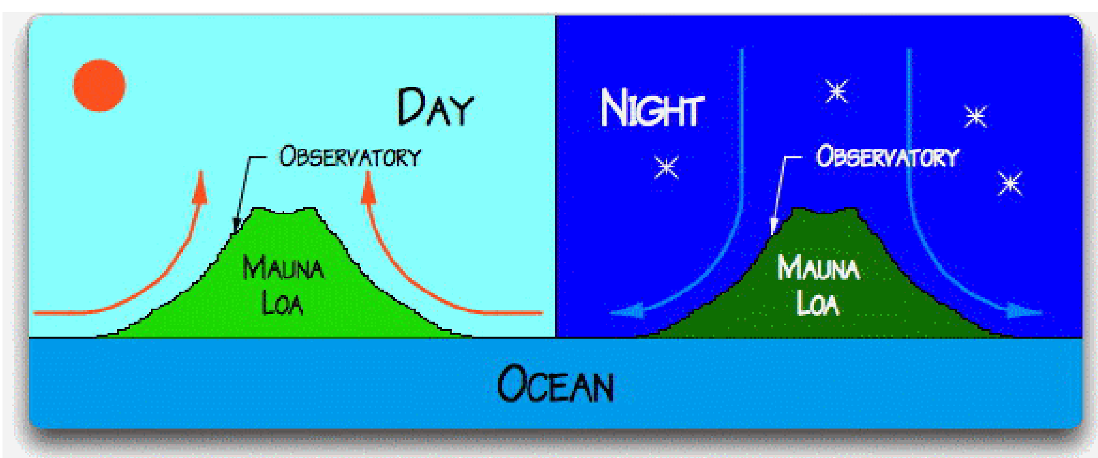



*Figure 18. Air currents at Mauna Loa during the day and at night*

Measuring at Mauna Loa began in 1958. Measurements are taken hourly. However, as we explained earlier, readings for only a few hours a day are selected for calculating daily average concentrations of $CO_2$.

In conclusion, sampling sites are not evenly distributed around the world. Some areas are very well provided with measurement stations (US and Western Europe), while others have hardly any (Africa and Asia).

## 2. Measurement by infrared absorption

The samples taken are then analyzed, with a different technique being used for each gas:

- infrared absorption for $CO_2$;
- fluorescence for CO;
- gas chromatography for $CH_4$, $N_2O$, $SF_6$ and $H_2$.

$CO_2$ is analyzed by infrared absorption, and the operating principle is that air is drawn into a cylinder. A transmitter sends out infrared light, which passes through the air sample to an infrared detector. The $CO_2$ atoms in the air sample will absorb some of the infrared radiation at a particular frequency. The higher the concentration of molecules, the more infrared will be absorbed, and the weaker will be the signal reaching the receiver. The detector's (electrical) signal is then translated into a quantity of $CO_2$. Hourly calibration ensures that the measurements are accurate.

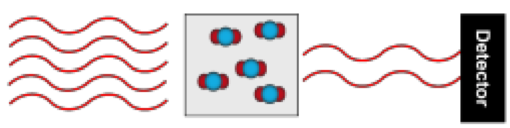



*Figure 19. Diagram of infrared absorption*

## 3. Processing the results

The infrared spectrometer provides raw data on $CO_2$ concentration for a particular site on a particular day. Data are then selected using a very precise method:

- firstly, the standard deviation over a minute must be less than 0.30 ppm;
- secondly, hourly data must not differ by more than 0.25 ppm from those for the previous hour;

- thirdly, data for hours when there is an updraught are not retained;

- and lastly, there is a method for eliminating outliers. A curve is adjusted in accordance with the data for preceding hours and, for each day, any hourly data that deviate from this curve by more than twice the standard deviation are withdrawn.

In all, data for an average of just 13.7 hours a day are retained.

The preliminary procedures for processing data are not neutral and are highly questionable scientifically. Their effect is, of course, to eliminate a number of variations, which might in fact be valid.

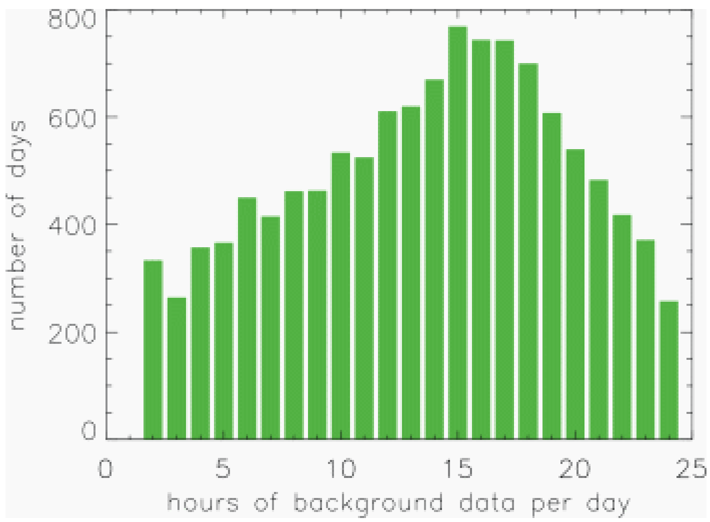



*Figure 20. Distribution of number of hourly data retained*

Figure 20 shows the distribution of the number of hourly data selected for processing, without taking account of days for which fewer than two hours of data have been retained. No data, or just one hour of data, have been retained for more than 6.5% of days.

## 4. Results

The data collected on the NOAA website give the following results:

- there is an increase in the concentration of $CO_2$ in various parts of the world;

- the variation in concentration depends on the location of the sampling site (longitude and latitude);

- there is a seasonal fluctuation.

The accuracy of the data depends partly on the way in which samples are taken. Results are more detailed for baseline observatories than they are for surface measurement stations.

a. Baseline observatories

Measurements have been taken from 1974 to 2013 at four observatories: Barrow (Alaska), Mauna Loa (Hawaii), American Samoa, and the South Pole (Antarctic).

The data for each observatory are available on the NOAA website in the form of text files. Three files are available for each laboratory: hourly, daily and monthly averages.

The files contain several columns:

- code corresponding to the site's name;
- date, from 1974 to 2013: year, month, hour, minutes, seconds;
- concentrations: a value of -999.99 is given when a value is missing;
- standard deviation on concentration measurements;
- number of points taken into account to calculate the average;
- latitude, longitude and altitude;
- type of measurement.

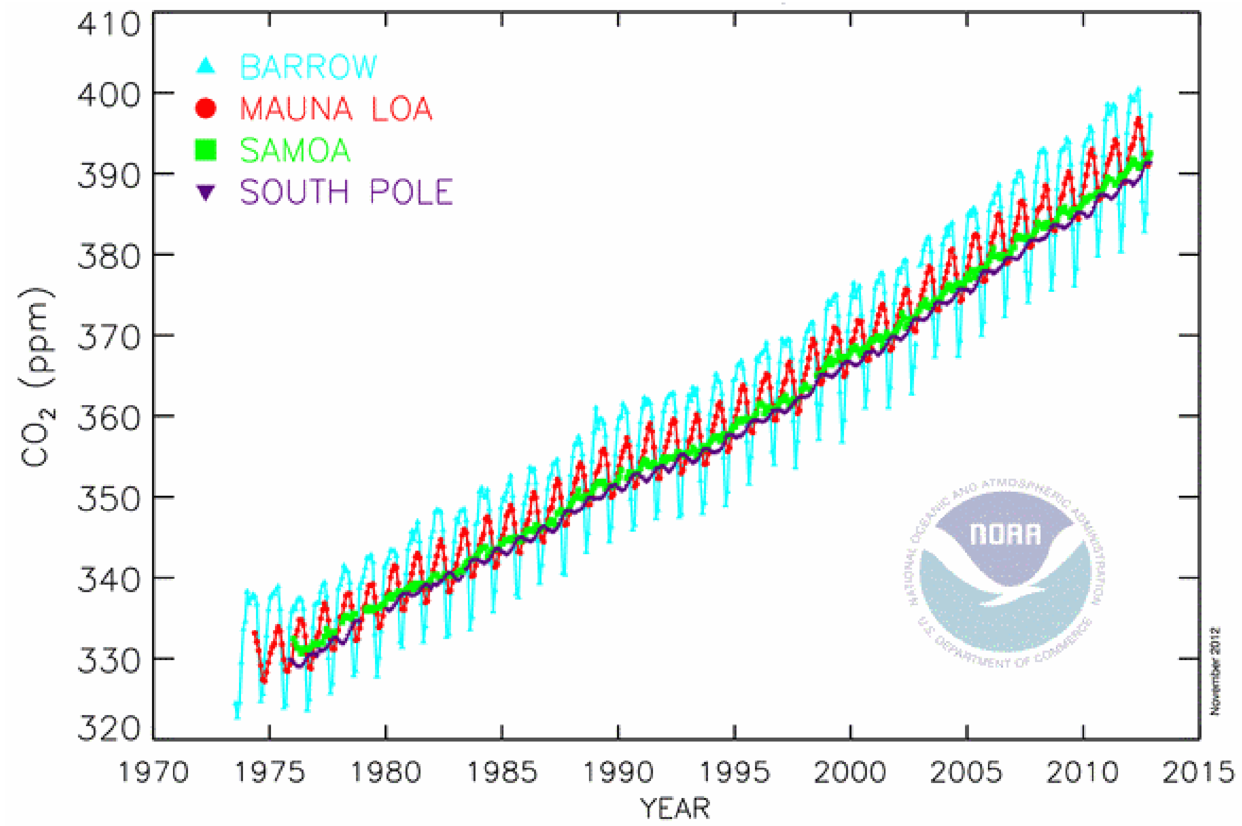
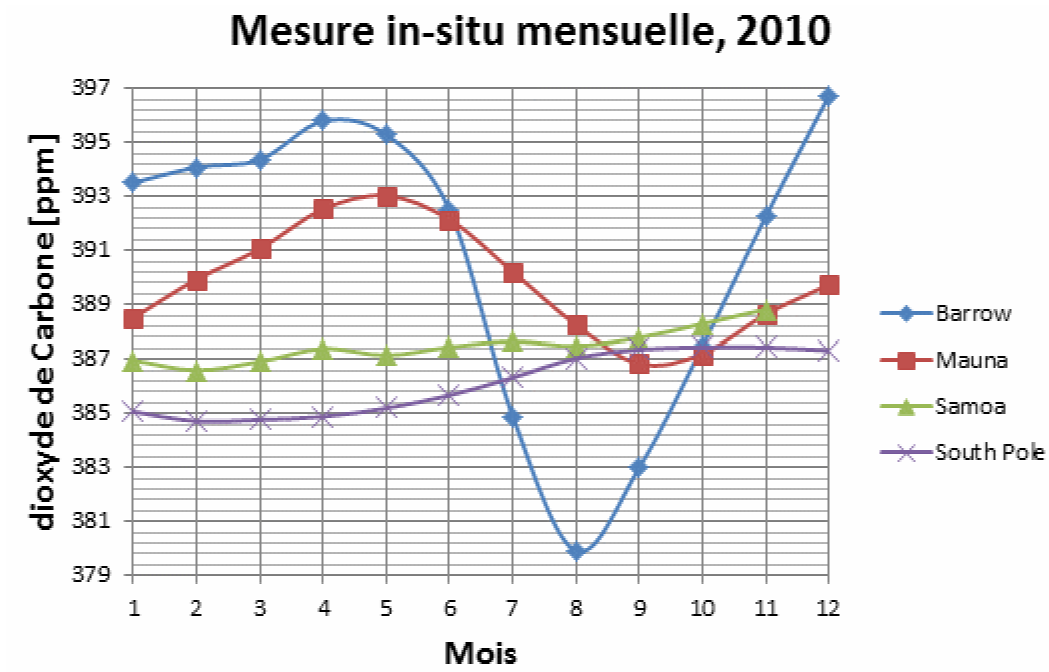



*Figure 21. Monthly average $CO_2$ concentrations for various laboratories. The three observatories differ in location (longitude and latitude) [Tans].*




Key
In-situ monthly measurements, 2010
Vertical axis: Carbon dioxide (ppm)
Horizontal axis: Month

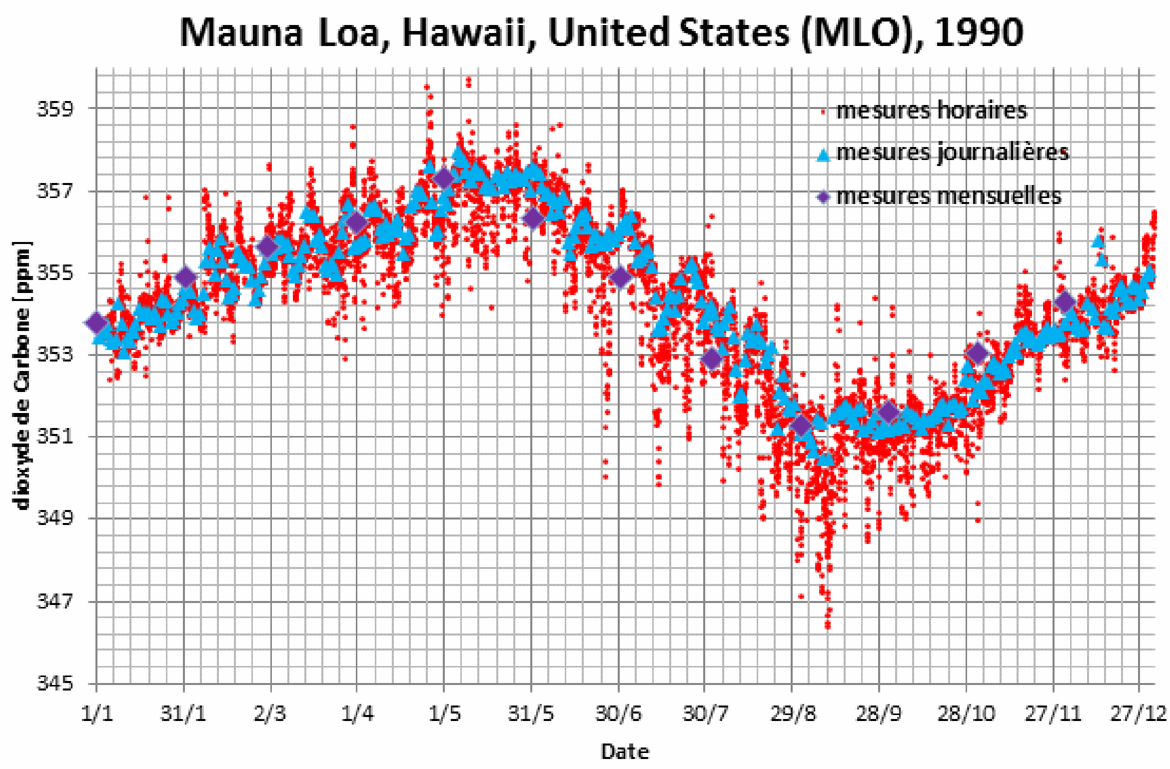
*Figure 22. Average monthly $CO_2$ for various laboratories, 2010.*
*The observatories differ in location (longitude and latitude).*

The results from these observatories show a rise in $CO_2$ concentrations that is independent of latitude (Figure 21). There are annual fluctuations in $CO_2$ concentrations, which are caused by seasonal changes and plant photosynthesis. During the summer, photosynthesis is very significant and $CO_2$ concentrations are high; the opposite is true in winter. The seasonal cycle is stronger in the northern hemisphere because the land surface is greater.

Figure 22 shows that the variation in $CO_2$ concentrations is not the same throughout the world. For example, the maximum $CO_2$ level recorded does not occur on the same date for Barrow and the South Pole. The variation in concentrations is also different at each site: the lower the observatory's latitude, the smaller the variation.

Let us come back to Mauna Loa. The measurements recorded there during 1990 are given in Figure 23. They show a daily variability of the order of 3 ppm and, once the data have been processed, there is a discrepancy between the monthly and daily values: monthly values are higher than daily values when there is an upward trend, and lower when there is a downward trend. This is explained by the choice of date for the monthly average: for example, for January, the date is the first of the month rather than 15 January (in the middle of the month).

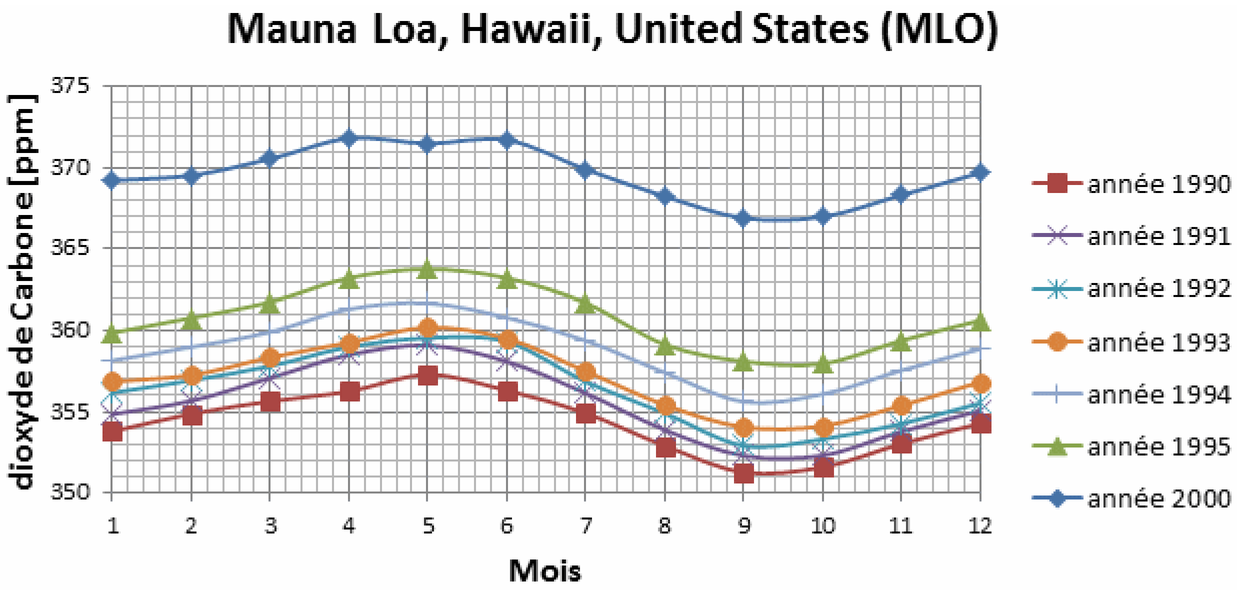
Also, Figure 24 shows the seasonal nature of $CO_2$ concentrations. Maximum concentration is reached in May, with minimum concentration in September. The NOAA explains that this difference is caused by plant photosynthesis.




Key

Top right: hourly measurements
daily measurements
monthly measurements
Vertical axis: Carbon dioxide (ppm)
Horizontal axis: Date

*Figure 23. Measurements of $CO_2$ concentrations at Mauna Loa, 1990*




<u>Key</u>

Right: year 1990, etc
Vertical axis: Carbon dioxide (ppm)
Horizontal axis: Month

*Figure 24. $CO_2$ measurements at Mauna Loa, 1990-2000*

b. Tall towers

The data for tall-tower samples are not provided. Only the results given in Figures 25 and 26 are available.

The results of a study conducted at Wisconsin Tower (US) demonstrate the influence of altitude on measurements of $CO_2$ concentrations (Figure 25). The variability of the measurements increases when they are taken at low altitude. The explanation offered by the NOAA is that the influence of human beings and plant life is felt more strongly at lower altitudes: concentrations reach a maximum during the day, and are at their lowest at night.

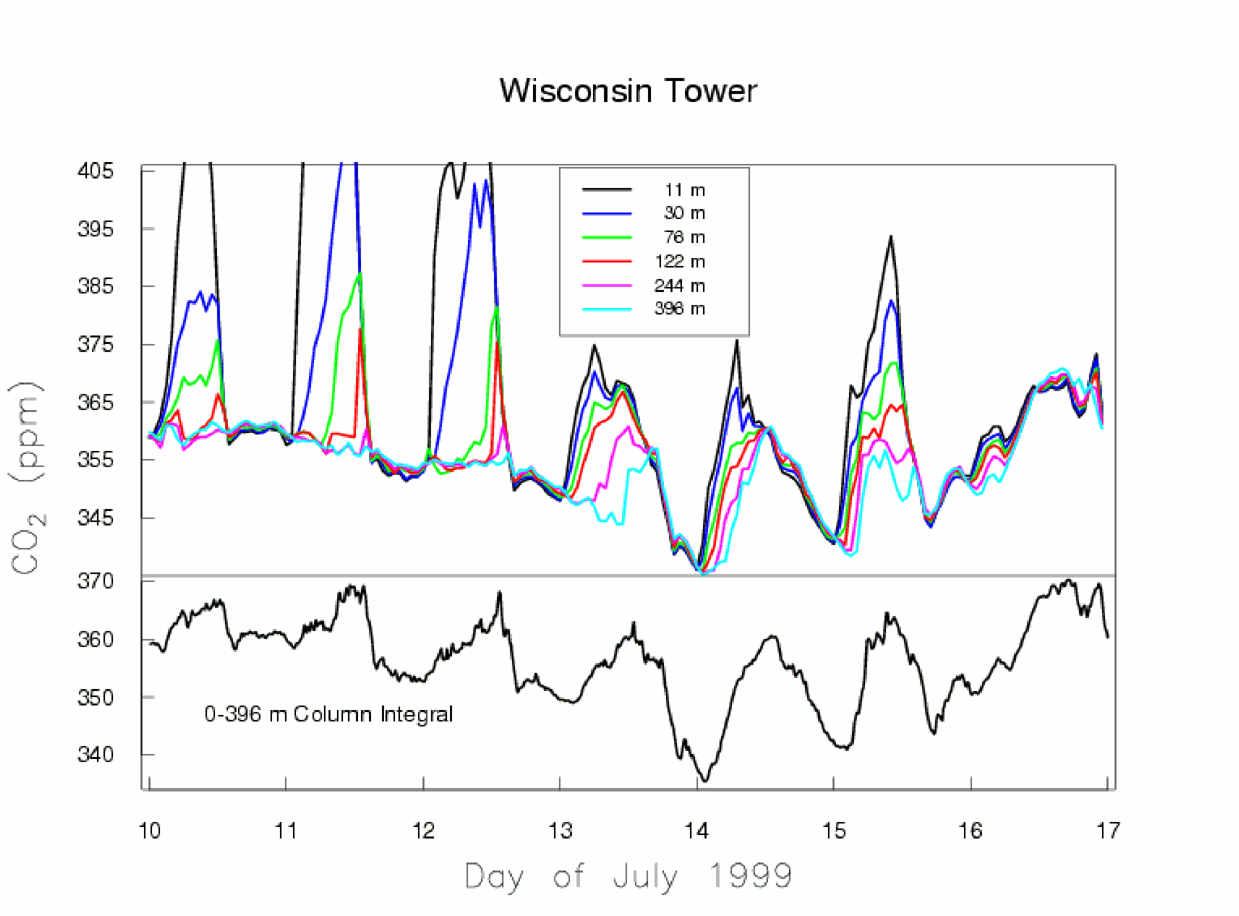



*Figure 25. Measurements of $CO_2$ concentrations for a week in July 1999, Wisconsin Tower*

Figure 26 shows the influence of the seasons on the variability of measurements at various altitudes. In January, altitude has no impact on the concentrations recorded: there is less vegetation and less 'plant respiration'.

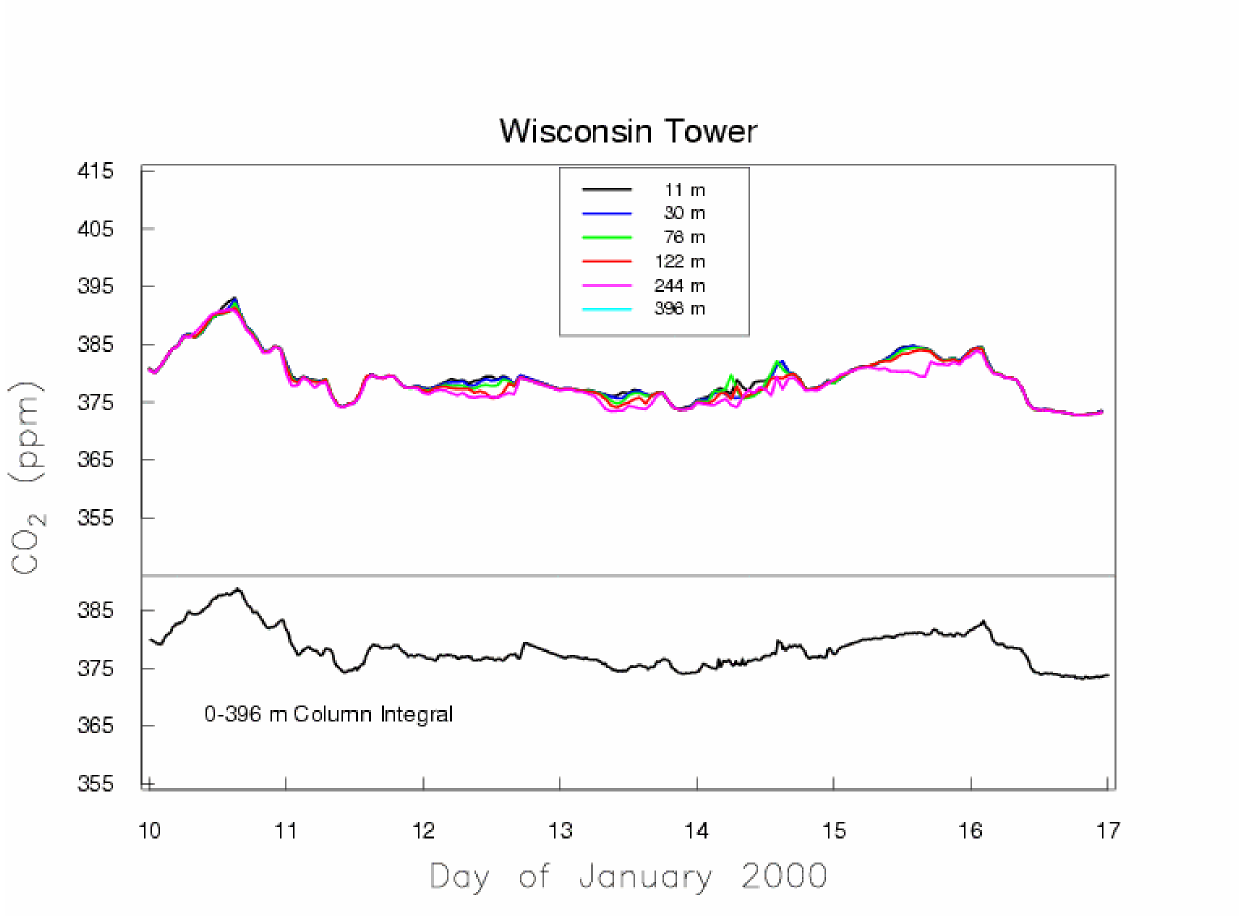



*Figure 26. Measurements of $CO_2$ concentrations for a week in January 2000, Wisconsin Tower*

c. Surface measurements

Samples are taken at various laboratories around the world and placed in flasks.

The data for each laboratory are available on the NOAA website in the form of text files (91 files). Each laboratory submits a text file containing the (already processed) monthly results. Sampling periods vary from one laboratory to another: for example, measurements for France cover the period 1982-2013, while those for Germany cover 2006 to 2013.

The files contain several columns:

- code corresponding to the site's name;
- date: year and month;
- concentrations: a value of -999.99 is given when a value is missing.

The files are much less detailed than those for the baseline observatories. It is possible to find the location of laboratories on the NOAA website, but not in the text files themselves.

Let us take the example of the following laboratories:

| Code | Name | Country | Latitude | Longitude | Altitude [m] |
|---|---|---|---|---|---|
| KZM | Plateau Assy | Kazakhstan | 43.250 | 77.880 | 2519.0 |
| KCO | Kaashidhoo | Republic of Maldives | 4.970 | 73.470 | 1.0 |
| CRZ | Crozet Island | France | -46.434 | 51.848 | 197.0 |

*Table 1. Location of three laboratories taking surface measurements*

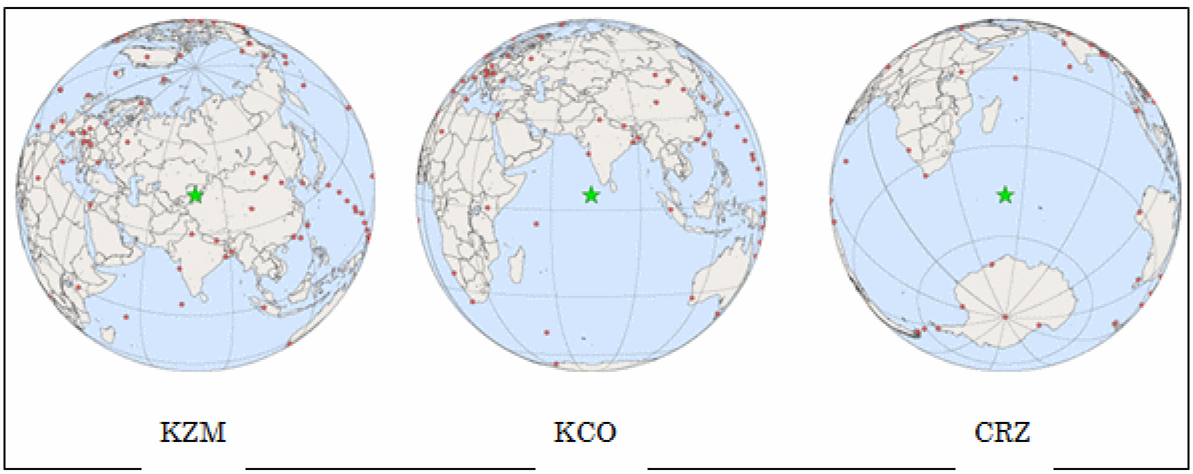
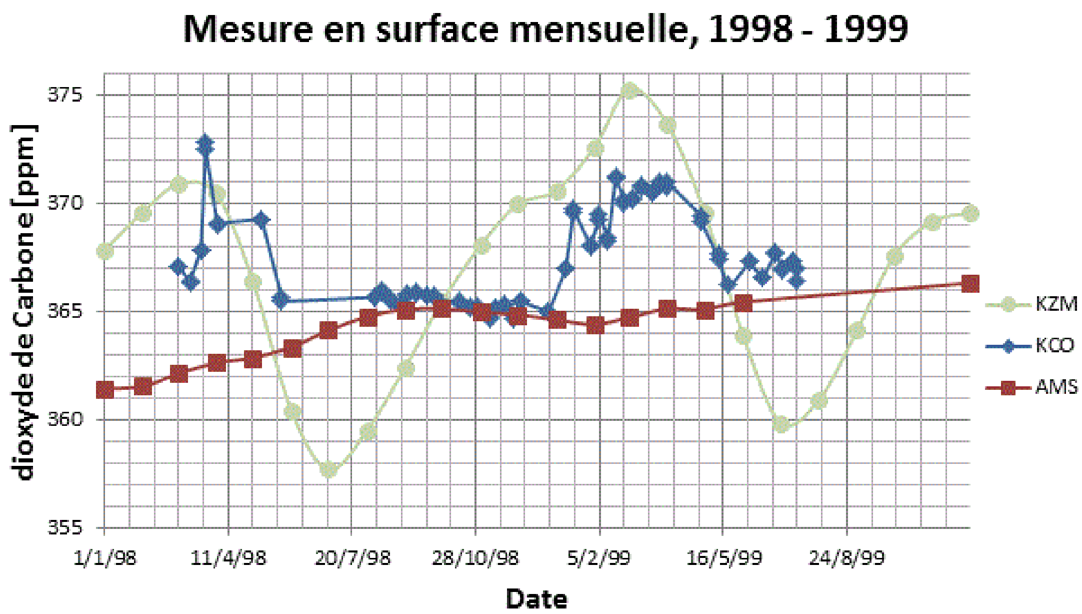



*Figure 27. Location of laboratories belonging to France, Kazakhstan and the Republic of Maldives*

These three laboratories are all located at about the same longitude (Table 1). If we combine the data for 1998 and 1999, we can see the same phenomena as in Figure 23. The variations in concentration are greater at higher latitudes. Unlike the measurements taken at the baseline observatories, the frequency of measurements at these three laboratories is less consistent.




Key

Monthly surface measurements, 1998-1999
Vertical axis: Carbon dioxide (ppm)
Horizontal axis: Date

*Figure 28. Monthly $CO_2$ average for various laboratories, 1998-1999*

## 5. Conclusion

- Poor distribution of sensors

The global distribution of measurements is far from even, with nearly all measurement stations being located in Europe or the US.

The choice of the Mauna Loa measurement station to represent the world's entire atmosphere is contestable, despite the arguments put forward by some scientists. Measurements are taken at just one place, in the high atmosphere, on a volcano. It would be possible to compare the Mauna Loa data with other measurements, over a long period, to see if they are representative, but this has never been done.

It has never been proven that $CO_2$ is distributed evenly above a certain altitude. The amount of $CO_2$ found in the low atmosphere cannot, in any event, be discounted in a global assessment. Nobody would think of discounting surface temperature measurements and looking only at high-altitude measurements.

- Insufficient data

The first problem is the way in which $CO_2$ samples are analyzed. Only 13.7 hours of measurements are retained each day at Mauna Loa, which is just a little more than half a day.

Two further problems arise when it comes to global readings. Firstly, the only data available for each site are monthly measurements; daily measurements are not available.

Also, each laboratory/observatory edits and selects its own data, which means the results are specific to each site's location.

For the Mauna Loa station, only night-time measurements are retained. As we explained earlier, this is 'justified' by air flows.

- Data processing

The data in the text files have already been processed, and it is explicitly stated that missing values have been replaced with averages or interpolations. The earlier curves are based directly on NOAA data.

The published data show an increase in $CO_2$ concentrations, but the fact that measurements are not uniform and the way in which they have been processed before publication deprive them of any scientific value: you have to have the raw data to validate the way in which they have been processed.

## *C. Direct chemical measurements of $CO_2$*

### 1. Measurement technology

Direct measurements of $CO_2$ concentrations, collected by various scientists, have been compiled by Ernst-Georg Beck in '180 years of atmospheric $CO_2$ gas analysis by chemical methods'.

Several techniques have been used, including titration and volumetric analysis, which make it possible to obtain a measurement that is accurate to within 3 ppm. These techniques have been well established since 1812 and have since been improved.

Measurements are taken in rural areas or on the outskirts of major towns or cities. This means they are subject to significant local variability caused by the absorption or release of $CO_2$ by the land or sea, plant photosynthesis, industry, local atmospheric pressure, wind, or various natural fluctuations. To be able to interpret this type of measurement, you would have to measure $CO_2$ in every cubic kilometer around the world.

Chemical measurements in the troposphere show variabilities of more than 400 ppm over a period of less than five years, which implies that an abnormal amount of $CO_2$ was released into the atmosphere during this period. These measurements therefore do not reflect the global concentration of $CO_2$.

## 2. Distribution of measurements over space and time

These measurements have been taken in various parts of the world, mostly in the northern hemisphere, since 1812. The temporal density of measurement points varies enormously from one place to another.

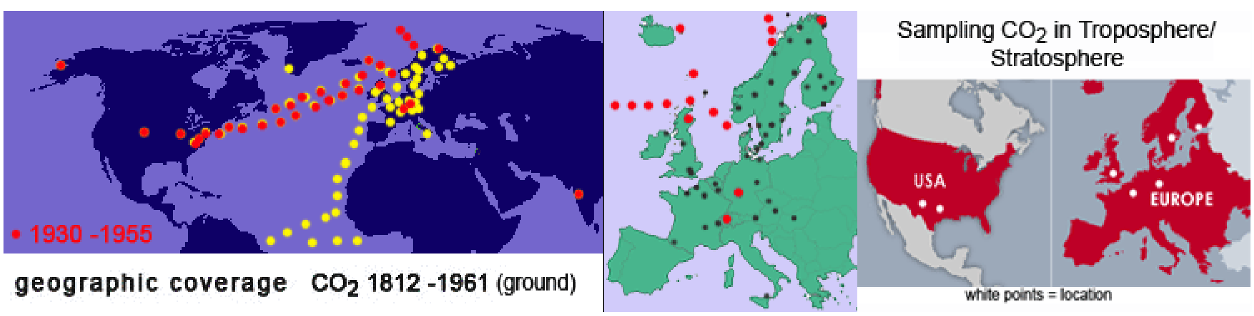



*Figure 29. Distribution of chemical measurements*

## 3. Results

The measurements compiled by Ernst-Georg Beck indicate $CO_2$ concentrations in excess of 400 ppm on various occasions in the past.

These data show a significant variability in $CO_2$ concentrations over the past 150 years, and contradict the data from ice-core samples, which indicate a strictly upward trend with very little variability.

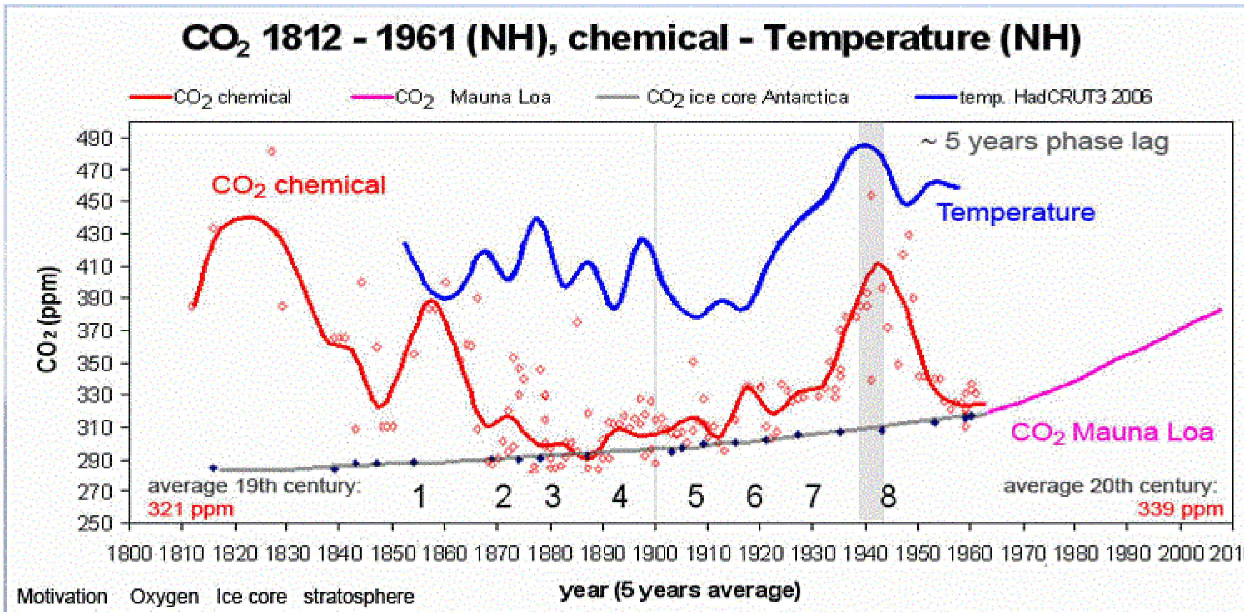



*Figure 30. Comparison of various techniques (Beck et al, 2008)*

### 4. Conclusion

This method of measuring $CO_2$ is well established, but measurement stations are not distributed evenly and there are clearly not enough of them, given the great variability of $CO_2$ concentrations. We shall simply note that the data collected by this method do not make it possible to conclude that $CO_2$ concentrations are rising.

## *D. Ice-core measurements*

### 1. Measurement technology

The concentration of air bubbles is measured by spectroscopy, the absorption of laser beams, and gas chromatography. Ice samples weighing 40 grams are placed in a vacuum and crushed. The air that escapes is captured and analyzed.

This measurement method is not very reliable [see Delmas]. The measurements are indirect and do not necessarily reflect the original composition. $CO_2$ can dissolve over time and be absorbed. Acid-carbonate reactions can occur, as can oxidation of organic matter by $H_2O_2$. These processes are encouraged by the presence of impurities in the ice. There are far fewer impurities in the ice in the Antarctic than there are in Greenland.

The absence of any recently released gases (such as $SF_6$) in ice cores makes it possible to conclude that they are perfectly hermetic and have not been recently contaminated by the air.

## 2. Distribution of measurements in space and time

In areas where temperatures are below 0°C, falling snow does not melt but builds up and gradually turns into ice. In doing so, it traps tiny air bubbles and dust. Today, ice-core analyses enable us to determine the $CO_2$ concentration in these tiny air bubbles back as far as 800,000 years ago.

Snowfall in Antarctica is rare, which limits the amount of data available.

Also, for the oldest periods, the ice has compacted under its own weight, which makes it more difficult to date with any accuracy. This means that the concentrations measured are averages over very long periods. It is possible for there to be a difference of as much as 6,000 years between the age of air bubbles and the age of the ice in which they are trapped, and this age gap has yet to be gauged with any precision.

Ice-core data are available on the NOAA website in text files. These files have several columns: age of air measured, age of ice, depth of ice, and $CO_2$ concentration, with associated uncertainty. The main sources of raw data are as follows:

1) The Vostok data [Vostok Data] are dated from 420,000 BC to 2000 AD. The age of the air is calculated with a precision of +/-5,000 years, sometimes extending beyond 10,000 years, and temporal samples vary between 2,400 and 4,500 years in the deepest layers [see Fisher].

2) The study going back farthest in history was conducted by the European EPICA project in Antarctica [Dome C Data]. The ice core extracted measures 3.1 km and makes it possible to measure $CO_2$ concentrations 800,000 years ago. Uncertainty about age 800,000 years ago is +/-6,000 years. Different dating methods have been used (LR04 and EDC2), and do not give the same result, showing a discrepancy of the order of 20,000 years [see Parrenin].

3) Measurements have also been made using ice cores at the Law Dome [Law Dome Data]. They are dated between 1948 and 1992. The data are smoothed out over 10 years for the deepest layers.

## 3. Results

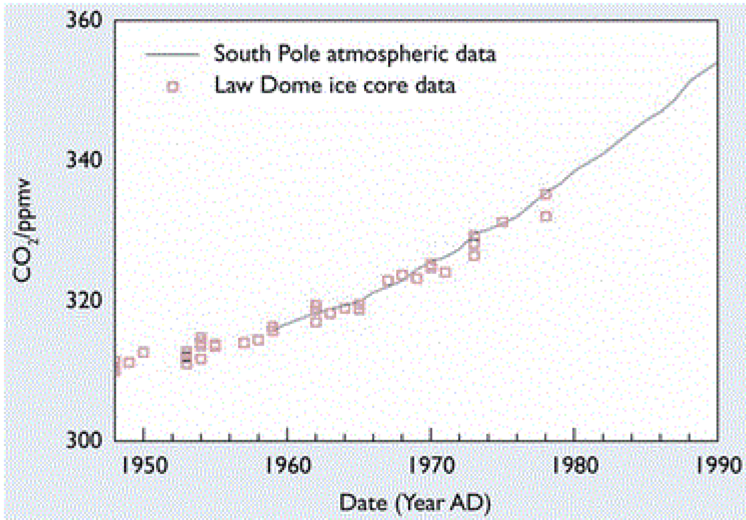



*Figure 31. Direct measurements of $CO_2$ compared with ice-core measurements*

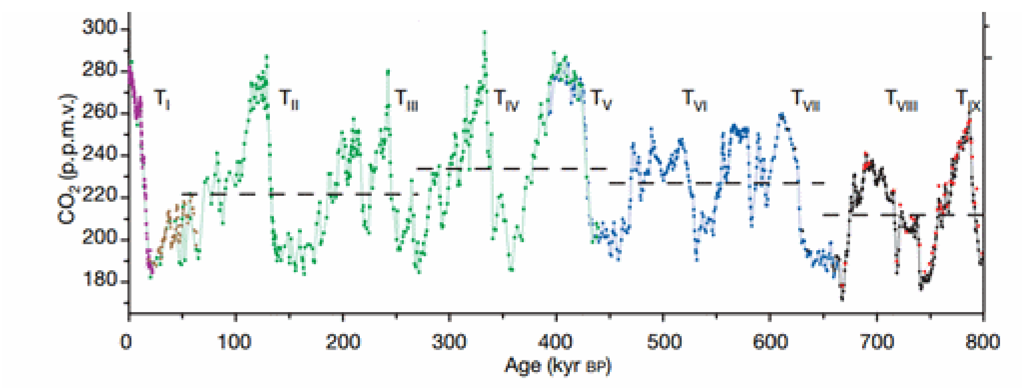



*Figure 32. $CO_2$ measurements at Dome C (violet, blue and black), Taylor Dome (brown) and Vostok (green)*

The $CO_2$ measurements indicate a relatively stable concentration of between 180 and 280 ppm (Figure 32). The ice-core data have been compared with direct atmospheric measurements at the South Pole, and these measurements seem to be in agreement on the annual level (Figure 31). The concentrations measured at the Law Dome concur with those measured at Vostok.

### 4. Conclusion

There are several methodological problems here:

- firstly, the method is open to criticism. It is an indirect measurement method, and the composition of the ice cores is not strictly representative of the atmosphere at the time. Also, there is enormous uncertainty about the actual age of the trapped gas;

- secondly, measurements are clearly limited to the areas in which samples are taken, and therefore cannot reflect global concentrations of $CO_2$.

## *E. Measurements using the stoma of fossilized plants*

### 1. Measurement technology

Stoma are microscopic pores in the leaves of fossilized plants. They are used for gas exchanges, and there is an empirical relationship between the density of stoma and the concentration of $CO_2$. These indirect measurements are not very accurate, with uncertainty of up to 60 ppm.

### 2. Results

These measurements indicate a much greater variability of $CO_2$, and very often much higher concentration levels, than ice-core measurements do. Also, the various studies analyzing this type of data do not agree. In [Beerling], the concentration range is between 225 ppm and 310 ppm for the period 9,000 years ago, whereas it is 250-360 ppm in [Wagner].

### 3. Conclusion

The uncertainty of these measurements is far too great for them to be used.

## *F. Critical analysis*

There is nothing that enables us to support the commonly-held conclusion that $CO_2$ concentrations are constantly rising and are higher than anything that might have been seen before the industrial age.

In fact, $CO_2$ concentrations constantly vary, from one place to another and from one time to another, just as temperatures do. To claim that the data collected at a small number of observatories (one hundred of them!), and then processed and expurgated in the ways we have described, are representative of the global value is an absurdity. This restricted view comes from a consensus of experts, and has never been validated.

The different measurement methods give different results, which is not at all surprising given the variability of the phenomenon. Reference to cores extracted from the ice is an absurdity: these ice cores are representative of the $CO_2$ concentration at the place of extraction (and over a very long period, as well!), and can tell us nothing about concentrations elsewhere.

There is a consensus within a certain community to present as 'scientific' the results obtained by the methods it recommends, even though these methods have never been validated and evidently suffer from major methodological defects.

Our conclusion is very clear: the entire methodology used to observe $CO_2$ has to be overhauled before we can even think about the results that have been obtained by these observations. The first step is to correctly document the natural variability of $CO_2$ concentrations (what affects them, and how do they manifest?). We must not forget that the aim here is to make a global assessment of $CO_2$ concentrations in the entire atmosphere.

Let us use a simple comparison to explain this. Let us imagine that we want to document incidents of sins committed by human beings. Before concluding that 'we can restrict our investigations to the areas around cathedrals', which would at least have the merit of simplicity, we would have to find out about the 'natural' variability of sin. Perhaps, in fact, more sins are committed far away from cathedrals?

# III. Cyclones

First we looked at the quality of existing data on cyclones, which then enabled us to analyze the way in which the data are processed.

We answered the following questions:

- Where can one find data on cyclones?
- How have these data been obtained?
- For how long have data on cyclones been available?

## *A. Measurements*

### 1. Sources of data

Various bodies are responsible for monitoring cyclones, depending on the cyclone basin concerned.

The National Hurricane Center (NHC) is one of the six services of the NOAA (National Oceanic and Atmospheric Administration).

The NHC covers the North Atlantic basin (including the Caribbean Sea and the Gulf of Mexico) and the North-East Pacific basin.

The NOAA website is very well documented, with plenty of data, and has a claim to scientific integrity [see Lubchenco].

We have looked at the NOAA data for the North Atlantic basin, working on the current HURCAT2 database. This is an updated version of HURCAT1, with new parameters having been added in 2004, and can be downloaded at [Cyclones_NOAA].

One difference between the HURCAT1 and HURCAT2 databases is that the former gives the categories of cyclones directly (using the Saffir-Simpson classification system). The Unisys website [see Cyclones_Unisys] presents HURCAT1 data as follows: for each year, it provides a chronological list of cyclones, giving their category, maximum wind speed and minimum pressure.

The other main difference between the two databases is that, since 2004, HURCAT2 has included six columns corresponding to new fields. These indicate how far from the center of the cyclone you need to be to record a certain wind speed.

## 2. Measurement technology

We have three technologies for monitoring hurricanes and predicting them as far as is possible.

a. Satellites

As we explained in Section I, 'Temperatures', there are two types of weather satellite.

The geostationary satellite monitoring the North Atlantic basin is **Goes-E**, an American NOAA satellite at longitude 75ºW.

The list of existing satellites is available on the extreme cyclone website, cyclonextreme.com [see Zucchi].

b. Doppler radars

In addition to the intensity and proximity of disturbances that are measured by basic weather radars, Doppler radars also measure the speed and direction of movement of these disturbances. The first Doppler radars were introduced in the 1950s.

The operational principle is as follows: Doppler radars emit microwaves that are reflected back by raindrops and ice crystals. Meteorologists can use the result received in numerical form to determine the quantity and speed of precipitations, cyclone patterns, and so on.

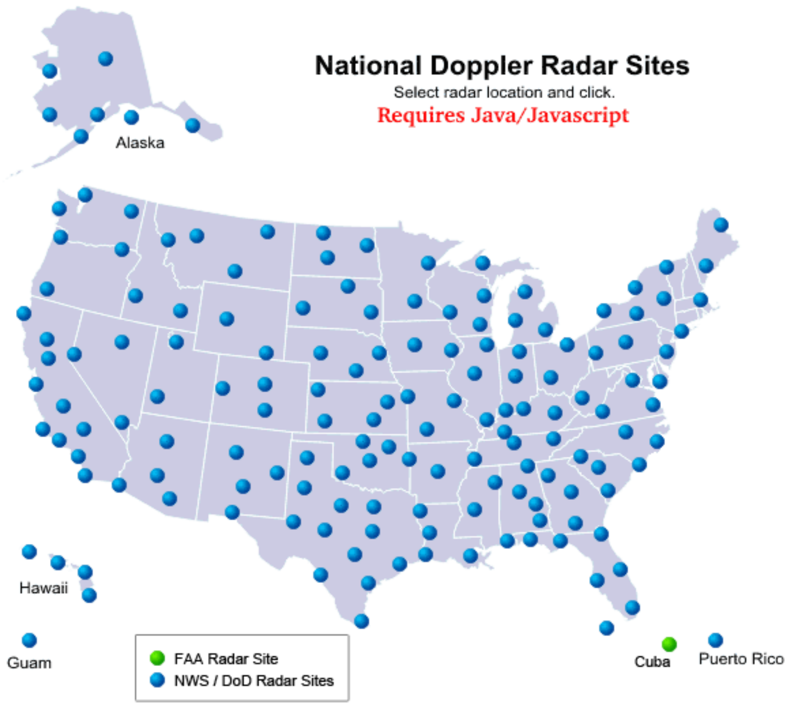



*Figure 33. Distribution of radars in the US, according to the [NDRS]*

A radar covers an area of 300 km, but cannot measure the speed of rotation of air masses at a distance of more than 100 km. Also, its resolution is of the order of one kilometer, when a tornado usually has a diameter of between one and 100 meters [see Radartutorial].

Radars are unevenly distributed in the rest of the world. In a country like France, where cyclones are rare, the purchase of radars is not financially justifiable.

c. Dropsondes

A dropsonde contains several weather instruments (barometer, thermometer, hygrometer and a GPS receiver making it possible to measure the direction and strength of the wind). Dropsondes are released from a weather reconnaissance aircraft and, as they fall, they collect various types of information on the cyclone.

Satellites are the best way of monitoring cyclones, which is why we think that the processing of data becomes pertinent as of the time they were put into effective, successful operation, which, according to Météo France, was in the 1970s.

In fact, global monitoring of the atmosphere has been conducted by the World Weather Watch global observation system since 1966.

## *B. Assessments based on the analysis of available data*

### 1. Preliminary analysis and processing of NOAA data

We decided to work on the HURCAT2 database, which is an 'enhanced' and fuller version of the HURCAT1 database.

We have nonetheless checked whether the data contained in the two databases are the same. We did this using the Unisys website, which contains HURCAT1 data, and then HURCAT2 data from 2011 onwards.

The database covers the entire North Atlantic basin, and the cyclones listed have not necessarily reached the coast.

The Unisys website gives a chronological list of cyclones for each year from 1851 to 2014, providing the following information on each one: period of activity (from start date to end date), maximum sustained wind speed over a 10-minute period, minimum pressure, and the category of the cyclone.

According to the explanations provided, the category is determined according to the Saffir-Simpson scale, for which the criterion is maximum sustained wind speed over a 10-minute period.

We divided the differences we found into two groups:

- Differences in the number of cyclones, tropical storms and tropical depressions

In 2000, by comparison with the Unisys database, HURCAT2 includes an additional subtropical/extratropical storm, with a maximum wind speed of 55 knots.

In 2003, by comparison with the Unisys database, HURCAT2 includes an additional tropical storm (Peter), with a maximum wind speed of 60 knots.

In 2004, a tropical depression (Tropical Depression TWO), with a maximum wind speed of 30 knots, has been taken off the Unisys database and does not appear in HURCAT2.

In 2006, by comparison with the Unisys database, HURCAT2 includes an additional tropical storm (Unnamed 13), with a maximum wind speed of 45 knots.

In 2011, by comparison with the Unisys database, HURCAT2 includes an additional tropical storm (Unnamed 14), with a maximum wind speed of 40 knots.

In 2013, by comparison with the Unisys database, HURCAT2 includes an additional tropical storm (Unnamed 16), with a maximum wind speed of 55 knots. This last example shows that, in this case, the Unisys website decided (voluntarily or not) to withdraw the tropical storm.

Changes have been made only as regards tropical storms and tropical depressions. The number of cyclones does not vary. Also, since there are relatively few cyclones, we do not think that the updating of the HURCAT database is a 'camouflage' for including additional cyclones.

- Differences linked to wind speed

In 2008, Unisys incorrectly recorded the maximum sustained wind speed of cyclone OMAR, which it puts at 110 knots when it was actually 115 knots. This error does not appear in HURCAT1. It causes a Category 3 cyclone in 2008 to become Category 4 in HURCAT2.

The HURCAT2 database is presented in the form described below.

On the NOAA website, you can download a text file containing the following fields for each cyclone:

- Cyclone number for that year
- Name, if available, or else 'UNNAMED'
- Number of best track entries – rows – to follow
- Year
- Month
- Day
- Hours
- Minutes
- Record identifier:
    - L – Landfall (center of system crossing a coastline)
    - W – Maximum sustained wind speed
    - P – Minimum in central pressure
    - I – An intensity peak in terms of both pressure and wind
    - C – Closest approach to a coast, not followed by a landfall
    - S – Change of status of the system
    - G – Genesis
- Status of system, options are:
    - TD – Tropical cyclone of tropical depression intensity (< 34 knots)
    - TS – Tropical cyclone of tropical storm intensity (34-63 knots)
    - HU – Tropical cyclone of hurricane intensity (> 64 knots)
    - EX – Extratropical cyclone (of any intensity)

  - SD – Subtropical cyclone of subtropical depression intensity (< 34 knots)
  - SS – Subtropical cyclone of subtropical storm intensity (> 34 knots)
  - LO – A low that is neither a tropical cyclone, a subtropical cyclone, nor an extratropical cyclone (of any intensity)
  - WV – Tropical Wave (of any intensity)
  - DB – Disturbance (of any intensity)
- Latitude
- Hemisphere
- Longitude
- Hemisphere
- Maximum sustained wind speed (in knots)
- Minimum pressure (in millibars)
- Additional detail on the track (position) of the cyclone

## 2. Processing of data

We found no outliers. There are missing and unchecked data, particularly as regards pressure.

We conducted a preliminary processing of the data to analyze trends in the number of cyclones over the years. We did not consider data preceding 1970 (as explained earlier). Among cyclones, we also included tropical depressions (which maximal wind speed is inferior to 34 knots) and tropical storms (which maximal wind speed is between 34 to 63 knots).

For each cyclone, we extracted the following information:

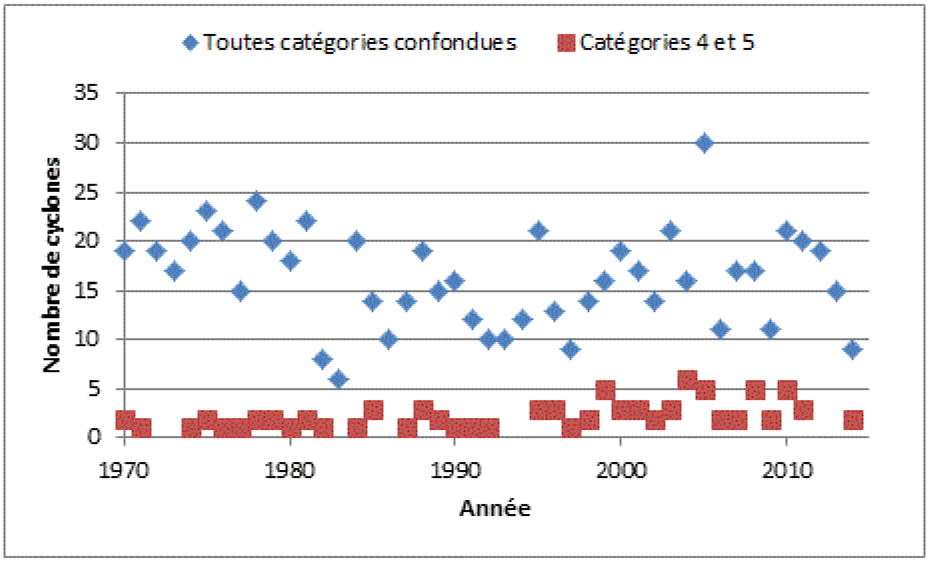
- Maximum recorded speed;
- Minimum recorded pressure;
- Duration (number of days).

We took account only of maximum recorded speed. We identified Category 4 and 5 cyclones. According to the Saffir-Simpson scale, these are cyclones whose maximum recorded speed is above 113 knots.

## 3. Results

To start with, we studied the trend in the number of cyclones in the North Atlantic basin since 1970, including data on cyclones that did not reach the American coast. The results show that there has been no increase in the number of cyclones since the 1970s.

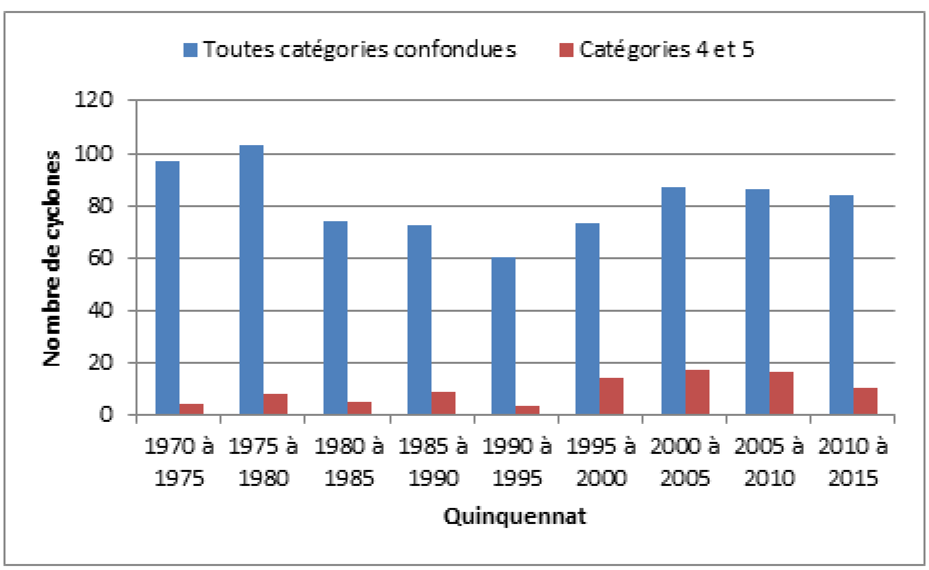
Next, we looked to see if there had been any increase in the number of Category 4 and 5 cyclones. The answer was yes:




Key

Top: All categories Categories 4 and 5
Vertical axis: Number of cyclones
Horizontal axis: Year

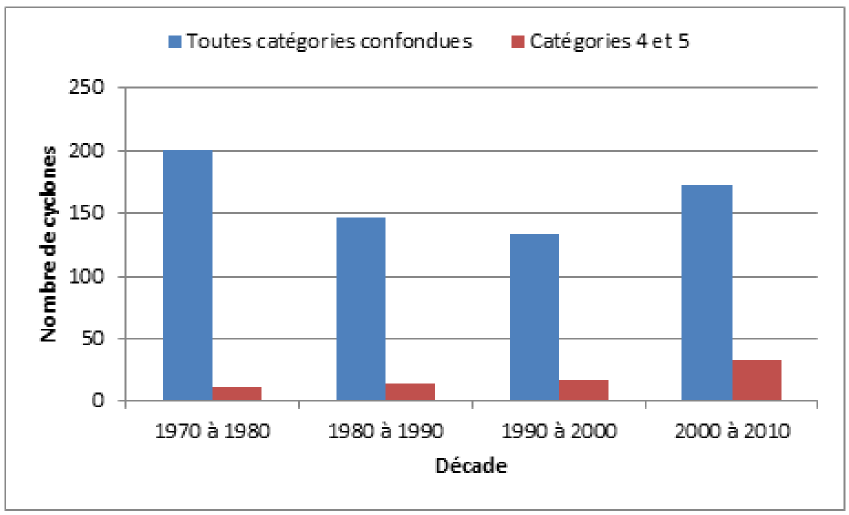
*Figure 34. Trend in the number of tropical depressions (in blue) and Category 4 and 5 cyclones (in red) since 1970*



Key

Top: All categories Categories 4 and 5
Vertical axis: Number of cyclones
Horizontal axis: Five-year period

*Figure 35. Trend in the number of tropical depressions, tropical storms and cyclones (in blue)and Category 4 and 5 cyclones (in red) since 1970, in five-year periods*




Key

Top: All categories Categories 4 and 5
Vertical axis: Number of cyclones
Horizontal axis: Decade

*Figure 36. Trend in the number of tropical depressions, tropical storms and cyclones (in blue)and Category 4 and 5 cyclones (in red) since 1970, in decades*

These data show a rise in the number of high-intensity cyclones and a fall in the number of low-intensity cyclones. However, as we shall see, this increase could simply be due to the improvement in measurement technologies.

## *C. Uniformity of data*

### 1. Uniformity over time

We have testimonies dating back to 1500 that describe cyclones. But they do not enable us to assess their intensity with any precision. Also, they are obviously not exhaustive.

The NOAA databases date back to 1851 and were initially based on eye-witness accounts. Before 1944, observations of cyclones were made only by ship.

Since then, the introduction of reconnaissance aircraft, the establishment and constant improvement of the satellite system (Dvorak technique in 1970, and infrared in 1980), and the arrival of Doppler radars have made it possible to greatly improve measurements.

Infrared satellites in particular, which were developed in the 1980s, have enabled us to make real advances in the accuracy of wind speed measurements. This is a problem in terms of the classification of cyclones into different categories. In fact, the standard used is the Saffir-Simpson scale, which is based on maximum sustained wind speed during a 10-minute period.

Improvements in the satellite system, as explained by Christophe Landsea at the 22$^{nd}$ Annual Governor's Hurricane Conference, summarized in [Governor's Hurricane Conference], now enable us to identify Category 4 and 5 cyclones, which we could not do before. So the increase in the number of high-category cyclones might be due to these technical advances [see Landsea and Brown].

In a search for standardization, studies by J. P. Kossin et al [see Governor's Hurricane Conference] were conducted by degrading the data obtained between 1983 and 2005 to bring it into line with the quality of old data. This had the effect of reducing the number of the most violent storms. However, it is incorrect to assess the trend on the basis measurements that have been corrected in this way, so we limited ourselves to studying these phenomena since 1970.

This is why, in our study, we give more weight to results concerning the trend in the number of cyclones since the 1970s than we do to those concerning the increase in their intensity.

The way in which data are analyzed varies, which also makes any standardization of the data difficult. We can cite the example of cyclone Andrew (1992), which was raised from Category 4 to Category 5 ten years later in the NOAA database.

In 2009, aware of the need for uniform data, the NHC launched the 'Atlantic Hurricane Database Re-analysis Project' [see NOAA_HRD], whose aim is to extend and review the HURCAT database. In order to do this, the analysts are going back to 1851, when records began, and are reviewing the data using up-to-date knowledge and techniques.

The NOAA is entirely transparent, as regards both the modifications to the database and the reasons for them, which are carefully explained on the website.

**2. Uniformity over space**

The quality of data varies significantly from one basin to another, and even for the same basin. Satellite coverage is far from uniform. The North Atlantic basin is well monitored and the recorded data are available.

**3. Critical analysis**

In this case, we have been able to obtain raw data and conduct our own analysis, which clearly demonstrates, contrary to what we are all reading all the time, that there has been no increase in the number of cyclones over the past 40 years. We have found a slight increase in the number of Category 4 and 5 cyclones (the strongest), but the numbers are very small each year, and the increase might simply be due to changes in 'accounting methods'.

A common deception is as follows: you begin by looking at cyclones that reach the US mainland (the ones that affect people and insurance companies) and you count them. Then you change the perimeter and include all cyclones in the North Atlantic, including ones that disperse at sea. Of course, the second group is bigger!

As we said earlier, the statistics presented here cover all cyclones in the North Atlantic.

# IV. Rising sea levels

## *A. Introduction*

Human beings are quite naturally interested in the sea level and for a long time have noted that it appears to be rising, but not everywhere and not uniformly. To be precise, the sea level, which rose 120 m in 18,000 years (source: the French Research Institute for Exploitation of the Sea – IFREMER), or 6.6 mm per year, has risen by only 1.2 mm per year (French Naval Hydrographic and Oceanographic Service – SHOM) since 1800, and the rate has not speeded up recently; see [Christy and Spencer].

All these figures should be treated with caution, as the data we have on sea levels 18,000 years ago must be regarded warily. They relate only to a small number of coastal observations. We cannot tell whether the Pacific Ocean was greater or smaller in volume than it is today, nor can we say, in the present day, how it is changing (see below concerning this paradox).

Two kinds of instruments are used:

- Marigraphs, which have been around for 200 years;
- Altimetry satellites, which measure the height of the satellite above the ocean; they have been around for 20 years, namely Topex/Poseidon (1992), Jason 1 (2001), Jason 2 (2008).

The water level varies naturally:

- Due to the tides (lunar attraction)
- Due to wind and storms
- Due to sea currents

This being so, the estimates provided by marigraphs and satellites can be no more than averages, if possible over one year or several years, as phenomena such as El Niño affect the sea level for a year or more.

### *B. Measurements*

All the measuring devices show rising sea levels. The increase is assessed as 1 mm per year in the case of marigraphs and 3 mm per year in that of satellites. The maps show clearly that the rise is not uniform and the rate is not increasing.
The reader needs to be clearly aware of the difficulty of trying to measure annual variations of one or two millimeters in something that varies by several tens of centimeters daily.

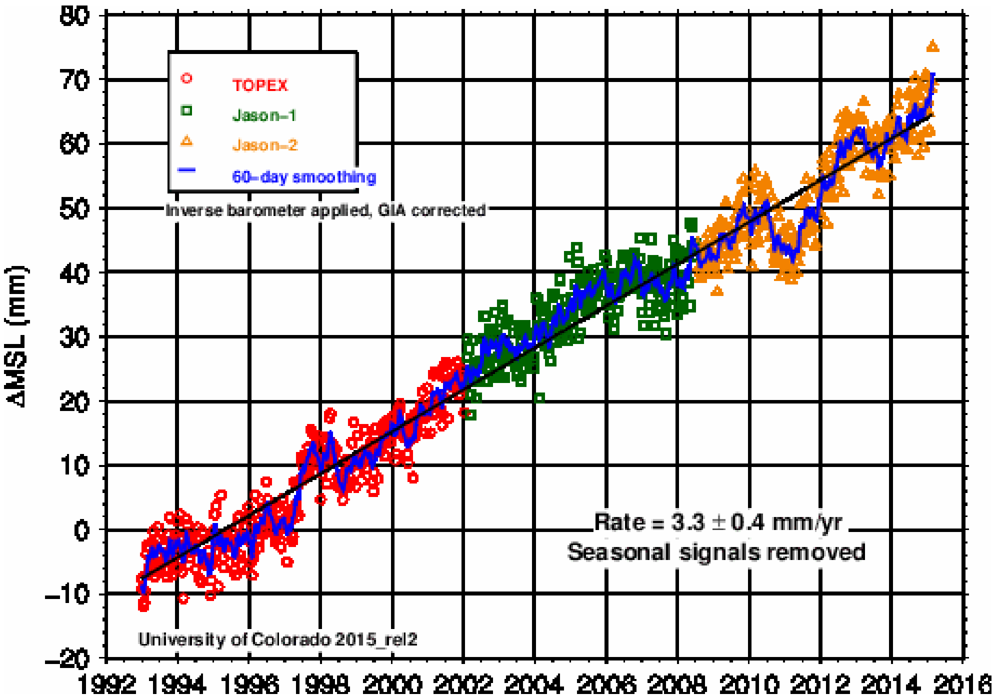



*Figure 37: Changing sea levels over time*

Here is the general graph supplied by the University of Colorado; see [UC1]. Similar graphs are available for each ocean separately.

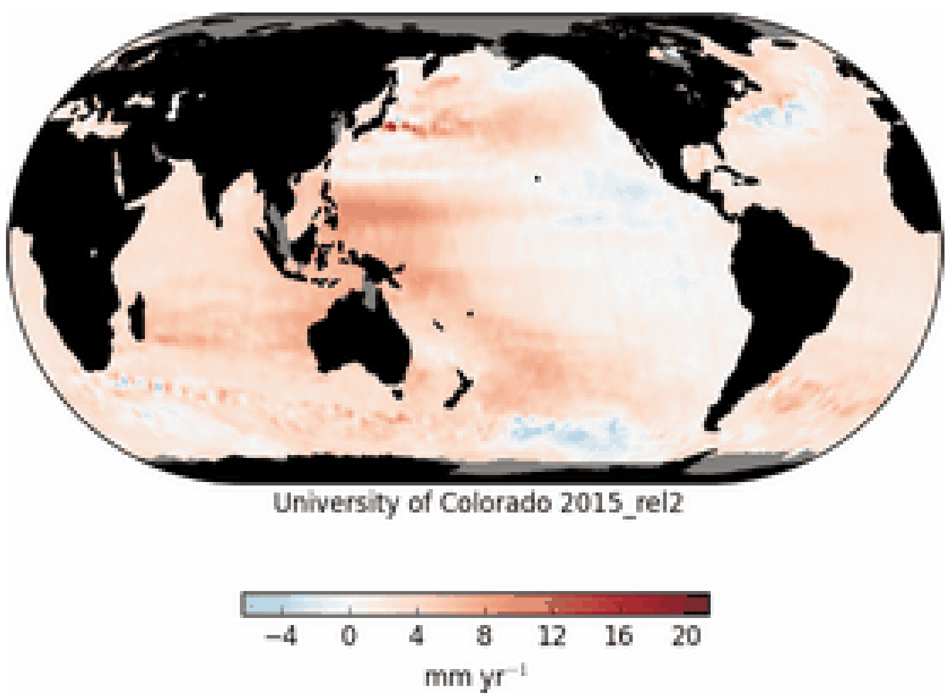



*Figure 38: Regional sea level trends*

On the map above – see [UC2] – the regions are shown in different colors according to whether ocean levels are rising or falling (red = rising; blue = falling).

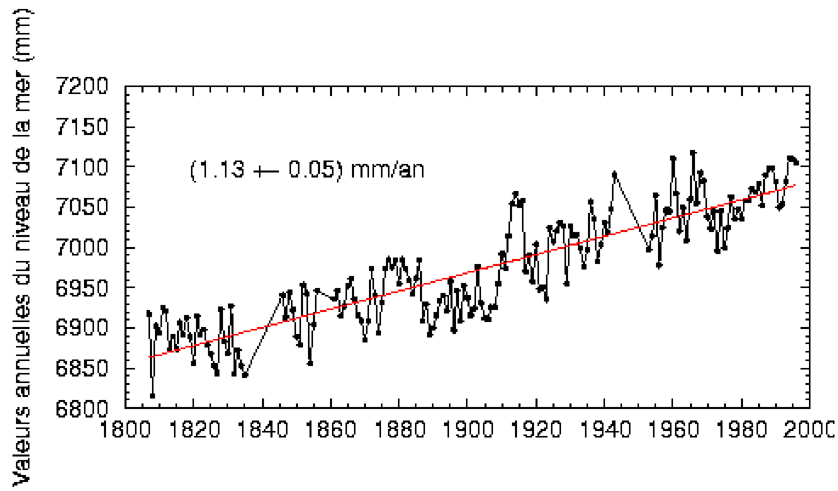



*Figure 39: Changing sea levels over time at Brest [Desnoës]*

Key :

Valeurs annuelles… Annual sea level values (mm)

Here are the readings taken by the Brest marigraph over 200 years (source: SHOM, paper by Yves Desnoës). It is very interesting to note peaks (ten or twenty years) and troughs (up to fifty years); see Annex for further details.

But a measurement is not a fact, because:

- Measurements can be marred by errors
- They may not cover the entire phenomenon but only certain aspects or some areas

The inconsistency between marigraphs and satellites may be due to the fact that marigraphs cannot see all the earth's seas, but satellites (limited to latitudes between 66° S and 66° N) are affected by positioning errors in their ground beacons (their measurements are not independent, contrary to what the operators think).

In the case of satellites the observation period is far too short to be able to deduce a trend. It would need hundreds of years, in view of the variability of the phenomena.

## *C. Attempts at explanation*

Most people imagine the Earth as a solid that never changes shape, like a lump of ceramic inlaid with basins forming the oceans. When people are told that the level in the basins is rising, they feel alarmed. As the water cannot come from elsewhere (from space), that appears to indicate that the water in situ is 'swelling up', or perhaps melting ice is contributing.

In either case, this is attributed to hypothetical 'global warming', for which there is no backing (see our Note to the Secretariat-General for National Defense and Security – SGDN – [BB1], updated 2006) but for which mankind readily takes responsibility.
Let us review these explanations:

### 1. Thermal expansion

This approach says that if the temperature rises, the oceans will expand. No doubt they will, but the container (the Earth) will expand as well. If we take a ball and draw a basin on top and heat it up, the result is not clear. Depending on the coefficients of expansion used, the volume of the basin will increase faster and the level will drop.

### 2. Melting ice

First of all, if an iceberg (ice floating in water) melts, that does not alter the sea level. "It is easy to prove that if a lump of pure ice floating on pure water melts, the water level does not change. The fact is that the volume of ice under water corresponds to the volume of liquid water needed to equal the weight of the ice cube." (French Wikipedia on Buoyancy, application to the case of an iceberg). Melting ice at the North Pole cannot therefore alter the sea levels.

Melting ice on land (Greenland, various glaciers, Antarctica) could certainly alter sea levels by several tens of centimeters. Estimates in this respect vary quite a bit, as the true mass of such ice is not known (the estimates have been arrived at simply by multiplying an area by an assumed average height).

However, recent studies published in the context of the Cryosat mission show the opposite trend happening in the Arctic – see [Cryosat].

Another thing affecting sea levels is the warm current known as El Niño.

### 3. El Niño

In 1982-83, the sea level off Christmas Island in the central Pacific rose by nearly 10 cm. In October the sea level was unusually raised by almost 25 cm over a distance of nearly 6,000 km from the Equator. Whereas it was rising in the eastern Pacific, at the same time it was falling in the western Pacific, exposing (and destroying) the upper layers of the fragile coral reefs surrounding a number of islands. Surface temperatures in the Galapagos Islands and along the Ecuadorean coast rose from 22°C to over 27°C! (IFREMER).
In order to assess the variations over very long periods, the effects of that current therefore need to be eliminated.

The following facts are well established:

- Earth experienced an ice age some 20,000 years ago (and, apparently, many others before that). Since then the Earth has been slowly warming up, without human beings having anything to do with it. We do not know why these changes happen. Maybe a variation in solar activity is responsible. The arguments based on a change in the Earth's orbit are false (see below).
- The quantity of ice at the poles varies considerably from year to year. This is what Roger Vercel wrote in 1938 in 'A l'assaut des pôles' (Assault on the Poles) (SCM Letter no. 24):

"Actually, something extraordinary is happening: at the same time as the French Empire, the ice shelves have started cracking, breaking up, disappearing… In 1816 and 1817, ice fields drifted as far south as below the 40th parallel, the same latitude as Toledo and Naples! Icebergs 60 meters tall have been reported everywhere in the Atlantic. Those are the pieces of the ice cliffs that gripped the polar lands.

And here we have William Scoresby, the most famous of the English whaling captains, writing to Sir Joseph Banks, one of Cook's companions and himself an Arctic explorer, that for the last two years he, Scoresby, had not found any ice on the coasts of Greenland between 74 and 75 degrees N. Such an opportunity to reach the pole by travelling up the Greenland coast will not come again for a while!"

Conversely, in March 2010, around fifty ships, including ferries carrying thousands of passengers, had to be freed by Swedish icebreakers after being icebound for several hours in the Baltic off Stockholm, a long way south of the pole, at a time of year when there is not normally any ice! (SCM Letter no. 50).

Generally speaking, there are considerable local climate variations in the space of a few hundred years. Vines were grown in the Stockholm area two thousand years ago and when Greenland was discovered (about 1000 AD), it was green. See [Garnier] for a detailed study of the last 500 years.

- Warming by a few degrees will not affect ice melting in the Antarctic, where the temperature is below -40°C.

In conclusion, the variation in the quantity of ice on the planet is widely acknowledged (as certain as one can be on such a matter!). The immediate variability of this phenomenon is so great that measurements over a few hundred years have no significance.

## *D. The Earth is not a solid that never changes shape*

### 1. The changing shape of the terrestrial globe

Seeing the terrestrial globe like a ‘lump of ceramic’ is totally wrong. The Earth’s crust is certainly not a solid that never changes shape; on the contrary, it is soft. This is illustrated by the following two facts, which have been definitely proven:

- Instantaneous deformation: it is subject to lunar attraction, which causes its shape to change with each orbit. The vertical extent of this phenomenon (known as the ‘earth tide’) is between 40 and 80 cm. See [Métivier].

- Long-term deformation: plate tectonics also show that the crust is not rigid. Huge plates between 10 and 100 km thick move about on the surface of the Earth’s mantle, which comprises molten rock. These plates bump up against one another and may be thrust upwards. So the level is not constant. The vertical shift may be a few millimeters per year.

### 2. Universal gravitation

People imagine this in simple terms: the heavier a body, the more it sinks. But that is incorrect: gravitation has to do with TWO masses attracting each other. If one of them decreases, the effect on the other will be felt.

Let us use an example to illustrate this. Let us assume an undersea mountain about 3,000 or 4,000 m below the surface. Most people will say that the water level above the mountain is the same as everywhere else: flat, or rather, spherical. But that is false, as due to its mass, the mountain creates a ‘gravitational anomaly’: there is a ‘hump’ which can be detected with sufficiently sensitive equipment. This scientifically clearly proven fact is totally misunderstood by the general public.

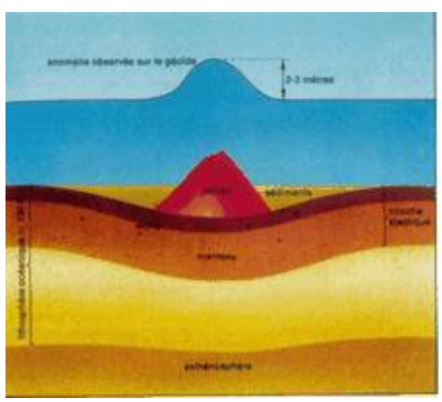


*Figure 40: Diagram representing the gravitational anomaly created by an undersea mountain [Desnoës].*

*Illustration from the paper given by Yves Desnoës (former Director-General of SHOM), SCM Seminar, 2005. See [Desnoës]. In this illustration the 'hump of water' is two to three meters high.*

### 3. Buoyancy

However, gravity provides an understanding of rising sea levels resulting simply from buoyancy. Where the mass is greater (land), the level will sink and where the mass is less (sea), the level will rise.

This is Archimedes' original figure in his treatise 'On Floating Bodies' [Archimedes]. We have an arc of a circle *ABC* which is the mean land level. On the portion *AB* we have an ocean and the actual level is $A_1B$, and on the portion *BC* we have mountains and the actual level is $BC_1$. If the whole thing is a fluid (in this case, we would call it 'viscous'), the portion $BC_1$ will tend to sink and the portion $A_1B$ will tend to rise. Archimedes demonstrates this by considering an internal arc *XYZ*. In equilibrium, the pressures on the two arcs *XY* and *YZ* should be the same.

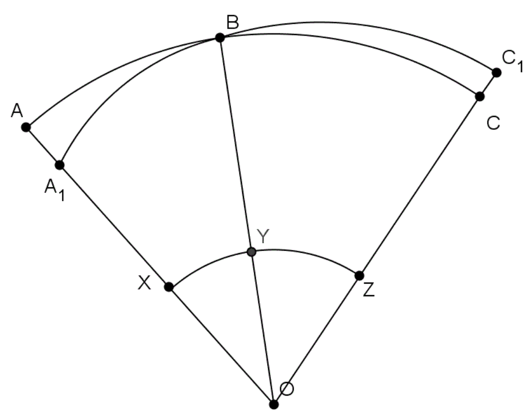



*Figure 41: Archimedes' arcs*

Equilibrium will be restored if the portion $BC_1$ sinks and the portion $A_1B$ rises.

### 4. Variations in the Earth's internal temperature

Temperature variation within the terrestrial globe is a mystery (we are talking here about the interior, not the atmosphere). Simple common sense would tell us that over five billion years it has had plenty of time to cool down. Admittedly, the earth's crust is a good insulator; it ought to be possible to calculate the cooling time needed, on the basis of temperature and thermal conductivity assumptions; a rough calculation is given in Chapter 1, Part Two, below. Some authors also assume that the core is the seat of nuclear reactions that are thought to help maintain the core temperature.

There is no doubt that such reactions exist, but we are not able to assess their quantitative effects. We will return to this in greater detail in Part Two.

If the terrestrial globe is tending to cool down, in cooling it contracts and that contraction will affect the heavier parts of the world more than the lighter ones; this accentuates the previous phenomenon.

Many authors also mention a 'post-glacial rebound'. Due to the warming up that followed the ice age, ice melted and the sea level rose. The ice having melted, the pressure it exerted on the rocks ceased and the rocks tended to rise: this is elasticity at work, and it is thought to have mainly affected those parts of the world in the northern latitudes.

This theory is based almost entirely on models, which are very questionable. In principle, ice melt should affect all those parts of the world that went from a temperature below 0°C to a higher temperature. A sphere has two hemispheres, and it is not clear why a phenomenon like this would affect one more than the other.

### 5. Abrasion of the land by rivers

Rivers have been flowing for some billions of years, and they carry earth and fragments of rock from the terrestrial areas to the depths of the oceans. Unlike the water cycle, this phenomenon is not reversible. Its effect is that the volume of land under water decreases and matter is deposited on the ocean floors. The quantities involved are considerable, but nowhere have we seen attention paid to this phenomenon.

### 6. A remark about method

We have not seen any models that have the interior of the terrestrial globe 'communicating' with the surface (apart from the dust generated by volcanoes). Admittedly, the sun plays a prominent part, but it is hard to imagine that the molten magma which the Earth is made of has no effect on the surface temperature. We will come back to this in Part Two.

## *E. Be careful!*

As this issue has taken on a major political dimension, all kinds of statements are made by absolutely anyone at all. Great care is therefore called for when accepting information.

### 1. Models

Conclusions based on any kind of model should be disregarded. As the SCM specializes in building mathematical models, we should also be recognized as competent to criticize them. Models are useful when attempting to review our knowledge, but they should not be used as an aid to decision-making until they have been validated. Now, validating a climate model requires thousands of years.

### 2. Measurements

The greatest caution is needed with regard to the conclusions drawn. There may be errors in measuring, but that is not the main issue. In most cases, the number of measurements is far too low to describe the phenomenon in question. They are much too recent (thirty years, sometimes 200 in the case of marigraphs) to take account of phenomena like ice ages.

### 3. Dishonesty

The level of dishonesty is rising much faster than the sea level. It has totally swept scientific literature, where a good many writers endeavor to produce models showing something worrying. The press disregards all the others and its various organs vie to bring them to public attention.

Here is an extract from SCM Letter no. 18, June 2002:

In late March Mr. Jean François Minster, CEO of IFREMER, appeared on the *Journal de 20 h* program on the TF1 channel. He spoke about a glacier breaking up in Antarctica. This was portrayed as a rare event. He offered it as proof of global warming and referred to sea levels rising "by several tens of centimeters". Those data, presented in this way, are fallacious:

- It is normal for a glacier in Antarctica to break up at that time of year;
- There is no reason to believe that, globally, Antarctic glaciers are retreating.

It is funny that now (in 2015) the IFREMER site makes no more mention of rising sea levels.

The alarmist news is contradicted by the facts:

This is what was written by Pierre Barthélémy in an article in *Le Monde* (December 18, 2005) entitled 'Thousands of refugees soon fleeing the ocean':
"Global warming will lead to the sea level rising by 5 mm per year in the 21st century, three times as fast as in the previous century. The areas most at risk are the Pacific islands, Bangladesh and the major deltas. In August the one hundred or so inhabitants of Lateu, in the Vanuatu archipelago in the South Pacific, made history quite unintentionally. Their village, lying on the Pacific shore on the small island of Tegua, became the first in the world to have to be relocated because of climate change and rising ocean levels. The roots of the coconut palms were under water, cyclones and spring tides were following one another at an unbelievable rate, the little coral reef 1 meter tall, the last line of defense against the waves, had eroded, mosquitoes carrying various diseases were flourishing in the

pools of stagnant water… So they had to move some hundreds of meters inland. Lateu today serves as a symbol."

But the sea level has not risen significantly in this part of the world for the last 25 years, as is evident from the local marigraph readings and satellite observations. See [Muller].
Quite the opposite:

A NUMBER of Pacific islands previously thought to be losing ground to rising sea levels caused by climate change have actually grown larger, according to scientists. A study published in this week's *New Scientist* magazine has revealed that despite long-held fears that islands in the Pacific Ocean would be washed away in coming decades due to rising sea levels from global warming, the islands are actually responding to the threat by growing larger. The study of 27 islands by the University of Auckland and the South Pacific Applied Geoscience Commission in Fiji found that over the last 60 years only four of the islands had shrunk, with the others either remaining stable or growing. [Daily Telegraph]

## 4. Critical analysis

The rising sea level is a basic thesis for journalists, to support the doctrine of global warming. They say, "Look, the sea is rising, and so we are in danger".
It is perfectly true that the sea level is rising, but essentially this is due to the cooling down of the core of the terrestrial globe which has been taking place gradually for five billion years. As a result of this contraction the lighter areas (the oceans) tend to rise up in relation to the heavier areas (the mountains). This is simply a consequence of buoyancy, and human beings have nothing to do with it.

# Annex

## The sea level at Brest

This is not relevant when considering mean ocean levels (our topic here), but it is relevant in showing the tremendous variability, even over long periods, and the problems of measuring.

Here are the annual data since 1807 (source: SHOM, provided by Yves Desnoës):

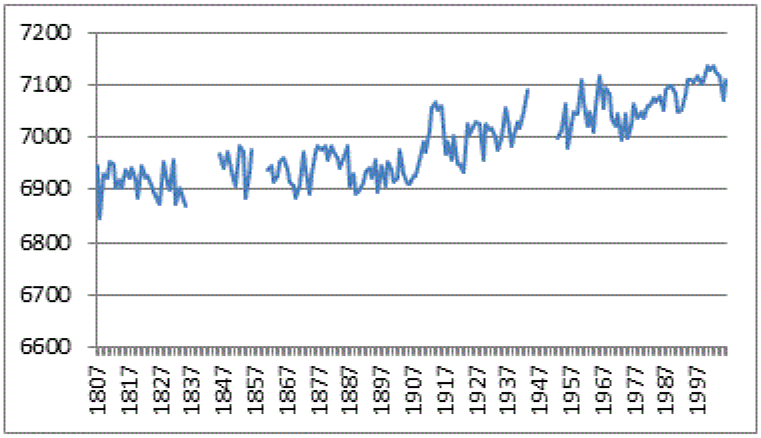



*Figure 42: Ocean level records for Brest since 1807 (SHOM)*

The very great variability of the annual mean from year to year is probably linked to the variability of the climate. When the atmospheric pressure falls, the sea level rises (the pressure of the column of air is less).

Here are the means for consecutive ten-year periods:

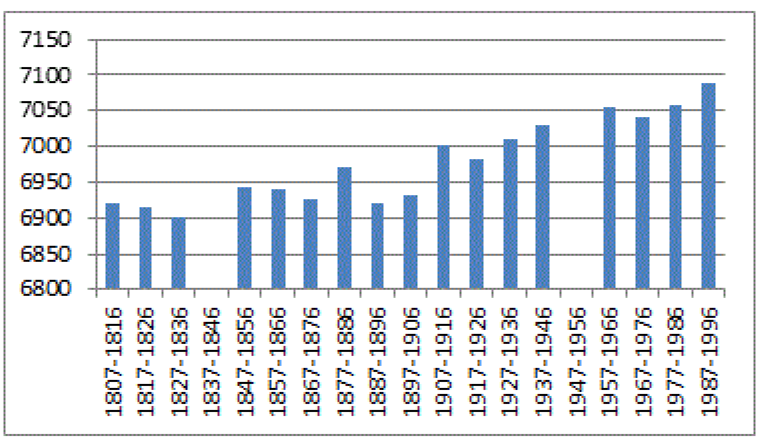



*Figure 43: Average ocean level at Brest per decade*

It can thus be seen that there are 30-year periods during which the mean level falls. The tremendous variability of the above graph shows that it is not possible to make a reliable forecast for a ten-year period. In the next ten years the level may equally well rise as fall.

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# Chapter 2

## A costly crusade

We have just seen that the crusade against a hypothetical 'global warming' is absurd, as global warming is not happening. But that crusade has a cost, which is very real. The initiative is, of course, European.

## I. The European Climate and Energy Package

### *A. CEP: introduction and costs*

In 1972 the European Community adopted its first Environment Action Programme. In 1997, in the context of the Kyoto Protocol, it undertook to reduce its Greenhouse Gas (GHG) emissions between 2008 and 2012. Upon its expiry in 2012 the Kyoto Protocol was finally extended until 2020 at the Doha Conference in an eight-year undertaking (from 1 January 2013 to 31 December 2020) made by the European Union (EU), Australia, Norway, Switzerland, Ukraine, Belarus, Kazakhstan, Liechtenstein and Monaco.

That was the background to the Climate and Energy Package (CEP). This is a set of texts adopted in 2009, and then revised in 2014, following the negotiations between the European member states [Cdc2]. It contains components of European climate change control policy. The Climate and Energy Package sets three key targets, called the 'triple twenties', to be attained by 2020:

- Reducing GHG emissions by 20% compared with 1990 levels ;
- Developing Renewable Energy Sources (RES) to 20% of total energy consumption ;
- Improving energy efficiency by 20%. Energy efficiency, also called intelligent energy, means optimizing consumption by searching for the least energy intensity. For a given system the aim is to find the operating state in which energy consumption is minimized while the yield remains the same. Energy efficiency affects sectors like transport and construction (building, renovation, etc.).

According to the Cour des Comptes, the French audit office, the French State invests around €37 billion in energy annually, backed up by nearly €20 billion of public funds or similar, such as specific tariffs, the public service obligations levy on electricity consumers (CSPE tax, used in particular to fund RES support policies) and low-interest rate loans, etc., including €3.6 billion of State supplies.

In its chapter dealing with the public costs of implementing the CEP, the French Audit Office [Cdc2] details the estimated costs of the CEP sector by sector on the basis of data supplied by the French Department of Housing, Town Planning and the Countryside (DHUP). We have summarized those costs in the table below.

| **Sector** | **(Scheme)** | **Cost (M€)** | **Comments** | **TOTAL (M€)** |
|---|---|---|---|---|
| **Tertiary housing** | Heat fund | 628 | Commitments 2009-2011; another €1.4 billion needed by 2020 | 4,776,0 |
| | Sustainable development tax credit (CIDD) | 1,780.0 | 2012 (€1.13 bill.) ; 2013 (€650 M) | |
| | Eco-zero (zero-rate loan) | 571.0 | 2009 (€192 M) ; 2010 (€189 M) ; 2011 (€109 M) ; 2012 (€81 M) | |
| | Eco-social (social housing loan) | 127.0 | 2009-2011 (€115 M) ; 2012 (€12 M) | |
| | 'Better living' program | 1,350.0 | Of which €500 M State | |
| | Energy modernization work | 320.0 | 2009-2013 : home (€230 M) ; overseas (€90M) | |
| **Transport** | Partial exemption from TICE | 3,400.0 | 2005-2013 | 4,850.0 |
| | Accrued no-claims bonus deficit covered by the State | 1,450.0 | 2008-2001 | |
| **Industry** | OSEO green loans | 500.0 | Funding in 2010 | 534.0 |
| | OSEO green energy loans | 33.0 | Funding in 2012 | |
| | Rational use of energy (ADEME) | 0.5 | Annual since 2012[2] | |
| **Agriculture** | 'Plant environment' and 'energy performance' plans | 20.6 | 2013 | 58.6 |

[2] 'TOTAL' calculated by adding up to and including 2013

| | | | | |
|---|---|---|---|---|
| | Sustainable, balanced land management | 37.5 | 2013 | |
| | TIC and TICPE exemption | 0.5 | 2013 | |
| **Renewables** | Cost of supporting RES + CSPE | 19,400.0 | 2005-2013 | 19,400.0 |
| **ETS** | Administrative cost of operation | 0.6 | Annual since 20081 | 1,810.6 |
| | VAT fraud | 1,600.0 | More fraud since self-assessment was introduced in 2010 | |
| | New Entrants Reserve (NER) | 207.0 | Mis-rating of NER (€95 M)[3] + special tax in 2012 (€112 M) | |

*Table 1 : Summary of sector-based CEP costs to 2013 (M€) [Sources : DHUP ; French Audit Office]*

Grouped together by sectors, the estimated total cost of the CEP to 2013 amounted to 4,776.0 million euros for tertiary housing, 4,850.0 for transport, 534.0 for industry, 58.6 for agriculture, 19,400.0 for renewable energy sources and, lastly, 1,810.6 million euros for the ETS.

Most of the French State's financial investments in climate change control policy are made in the field of renewable energy sources. To help reduce GHG emissions, $CO_2$ in particular, a Community Emission Trading System (EU ETS) has been set up. Enterprises can assess their GHG emission rates with the aid of the GHG Audit method and the Carbon Audit tool. These three points are discussed in more detail below.

## *B. Renewable energy sources*

The European Union's aim is as follows: renewable energy sources should supply 20% of the EU's final energy consumption by the year 2020. France has set itself the target of reaching 23%. By the end of 2013 it had reached a level of 14.2%.
This target breaks down according to the three renewable energy source sectors: heat, transport and electricity, for which the cover targets are 33%, 10.5% and 27% respectively by 2020.

[3] Source: French Audit Office

All in all, there are five major families of renewable energy sources: solar, wind, hydro, biomass and geothermal.

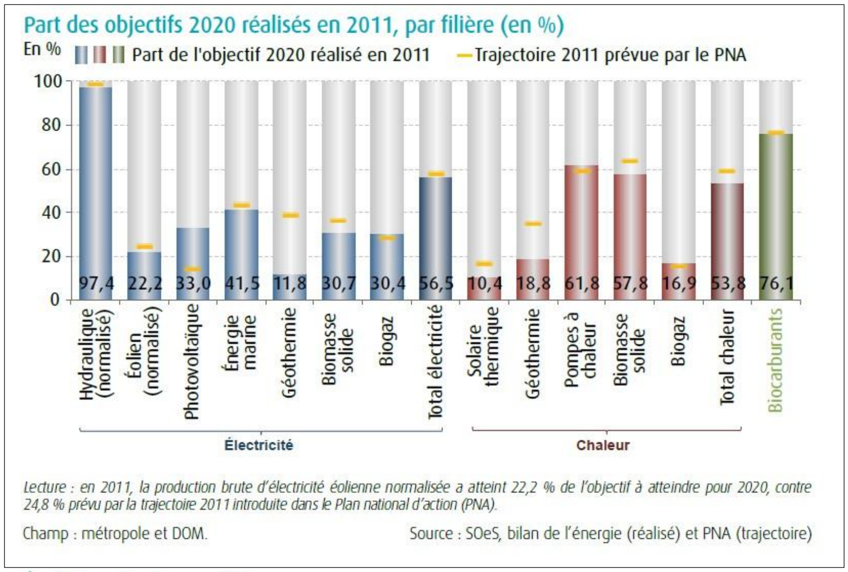


*Figure 1: CEP targets for renewable energy sources by sector (in %). Source: Department of Observation and Statistics (SOeS) and National Action Plan (NAP)*

Key :

| | |
|---|---|
| Part des objectifs… | 2020 target attainment in 2011, by sector (%) |
| En % | In % |
| Part de l'objectif… | 2020 target attainment in 2011 |
| Trajectoire… | 2011 path according to NAP |
| Hydraulique (normalisé) | Hydro (standardized) |
| Eolien (normalisé) | Wind (standardized) |
| Photovoltaïque | Photovoltaic |
| Energie marine | Marine |
| Géothermie | Geothermal |
| Biomasse solide | Solid biomass |
| Biogaz | Biogas |
| Total électricité | Total electricity |
| Solaire thermique | Solar thermal |
| Géothermie | Geothermal |
| Pompes à chaleur | Heat pumps |
| Biomasse solide | Solid biomass |
| Biogaz | Biogas |
| Total chaleur | Total heat |
| Biocarburants | Biofuels |
| Electricité | Electricity |
| Chaleur | Heat |
| Lecture : … | Interpretation: in 2011, gross standardized electricity |

| | |
|---|---|
| | production from wind reached 22.2% of the target for 2020, against 24.8% according to the 2011 path established in the National Action Plan (NAP). |
| Champ : … | Field: metropolitan France and overseas departments |
| Source : … | Source: SOeS, energy balance (actual) and NAP (path) |

## 1. Assessment of electricity from renewable sources in France

To start with, here is an inventory of renewable energy production in France.
France's renewables capacity is as follows:

- Mainland France's hydro capacity is 25.2 GW
- France's wind farms total 9,482 MW
- France's solar plants amount to 5,860 MW

The graph shows the quantity of energy from renewable sources consumed in France and its distribution over the three sectors, namely solar, wind and hydro.

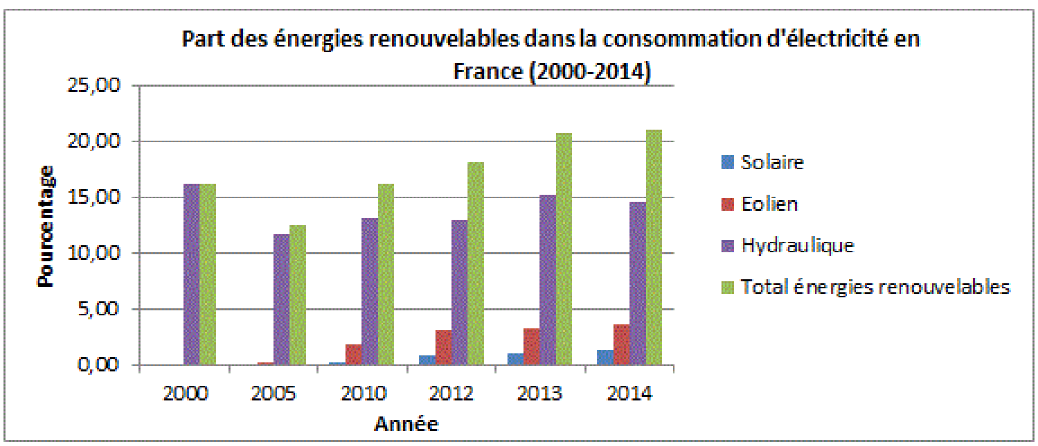


*Figure 2: Renewables' share of France's electricity consumption by sector (in %). Source: RTE*

Key :

| | |
|---|---|
| Part des énergies… | Renewables' share of electricity consumption in France (2000-2014) |
| Pourcentage | Percentage |
| 25,00 (etc.) | 25.00 (etc.) |
| Solaire | Solar |
| Eolien | Wind |
| Hydraulique | Hydro |
| Total énergies renouvelables | Total renewable |
| Année | Year |

The only type of renewable produced and consumed in France in 2000 was hydro. Since then, hydro power production has remained constant overall, whereas that of other renewables has increased, with wind, solar and other more marginal renewable energy sources (biomass, etc.) coming on stream.

Following a big increase between 2005 and 2012, wind power has stagnated since, despite the announced ambitions of building 19 GW wind power on land and 6 GW wind power at sea by 2020. That would represent an investment of around €2.9 billion per year. Wind power is stagnating because the most favorable sites for wind farms have already been developed, as pointed out in [Energiesactu]. The wind power sector has reached 4.0% of national electricity consumption. Now it is meeting with strong resistance from local people opposed to the construction of new wind farms.

## 2. High production cost of renewables

Energy from renewable sources such as wind and solar has experienced rapid growth but is costly to produce, far more so than nuclear or hydro power.

Here is a list of the main types of energy used in Europe:

- Solar (150-400 euros/MWh)
- Oil (150-300 euros/MWh)
- Coal (50-100 euros/MWh)
- Wind (70-200 euros/MWh)
- Biomass (43-133 euros/MWh)
- Nuclear (30-120 euros/MWh)
- Gas (60-80 euros/MWh)
- Large hydro (15-20 euros/MWh)

French consumers currently pay €0.1440 per kWh of electricity [electricity suppliers]. These figures show that increasing the share filled by renewables is not profitable, compared with nuclear in particular.

Moreover, the cost of connecting to the grid must not be overlooked. This is assessed by the French Audit Office at €5.5 billion by 2020.

Nevertheless, being bound by its undertakings, the French government has put in place a number of policies in support of funding renewables.

## 3. State support measures

a. Measures common to the heat and electricity sectors

- Lower-rate VAT

Lower-rate VAT is applied to work to improve the energy quality of buildings over two years old for use partly or wholly as housing. It is also applied to district heating systems that use more than 50% renewables. VAT was lowered from 19.6% to 5.5% and then raised to 7% in 2012 (for the former). The cost of this measure has been assessed at €1.92 billion between 2005 and 2011.

- Sustainable development tax credit (CIDD)

Introduced in 2005, this applies to work done in a home built more than two years ago with the aim of making it more energy-efficient. The cost of this tax credit is assessed at €8 billion from 2005 to 2013, see [CdC1]. Between 2014 and 2020 it is assessed at €4.6 billion, assuming current support policies remain unchanged. This sum is paid by the taxpayer, see [CdC2].

- Eco-loans

The zero rate eco-loan (Eco-zero) is granted to finance improvements to the energy consumption of a home built pre-1990. The social housing eco-loan (Eco-social) has kicked off the renovation of high-energy social housing. The costs of Eco-zero and Eco-social are assessed at €571 M and €127 M respectively between 2009 and 2012. See [Cdc2].

Other measures have also been put in place. Even though the cost of these is difficult to calculate, the French Audit Office provides an assessment. Firstly, if certain criteria are met, it is possible to qualify for tax exemptions and specific allowances, at an estimated cost of around €0.5 M per year. In addition, some equipment qualifies for special reducing-balance depreciation over 12 months. This measure has been costed at €4 M per year by the French Audit Office, see [Cdc1].

- Support for research and innovation

The cost of support for research and innovation for the renewables sector between 2014 and 2020 is assessed at €2.1 billion. See [Cdc2].

b. Aid measures for the electricity sector

- Purchase obligation tariffs

The principle of the obligation-to-purchase tariff is this: EDF and the local electricity distributors have to buy energy produced from renewable sources from the producers at a fixed tariff. The term of this obligation is 15 to 20 years, according to the operator.

The tariff for purchasing energy from renewable sources can be set by order of the Minister for Energy on the recommendation of the Energy Regulation Commission. However, the purchase tariff can also be fixed in the purchase contract following a call for bids.

- Calls for bids

EDF and the local electricity producers pass on the impact of this obligation to a portion of the CSPE tax paid by the consumer. The purpose of this tax is to offset not only the extra costs of the support measures for renewables and the purchase obligation but also the higher cost of producing electricity in those parts of the country not interconnected to the continent and the solidarity tariffs for people living on the poverty line. See [FEE].

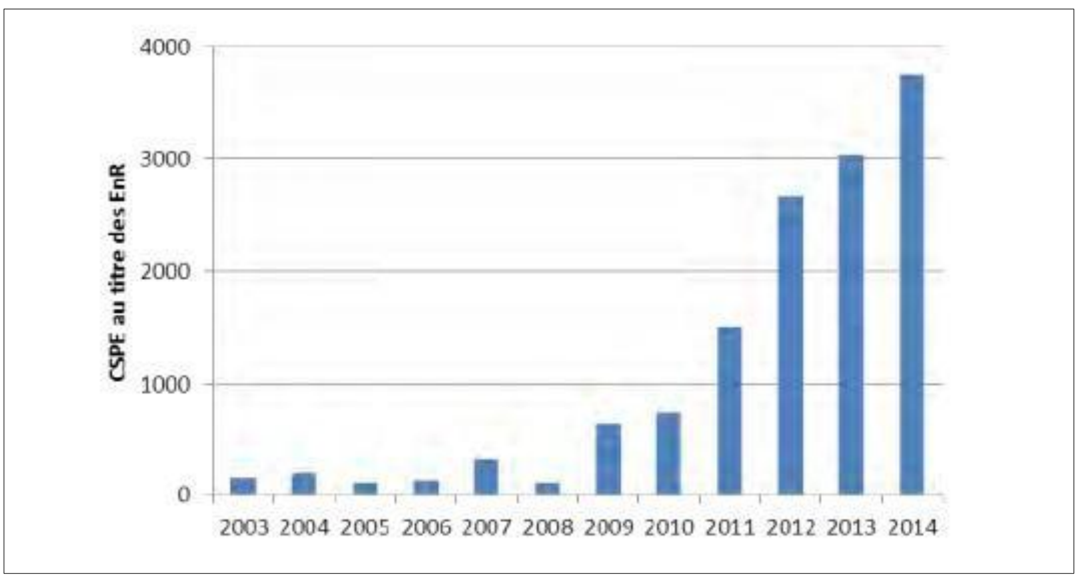


*Figure 3: Trend for CSPE corresponding to RES (M€). Source: ERC*

Key :
CSPE au titre des EnR CSPE in respect of RES

The Energy Regulation Commission has published a report analyzing the costs and profitability of renewables (for the three sectors of land-based wind power, photovoltaic solar and biomass). We have looked at the main two of these.

- **Wind**

Almost all of France's wind farms qualify for the purchase obligation introduced in 2001. EDF purchases the electricity at a price of €0.082/kWh, well above the cost of producing wind power.

This purchase obligation has a term of 15 years, but a power plant nowadays has an average operating life of 20-25 years. This is another factor behind the overprofitability of the sector.

It must be stressed [Ichay] that profitability varies considerably according to the geographical location of the wind farms.

- **Photovoltaic**

Dynamic purchase tariffs have avoided excessive profitability (unlike the wind power sector).

The purchase tariff is currently €0.2617/kWh, with no change for 20 years.

c. Aid measures for the heat sector

- Heat fund

This fund is managed by ADEME (French Environment and Energy Management Agency) and is used to support heat production from renewable sources in blocks of flats, the tertiary sector, agriculture and industry (except for private individuals).

Between 2009 and 2013, the cost was limited to €1.2 billion. However, another €1.4 billion would be needed in order to attain the target for 2020. See [Cdc2].

- Guarantee fund and AQUAPAC fund

These two funds are more marginal support measures directed at geothermal energy.

d. Aid measures for the transport sector

In the area of transport a general tax on polluting activities has been introduced. The aim of this is to foster the inclusion and distribution of biofuels.

## 4. Renewables cost summary

The table below shows cost and investment estimates for the renewables sector to 2020.

| Sector | (Measure) | Cost (M€) | Comments | TOTAL (M€) |
|---|---|---|---|---|
| Renewables | RES support expenses + CSPE | 19,400.0 | 2005-2013 | 75,300.0 |
| | | 44,000.0 | 2014-2020 (of which €35.6 bill. for CSPE) | |
| | Heat Fund expenses | 1,200.0 | 2009-2013 | |
| | | 1,400.0 | Energy Regulation Commission estimate for 2020 | |
| | Research | 1,700.0 | 2002-2011 | |
| | | 2,100.0 | Energy Regulation Commission estimate for 2020 | |
| | Connection to grids | 5,500.0 | RTE and ERDF estimate for 2020 | |

*Table 2: RES cost estimate summary under the CEP (M€) [Sources: DHUP; Audit Office]*

## *C. Measuring methods and tools, quota trading system*

### 1. GHG audit and carbon audit

The greenhouse gas emission audit (GHG Audit) is a method for quantifying emissions of the main greenhouse gases (GHG) at the level of a product or an entity (enterprise, regional administration, state, NGO). Article 75 of the Grenelle II Act makes a statutory GHG Audit mandatory for certain entities. These are [ABC]:

- Enterprises with 500 or more employees (250 employees in the overseas departments and territories) ;
- Public corporations with 250 or more people ;
- Semi-autonomous regions with a population of 50,000 or more.

The Carbon Audit is a tool for calculating GHG emissions. It was originally developed by ADEME then adopted by *Association Bilan Carbone* (ABC). However, since 2011 the Bilan Carbone® has been a registered trade mark denoting a carbon accounting tool and method. It can be used for the purpose of complying with Article 75 of the Grenelle II Act, as Version 7 includes automatic data extraction in the regulation format. The tool is meant to be operational for use in assessing GHG and carbon emissions. As we will see below, it is in fact completely invalid.

A Carbon Audit comprises Scopes 1, 2 and 3, namely [A2DM]:

- Scope 1: direct emissions (energy combustion) from stationary and mobile sources;
- Scope 2: energy-related indirect emissions;
- Scope 3: emissions from purchasing, standstills, upstream freight, employee travel, waste, etc.

The cost of a carbon audit for an enterprise depends on the following factors:

- Number of sites to be audited
- Nature of business (production, distribution, services, etc.)
- Number of employees
- Level of precision desired by the enterprise

The cost of a GHG audit varies according to the type of audit carried out, the type of entity and the consultant's experience [APCC]:

- GHG audit scope 1, 2 and 3: from €5,000 to €20,000 for between 12 and 20 days' work

- GHG Regional audit: from €10,000 to €27,000 for a minimum of 20 to 25 days' work

- Statutory GHG audit scope 1 and 2: from €3,500 to €5,500 for a minimum of 4 to 5 days' work

The cost of an audit in France can generally be estimated at between €15,000 for smaller entities and €100,000 for the biggest entities [GHG audit report]. The first audit is the most expensive as it requires the data collecting system to be set up. Once the system is up and running, the cost of further audits is lower.

SCM carried out a critical analysis of the Carbon Audit in November 2008 [BC]. The Carbon Audit is not a legal obligation at world level, yet the European Community has started issuing recommendations. France immediately passed laws and regulations that are restrictive in nature. But whereas in France, laws and regulations are endlessly debated (e.g. Carrez Act, radar speed checks), the Carbon Audit has not so far undergone any methodological criticism.

What would have to be done to make the Carbon Audit logically consistent? The answer is simple: remove everything relating to the past (old buildings, standstills) and everything relating to the future (such as dismantling) and confine it to the present by recording instantaneous emissions (this can be done at per-year level and then brought down to per-day level, for instance).

Finally, assuming the Carbon Audit to be reduced to the minimum, that is to say, current activities and only those relating to the enterprise itself (not activities that are contracted out), we have to consider the uncertainties. By restricting the scope in this way, is it possible to obtain a satisfactory, reliable result that could perhaps be taken as the basis for assessment?

The answer is a clear No. Due to the variability of industrial processes, an accurate evaluation is theoretically possible, but completely impossible in practice, as the waste from similar processes can vary by between 20% and 100% according to circumstances. As regards employees and their means of transport, this comes up against privacy considerations: this is not something the employer needs to know.

It is thus impossible in practice for an enterprise to keep $CO_2$ accounts that are as detailed and accurate as its VAT return, for example.

So what should we do? Obviously, the temptation will be to say "Let's use averages and rough values: such-and-such a process produces approximately that quantity of $CO_2$; for 1,000 employees we will assume roughly this number of cars producing approximately that amount of $CO_2$".

However,

- The Carbon Audit no longer has any incentive value: a manufacturer will see no point in replacing an inefficient machine with a more efficient one as this is not taken into account in the audit, which is based only on average values.

- The Carbon Audit cannot be used as a basis of assessment. According to the laws in force an assessment can only be made on the basis of quantities actually produced and not on the basis of estimated quantities, however those estimates were arrived at.

The Carbon Audit is the modern counterpart of 'selling indulgences', as practiced by Pope Leo X in particular. It serves no purpose at all: the planet really couldn't care at all about the quantity of $CO_2$ emitted by this or that enterprise. But it does serve to finance the crusades. As Victor Hugo said, "The gold sequin can be seen passing through their fingers" (Les Châtiments).

## 2. EU Emission Trading System (ETS)

This scheme, introduced in 2005, aims to limit emission by sectors of industry that are big polluters by imposing a ceiling which is lowered each year (EU ETS). The object of the scheme is to help the EU and the member states to meet their undertakings to reduce greenhouse gas emissions made in the context of the Kyoto Protocol.

This ceiling is imposed by the member states and applies to some 12,000 facilities in sectors such as electricity generation, heating networks, steel, cement, refining, glass and paper, representing over 40% of Europe's greenhouse gas emissions [MEDDE].

Enterprises are allotted quotas under the National Quota Plan (NQP) according to the potential for reduction and the growth forecasts for the sectors concerned [Inspectorate of Classified Facilities]. In function of the ceiling, enterprises receive emission quotas which they can buy or sell according to their requirements. For example, an enterprise emitting above the $CO_2$ emission quota can buy an emission reduction from another enterprise that emits below the $CO_2$ emission quota.

As an example, let us suppose that 20 tonnes of emissions are available on the $CO_2$ emissions market in 2015, with a quota of 10 tonnes per enterprise. Enterprise A emits 10 tonnes of $CO_2$ and enterprise B also emits 10 tonnes. So far, so good, both enterprises are within their quotas. However, in 2016 the $CO_2$ emissions market shrinks to 18 tonnes of emissions available and a quota of 9 tonnes per enterprise. Enterprise A emits 7 tonnes of $CO_2$ but enterprise B emits 11 tonnes. Enterprise B has exceeded its quota of 9 tonnes and will have to buy 2 tonnes of emission reduction from enterprise A in order to meet its quota.
Here are the European quota transaction volumes between 2005 and 2009 [$CO_2$ quota price]:

| | Volumes traded (million quotas) | Value of transactions (million euros) | Average quota price (€) |
|---|---|---|---|
| 2005 | 262 | 5,400 | 20.6 |
| 2006 | 828 | 14,500 | 17.5 |
| 2007 | 1,458 | 25,200 | 17.3 |
| 2008 | 2,731 | 61,200 | 22.4 |
| 2009 | 5,016 | 65,900 | 13.1 |
| Source: Caisse des Dépôts Climate Mission calculations from Carbon Review data | | | |

*Table 3 : European quota transaction volumes between 2005 and 2009*

The quantity of transaction volumes increased 20-fold between 2005 and 2009, whereas the transaction value increased 12-fold. The average quota price varies from year to year.
No-one has ever pondered the impacts this scheme has had on relocations. In the face of ever-tighter regulations, manufacturers know that they will not be able to carry on their business indefinitely.

Between 2008 and 2009 a VAT fraud involving $CO_2$ quotas occurred in France, resulting in a tax loss of €1.6 billion for the French State and €5 billion for all the European Union member states [Cdc3]. Three flaws in the design of the ETS led to this fraud:

- Failure to make the VAT collection system secure for real-time transactions
- Virtually uncontrolled access to national quota registers
- Lack of external market regulation

This is the biggest tax fraud in such a short time ever recorded in France.

# II. The United Nations Environment Programme

## *A. Introduction to UNEP*

The United Nations set up the United Nations Environment Programme (UNEP) in 1972 as part of its policy of reducing and adapting to climate change. The UNEP is the highest environmental authority in the United Nations system with the brief of dealing with environmental issues at regional, national and global level. The Programme has a number of aims:

- Assessing global, regional and national environmental conditions and trends
- Developing international and national environmental instruments
- Strengthening institutions for sound environmental management
- Facilitating knowledge and technology transfer for sustainable development
- Promoting new partnerships and new perspectives within society and the private sector

The UNEP encourages governments and enterprises to reduce emissions, helps the most vulnerable countries and communities to find ways of building resilience to climate change, and assesses the overall cost of measures to adapt to and reduce climate change.

It estimates the total cost of global warming at $150 billion per year between 2025 and 2030, and from $250 to 500 billion per year up to 2050. The budget for Africa alone accounts for $50 billion of these estimates.

Of course, the UNEP has never considered whether climate change is actually happening, having taken it as a given from the outset.

## *B. UNEP 2013 report*

### 1. Introducing the report

Each year the UNEP draws up a report, divided into a number of sections entitled Climate Change, Disasters & Conflicts, Ecosystem Management, Environmental Governance, Chemicals & Waste, and Resource Efficiency. These correspond to Sub-Programmes for which, among other things, it carries out a financial audit.

The UNEP is largely funded by contributions from member countries. We have examined the budget for 2013, as the 2014 budget has not yet been validated. It is based on the Environment Funds, the contributions allocated (member states' contributions for the purpose of supporting a specific program), and the UN's ordinary budget and amounts in total to \$207.7 M. In 2013 the amounts for the three resources were \$82.75 M, \$120.94 M and \$4.27 M, respectively.

The total amount allocated is \$274.4 M, that is, an additional 32% compared with the UNEP's available budget. Expenses amount of \$194.6 M. The UNEP gives very little information about exactly what these costs comprise. This overall budget covers all the Sub-Programmes initiated by the UNEP as detailed below.

### 2. Breakdown of UNEP Sub-Programmes

For each of the Sub-Programmes we have listed the main plans of action and, thus, expense items. We have noted the budget made available for each Sub-Programme. The UNEP set itself milestones in 2011 to be achieved by 2013. Depending on how many milestones are achieved in relation to the initial milestones, the report classes the activities in three categories: attained, not yet attained and attained late.

- **Climate change**

– UNEP's aim: "UNEP assists governments, businesses and individuals to reduce emissions in an effort to minimize the pace and scale of climate change, and assists those nations and communities most likely to be affected to become more resilient to changing conditions".

– UNEP's activities: "Increasing the number of countries that integrate adaptation, including an ecosystem-based approach, into their national development plans, developing clean energy, financing energy, reducing emissions from deforestation and forest degradation, promoting scientific assessment and openness".

– Specific programmes: 'Sustainable energy for everyone'.

– Budget: €41.35 M.

It is to be noted here, and this is very relevant to our analysis, that the UNEP's aim under the heading of 'climate change' is not to study climate change (in particular, by analyzing the data), but to encourage countries to reduce GHG emissions, which is quite different. There has been a jump from a vague consideration to a specific conclusion, "we need to reduce", without any forethought.

- **Disasters and conflicts**

– UNEP's aim: "UNEP aims to minimize such threats to human well-being by supporting governments to reduce risk factors through better policies, carrying out post-crisis assessments, and building recovery programmes that address environmental needs, support peacebuilding and promote long-term sustainable development.".

– UNEP's activities: "Risk reduction, performing post-crisis assessments, assisting with post-crisis recovery".

– Specific progammes: 'Clean villages and schools'.

– Budget: €25.17 M.

To our knowledge, of the countless wars and conflicts taking place around the world, there are really very few that arose from climate change!

- **Ecosystem management**

– UNEP's aim: "UNEP assists governments to ensure that their ecosystems are conserved and sustainably managed to ensure long-term provision of ecosystem services essential for human well-being and economic growth".

– UNEP's activities: "Helping to integrate ecosystem management into development, building capacity to use ecosystem management tools, ecosystem services, and financing".

– Specific programmes: 'Great Apes Survival Partnership' (GRASP).

– Budget: €33.25 M.

- **Environmental governance**

– UNEP's aim: "UNEP produces expert scientific assessments and assists member states to implement their environmental obligations and develop their policies, laws and institutions to place environmental sustainability at the heart of development".

– UNEP's activities: "Establishing international policies, strengthening environmental law, integrating the environment into development, consolidating the scientific bases for decision-taking".

– Budget: €42.11 M.

- **Harmful substances and hazardous waste**

– UNEP's aim: "Providing scientific assessments, bringing together the international community to address global challenges, and assisting governments to develop appropriate policies for monitoring and controlling harmful substances and hazardous waste".

– UNEP's activities: "Increasing the number of countries with environmentally friendly harmful substances and hazardous waste management. Increasing the number of countries putting in place policies for harmful substances and hazardous waste at global level".

– Budget: €29.98 M.

- **Resource efficiency**

– UNEP's aim: "To promote sustainable natural resource use so that well-being and prosperity can be achieved within the Earth's ecological constraints and capacities".

– UNEP's activities: "Strengthening the bridge between science and politics, adopting strategic measures, increasing viable commercial practices in key sectors, promoting more sustainable products and lifestyles".

– Budget: €35.86 M.

## III. Critical analysis

In concluding this chapter we may note that the costs of controlling climate change are exorbitant:

- €30 billion for France up to 2013, of which some €20 billion is for renewables alone. The budget allocation for renewables is expected to reach €75 billion by 2020.

- $274.4 M in 2013 for the United Nations' UNEP programme. This budget can be expected to increase given UNEP's alarming assessments of the cost of global warming: $250 to 500 billion annually until 2050.

These astronomical investments have no relevance, particularly in the renewables sector.
In France, 25.2 GW are produced from hydro sources and 9,482 MW by wind farms, as against 550 TWh by nuclear plants. So nuclear energy is paying for energy from renewable sources. Almost all of France's wind farms come under the purchase obligation introduced in 2001. EDF buys the energy at a price of €0.082/kWh, which is well above the wind energy production cost.

For reasons of false virtue, a niche market has been created that is conveniently supplied by taxes (or electricity bills) paid by all taxpayers.

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# Chapter 3

## The crusade is futile

In this chapter we will see that the crusade is essentially futile, because whatever we do, there is no way we can attain the targets that have been set.

## I. The Kyoto Protocol

On December 11, 1997, the United Nations Framework Convention on Climate Change (UNFCCC) member states adopted a protocol at the third Conference of the Parties (COP 3) in Kyoto. The Kyoto Protocol set greenhouse gas (GHG) emission reduction targets for 37 industrialized countries only (Germany, Canada, USA, Russia, France, etc.) which alone account for 55% of GHG emissions [NU]. The overall target was an average reduction of 5.2% from 1990 levels of emissions of six greenhouses gases between 2008 and 2012.

It came into effect on February 16, 2005. Of the 192 UNFCCC member countries [RIAED]:

- 155 countries ratified the Protocol, of which 21 industrialized countries (including Germany and Japan), 13 transitional countries (including Russia and Bulgaria) and 121 developing countries (including China and Algeria)

- 6 countries signed the Protocol but did not ratify it (including Australia, the US and Monaco)

- 31 countries neither ratified nor signed the Protocol (including Vatican City and Singapore)

The target finally achieved by the 37 industrialized countries was a 20% reduction in their GHG emissions between 2008 and 2010 from the reference year, 1990. A very good result, apparently. However, anthropogenic carbon emissions (i.e. those of human origin) at global level have continued to rise since the nineteen-nineties.

Emerging countries such as China and India now account for 51% of anthropogenic GHG (such countries not being under any restrictions due to the Kyoto Protocol in 1997), simply because the production activities that previously took place in our countries have now been transferred to them.

The rise in emissions by emerging countries is to a great extent attributable to imports of goods and services by industrialized countries. Importing products is a way of reducing GHG emissions (production and transport) in the importing countries (i.e. Europe), but conversely it increases them in the exporting countries (i.e. China) [RAC].

With the Kyoto Protocol expiring at the end of 2012, an extension was voted by the UNFCCC governments at the Conference of the Parties (COP 18) in Doha, Qatar. This further period represents an eight-year commitment (from January 1, 2013 to December 31, 2020) by the European Union (EU), Australia, Norway, Switzerland, Ukraine, Belarus, Kazakhstan, Liechtenstein and Monaco [NU2].

These countries account for approximately 15% of global GHG emissions and their undertakings vary considerably, from a 20% reduction from the 1990 level in the case of the EU to a 0.5% reduction compared with 2000 in that of Australia.

Canada (December 2012), Japan (December 2010), Russia (December 2010) and New Zealand decided not to go along with this second round of the Kyoto Protocol.

It is thus clearly evident (and has been shown by the French Audit Office) that there is no actual reduction in GHG but only an apparent drop, due to production transfers. Of course, relocation results in job losses.

## II. France's $CO_2$: launch of the crusade

Of all the greenhouses gases, the one held chiefly responsible for the ills of the twenty-first century is $CO_2$. The increase in $CO_2$ concentration – which is controversial, see above – is held to be due to human activity alone.

Of course, in the natural world, $CO_2$ occurs independently of human activity. If human activities are to be blamed, the concept of 'anthropogenic $CO_2$' needs to be brought out. This is a difficult stylistic exercise, as those in charge do not include $CO_2$ produced by human respiration (human beings, like any animal, produce $CO_2$ when breathing), but only the $CO_2$ produced by human activities. In order to quantify anthropogenic $CO_2$ those in charge divide up human activities into separate areas (transport, energy, etc.) and attempt to quantify $CO_2$ emissions associated with each of these activities on a country-by-country basis. They then attempt to show that since the beginning of the industrial era the amount of $CO_2$ in the atmosphere has increased considerably. There is therefore a big temptation to establish a causal link between industrial emissions and rising $CO_2$ levels.

In fact, there are two major errors of reasoning here:

- First of all, as explained in Chapter 1, the $CO_2$ level varies all the time and it is incorrect to say that the maximum is associated with industrial activities

- Secondly, there is no difference at all between $CO_2$ produced by human beings and 'ordinary' $CO_2$; both are absorbed by plants, oceans, etc. It is nonsense to think that anthropogenic $CO_2$ increases the atmospheric $CO_2$ level.

The fact is that we do not know the sink and source mechanisms that regulate $CO_2$ concentrations naturally. To claim that human emissions are simply added to those already occurring is nonsense. They are part of the carbon cycle, like the rest.

The same principle applies to the water cycle. If we tip a one-liter bucket of water into a mountain lake, the volume of water in the lake will not increase by that amount. The lake is being fed all the time by rivers and mountain streams, to which our bucket of water is an addition, and it is being drained all the time by evaporation, plant life, rivers flowing out of it, etc.

To assess the relevance of the measures taken, let us evaluate the quantity of anthropogenic $CO_2$ and in particular, that emitted by France. What is France's share of global GHG emissions?

In 2010, France emitted 347 Mt of $CO_2$ but, as mentioned above, that figure takes no account of human breathing (see [Planetoscope]). Total anthropogenic $CO_2$ emissions in the same year amounted to 30.6 Gt. See [LeMonde].

France's share of global $CO_2$ emissions is:

$$\frac{CO_2\ (France)}{CO_2\ (anthropogenic)} \approx \frac{347}{30{,}600} \text{ or } 1.13\%$$

$CO_2$ makes up 40% of all greenhouses gases $\left(\frac{CO_2\ (total)}{GHG\ (total)}\right)$ See [Williams]

Nevertheless, that proportion is debatable, and the figure of 40% is an 'upper limit' (the maximum value observed in the various studies).

Current estimates are that the atmospheric $CO_2$ concentration was 280 ppm in 1750 and 350 ppm in 2004 (Jean-Marc Jancovici), an increase of 25%.

$$\left(\frac{CO_2\ (anthropogenic)}{CO_2\ (total)}\right)$$

The percentage of global greenhouse gas emissions represented by $CO_2$ from France's activity therefore totals:

$$\frac{CO_2\ (France)}{CO_2\ (anthropogenic)} \times \frac{CO_2\ (total)}{GHG\ (total)} \times \frac{CO_2\ (anthropogenic)}{CO_2\ (total)} = \frac{CO_2\ (France)}{GHG\ (total)}$$

$$\frac{347}{30{,}600} \times \frac{40}{100} \times \frac{30}{100} \approx 1.13 \times 10^{-3}$$

or 0.113%!

The funny thing is that the data show that the percentage of $CO_2$ due to human respiration is only half that due to the energy industry. So, by breathing, French people generate 20 million tonnes of $CO_2$ [CITEPA], equivalent to around 6% of France's total $CO_2$ emissions. The energy industry, for its part, accounts for 13% of such emissions. See [Panorama2009].

It is also interesting to quantify France's share of the composition of the atmosphere, that is, $CO_2$ emissions due to French activities in relation to the total atmosphere. That share is:

$$\frac{0.04}{100} \times \frac{25}{100} \times \frac{347}{30{,}600} \approx 1.13 \times 10^{-6}$$

since $CO_2$ makes up 0.04% of the atmosphere. In other words, what we are fighting for today represents one millionth of the composition of the atmosphere. If we were to put a complete halt to all our industrial $CO_2$ emissions, the composition of the atmosphere would at most vary by one millionth.

The variation would in fact be undetectable because, as mentioned above, the $CO_2$ content varies all the time, from place to place, from day to day, and so it would not be possible to show such a small variation. It is therefore clear from these figures that we are fighting for 'hot air', if we may put it like that. Don Quixote tilted at windmills, which at least are tangible objects.

# III. France's vain struggle against greenhouse gas

## A. *French GHG emissions: a drop in the ocean*

The European Union (with 28 member states) accounted for only 8% of global greenhouse gas (GHG) emissions in 2014 [CC]. France is one of the lowest GHG emitters, being responsible for no more than 1.2% of global emissions in 2012 [CC]. France in fact recorded a 13% drop in its GHG emissions over the 2005-2014 period, for the relocation reasons described above.

Looking solely at $CO_2$ emissions, the European Union (with 28 member states) reduced its global emissions by 13.8% over the 1990-2012 period, with emissions falling from 14.7% in 1990 to 11% in 2012 [CDC]. France reduced its emissions by 5.4% between 1990 and 2012. They fell from 1.7% in 1990 to 1.1% in 2012 in global terms.

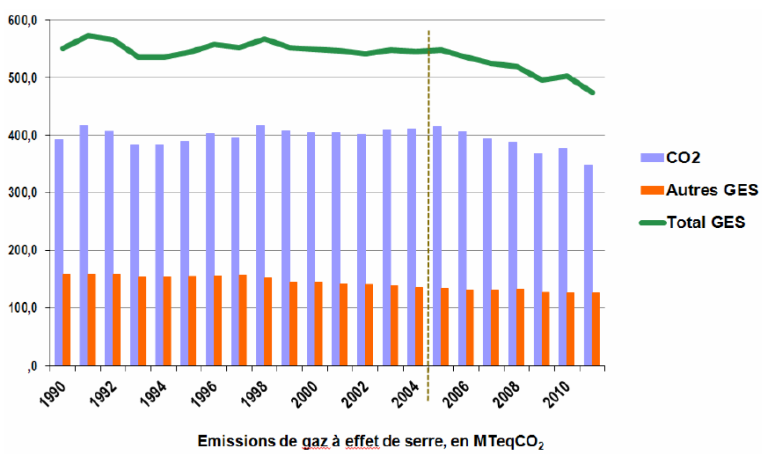


*Figure 1: France's GHG emissions [French Audit Office]*

Key:

| | |
|---|---|
| $CO_2$ | $CO_2$ |
| Autres GES | Other GHG |
| Total GES | Total GHG |
| Emissions de gaz… | Greenhouse gas emissions in $MTeqCO_2$ |

However, care should be taken when interpreting these results. Two things need to be taken into account:

- Firstly, the drop is not due solely to sustainable development policies. The economic crisis played a part in reducing industrial emissions and thus in the fall in GHG emissions.

- Secondly, GHG emissions only take account of emissions within the territory, i.e. France.

If one follows the French Audit Office's practice of including the carbon footprint, which takes account of emissions associated with imports and exports of GHG, the results are no longer the same at all. France's carbon footprint (545 $MtCO_2$) was perceptibly higher than its emissions (410 $MtCO_2$) in 2005. This difference can be accounted for by the quantity of GHG imported into France exceeding the quantity of GHG exported.

When the carbon footprint is taken as a reference indicator, an increase between 1990 and 2005 then becomes apparent [CC] and the results are distinctly less satisfactory.

## *B. The French crusade against the drop in the ocean*

Although France's emissions are merely a drop in the ocean, France has decided to combat that drop. Accordingly, in 2008 the country adopted an ambitious and restrictive policy with the enforcement of the Climate and Energy Package (CEP), as discussed in the previous chapter, with targets of:

- Reducing Greenhouse Gas (GHG) emissions by 20% from the 1990 level by 2020

- Developing Renewable Energy Sources (RES) up to 20% of total energy consumption

- Increasing energy efficiency by 20%

As mentioned above, France is already one of the world's lowest GHG emitters, as most of its electricity is produced via the nuclear route (78% [CGP]). But, to demonstrate how virtuous it is, France has even revised one of its targets upward: developing its RES up to 23%.

Now, paradoxically, developing RES does not always go hand-in-hand with a reduction in GHG emissions. If we take the example of Germany, one of the European countries that has developed its RES the most (25.8% in 2014 [AE]): it is one of the countries whose energy is increasingly carbon. RES, like wind power or photovoltaic, are dependent on climatic conditions: there will be active times (plenty of wind and sunshine, and high electricity production) and slack times. Production is therefore very variable, and there is no means of storing large quantities of electricity.

Germany therefore supplements its electricity generation with coal-fired (41%) or gas-fired (9%) thermal power stations or imports (6% in 2014) [energia]. Clearly, in developing RES in Germany, sufficient thought has not been given to the intermittent nature of the supply and France, evidently, is not prepared to do so either.

In France, the sectors emitting the most GHG in 2014 were road transport (27.9%), industry (22%), agriculture (21.2%) and residential and tertiary construction (18%) [CC].

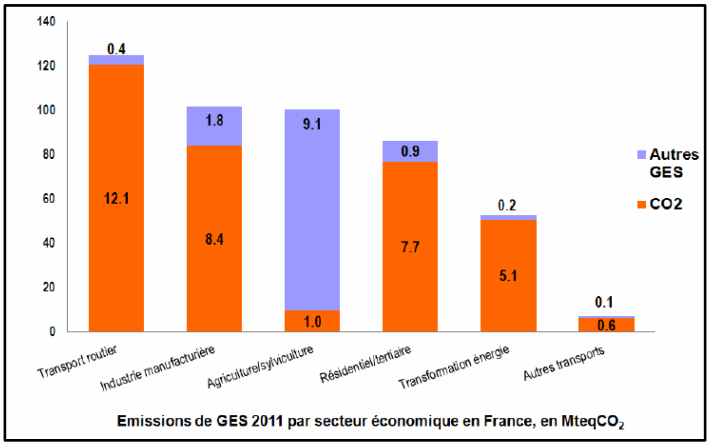


*Figure 2 : GHG emissions by economic sector in France in 2011 (MteqCO$_2$)[French Audit Office]*

Key :

| | |
|---|---|
| Autres GES | Other GHG |
| CO2 | $CO_2$ |
| Transport routier | Road transport |
| Industrie manufacturière | Manufacturing industry |
| Agriculture/sylviculture | Agriculture/forestry |
| Résidentiel/tertiaire | Residential/tertiary |
| Transformation énergie | Energy conversion |
| Autres transports | Other transport |
| Emissions de GES 2011… | GHG emissions by economic sector in France in 2011 (MteqCO$_2$) |

The measures taken by France to reduce its GHG emissions are not consistent. They mainly apply to housing and the tertiary sector, whereas the main GHG emitters are transport and agriculture.

In the case of agriculture, France concentrates on lowering $CO_2$ emissions by farms and disregards the other GHG like nitrous oxide and methane, which make up more than 90% of the sector's total emissions [CC].

As to transport, the measures are costly and ineffective. Investment in transport infrastructure represents a cost per tonne of $CO_2$ avoided in excess of one thousand euros. That means that on average, one thousand euros more has to be spent (compared with what would have been paid had the infrastructure been left unchanged) in order to reduce $CO_2$ emissions by one tonne. This is costly, pointless, and deeply harmful to the sector's economy.

Apart from the inconsistency of the measures, the impact of the schemes for reducing GHG emissions has not been fully assessed. For example, take the 'Sustainable Development Tax Credit' (CIDD) introduced for the tertiary housing sector. This funds a whole range of work in housing, without differentiation. The scheme is efficient in the case of roof and wall insulation, with a public cost of €21 per tonne of $CO_2$ avoided. On the other hand, it is completely inefficient when it comes to supporting solar thermal energy production, with a cost of €432 per tonne of $CO_2$ avoided, i.e. twenty times more expensive than insulation.

## IV. Critical analysis

The crusade is futile: there is no point in trying to reduce our $CO_2$ emissions, which do not affect the climate.

France has only a minor part to play at a technical level. Its industries are cleaner than the world average, as are its cars, and above all its energy production, which is chiefly nuclear, emits less $CO_2$ than others. That does not prevent those in charge in France, who are always looking out for crusades, from trying with all their might to get France involved, ahead of all the others, and going farther and faster than them. In the latest version of the Kyoto Protocol, the member countries account for no more than 15% of global GHG emissions, but we are trying with all our might to be in there.

The measures taken are inconsistent and have not been fully assessed:

- The measures relating to transport are costly and inefficient

- Those relating to agriculture are off-target: they are focused on cutting agricultural $CO_2$, which represents only 10% of the sector's total emissions.

France is prepared to spend a lot of money pointlessly reducing the emissions in its territory, without being aware that the resulting relocations are seriously detrimental to employment.

The only relevant measures are commonplace ones: of course it is a good idea to improve the insulation in buildings, as the heating bills will be lower. But, in order to come to that conclusion, which is not novel, there was no need to talk about global warming or greenhouse gas and to create this whole intellectual construct which, born out of mysticism, is dying in arbitrariness.

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# Part Two

# Scientific aspects

*Chimera, prejudice, sombre falsehood*
*Victor Hugo: Les Châtiments*

# Chapter 1

## Natural climate variability

The Earth is about 5 billion years old; human beings appeared on it only 5 million years ago, and *Homo sapiens* has only lived here for 200,000 years. As for the industrial era, it is only about 150 years old. Therefore, earlier climate changes (including the ice age that happened 20,000 years ago) are clearly of natural origin.

That the climate can still be variable on a 5 billion-year-old planet is at first sight surprising, since it could all have stabilized long ago. But in fact there are numerous causes of climate change that are completely natural. The primary one is external to the Earth: the Sun. The Earth itself can also have a huge influence on climate, at depth (natural geothermal energy), on the surface (ocean currents and volcanic eruptions) and at altitude (clouds and climate oscillations). The globe is not a rigid, nondeformable solid.
In this chapter we list the main natural factors that can influence the climate.

## I. The Sun

The amount of energy given out by the Sun and received by the Earth influences the Earth's temperature and insolation.

### *A. Solar activity*

Solar activity refers to the set of phenomena affecting the sun (sunspots, eruptions, emissions of solar particles, etc.). When this activity varies, the amount of energy that the Sun sends to the Earth is no longer the same.

Solar activity is not constant. In fact, the energy and radiation emitted by the Sun vary, particularly in cycles with an average duration of 11 years.

At times of peak solar activity, black areas (known as sunspots) cover the photosphere. The temperature in these areas is 3,700 °C (instead of 4,500 °C). These black spots often have a diameter greater than that of the Earth. At times of maximum solar activity there are also more solar eruptions and the solar wind is more intense (see [Fondevilla1]).

Let us explain in greater detail how variations in solar activity influence our climate. The three main causes are the following:

- Solar radiation,
- Solar wind,
- Solar eruptions.

**1. Solar radiation**

The variation in the intensity of solar radiation (intensity of ultraviolet radiation) influences the temperature of the ozone layer.

Ozone is a gas capable of absorbing ultraviolet radiation and transforming radiant energy into thermal energy. The greater the intensity of ultraviolet radiation, the greater the number of ozone molecules that are excited (by absorbing radiation energy) and the higher the temperature. Conversely, as the intensity drops, the stratosphere cools.

**2. Solar wind**

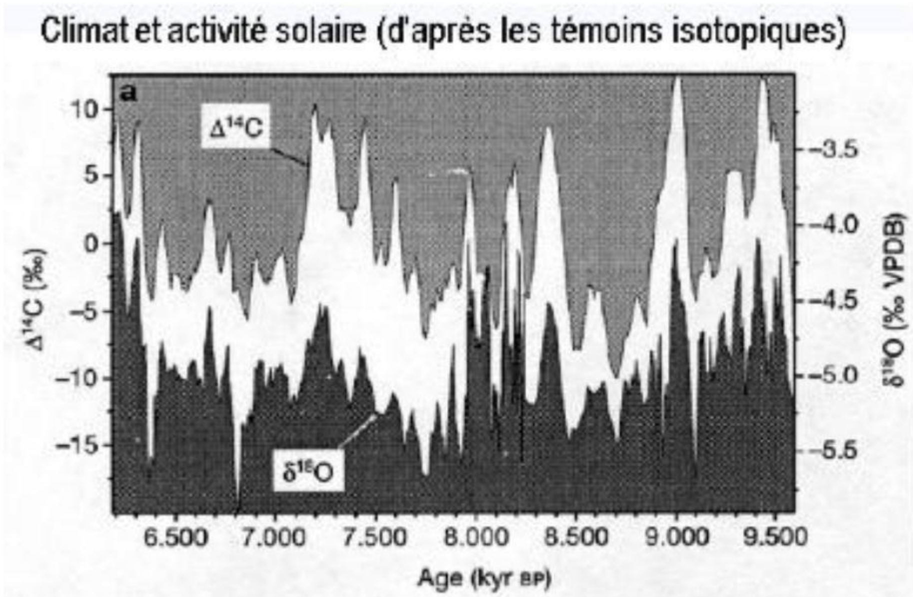
Solar wind is a flux of electrically charged particles consisting essentially of ions and electrons that are ejected from the Sun's upper atmosphere. This flux varies in speed and temperature over time in accordance with solar activity [Wikipedia]. It can have an impact on the amount of cosmic radiation reaching the earth and therefore on the climate (see [Fondevilla2]).

Cosmic rays are high-energy particles coming from stars and supernovae. They affect health and electronic instruments and can encourage cloud formation.

**3. Solar eruptions**

They can cause magnetic storms and have a great impact on the Earth's magnetic shield (the magnetosphere). This results in changes to the radiation received by the Earth and therefore in changes to the climate.

To demonstrate the Sun's influence on climate, [Neff et al.] analyzed data from a stalagmite (a rising limestone concretion) from a cave in Oman.




Key:

| Key : | |
|---|---|
| Climat et activité solaire (d'après les témoins isotopiques) | Climate and solar activity (according to isotope proxies) |

*Figure 1: Variations in solar activity and the Earth's climate*

This graph shows variations in Carbon 14 and Oxygen 18 over time. The former reflect solar activity directly. In fact, Carbon 14 is formed by the action of cosmic rays on atmospheric nitrogen.

The stronger solar activity is, the more intense the solar wind is and the more it prevents cosmic rays from entering the atmosphere. The second set of measures represents climate parameters such as temperature and precipitation. It can be seen that the trends in the two curves are similar, which is why a correlation between the two is plausible.

That solar activity can influence the overall climate of the Earth would seem to be evident to any sensible person. However:

- There are no historical measurements and no direct means of reconstituting them. In principle we are skeptical about the scientific validity of graphs such as the one shown above. These are measurements taken in a single place and the reconstruction procedure has not been validated. We have serious reservations concerning graphs that have different sets of measurements on the *y*-axis (with one scale on the left and another on the right), since one can make them show whatever he likes.

- With regard to academic studies (model building), very few include solar activity or even merely acknowledge its existence. The vast majority of publications focuses on anthropic aspects.

- Currently we do not know how to correctly measure solar activity as a whole.

### *B. Albedo*

Albedo is a physical quantity used to evaluate the amount of sunlight reflected by a surface [CNRS1]. It is a dimensionless quantity with values ranging from 0 to 1: a surface that reflects all sunlight has an albedo of 1 and a perfectly black (and therefore absorbent) surface has an albedo of 0.

This quantity is important when applied to climate since it expresses the part of the Sun's radiation that will be reflected by the clouds and the Earth's surface. This radiation, therefore, will not heat the planet.

Here is a range of values for the Earth's albedo:

- Oceans: 0.05 – 0.10,
- Sand: 0.25 – 0.40,
- Ice: 0.60,
- Snow: 0.90,
- Water: 0.10 – 0.60,
- Mean albedo of the Earth: 0.30.

The mean albedo of the Earth varies between 0.30 and 0.35, which is quite high compared with other celestial bodies (Mercury and the Moon have an albedo of approximately 0.07 and therefore absorb a large part of the Sun's radiation).

Anything that alters the albedo will also alter the climate. For example, the melting of sea ice and changes in land use (such as desertification or deforestation) are phenomena that can change the local albedo and therefore the planet's energy exchanges.

The natural phenomenon that has the greatest influence on the Earth's albedo is cloud cover. In fact the albedo of clouds may reach 0.80, so where there are clouds a large proportion of the Sun's radiation will not reach the ground and will be reflected back into space.

# II. The Earth's movement around the Sun

Three phenomena can change the Earth's motion and position in relation to the Sun, and result in climate change at hemispheric scale. Contrary to general belief, they do not affect the overall insolation received by the planet (see our papers on this subject [BB_OR]). These phenomena, also called Milankovitch parameters, are:

- Variations in the tilt of the Earth's axis,
- Variation in the shape of the Earth's orbit around the Sun,
- Precession.

## 1. Variations in the tilt of the Earth's axis

The tilt of the Earth's axis is a variable quantity. [Milankovitch] calculated it to vary between 22.1° and 24.5° over a 41,000 year period. The greater the tilt, the more pronounced are the seasons. Cooler summers could favor glacier formation locally and alter the albedo.

Currently, the Earth's axis has an obliquity of 23.4°, which is close to the average between the two extremes. It is currently in a descending phase and will reach its minimum in roughly 10,000 years. If the tilt of the Earth's axis is taken as the only parameter influencing climate, summers will become cooler and winters warmer in one hemisphere, while the consequences for the other will be the opposite.

However, the tilt of the Earth's axis has no impact, of course, on the overall amount of energy received by the planet as a whole, because a sphere has two hemispheres.

## 2. Variations in orbital eccentricity

The Earth's orbit around the Sun varies in cycles that last from 90,000 to 100,000 years. The eccentricity of the Earth's orbit characterizes the difference in shape between a perfect circle and the orbit. The perihelion is the point on the orbit at which the Earth is closest to the Sun, while the aphelion is the point where it is farthest away. With variations in the orbital ellipse, the perihelion approaches the sun and the aphelion moves away from it.

Orbital mechanics requires that the length of the seasons be proportional to the perimeter of the Earth's orbit swept between the solstices (the times of the year when the sun is farthest from the Equator; day length is maximum at the summer solstice and minimum at the winter solstice) and the equinoxes (times of the year when the length of the day is equal to that of the night). Eccentricity varies considerably over time, which makes the distance between the Earth and the Sun oscillate between 140 and 165 million kilometers (87 and 103 million miles).

During the previous interglacial period 128,000 years ago, eccentricity was close to 0.04 (compared with less than 0.02 at present) and the energy received by the Earth between perihelion and aphelion varied by approximately 16% instead of today's 6%. That means that when the Earth reached its aphelion, it received 16% less solar energy than when it was at its perihelion. Since the Earth always covers equal areas of its orbit in equal times (according to Kepler's laws), the total insolation received during its rotation around the Sun is constant (see our paper [BB_OR]). Nevertheless, the solar energy received is locally subject to more variations when orbital eccentricity is high.

These questions regarding the impact of orbital shape on climate are scientifically very interesting, but it is clear to everyone that they do not enter into the present debate on global warming because the debate addresses the last one hundred years, while orbital variations occur over hundreds of thousands of years.

### 3. The phenomenon of precession

Because the Earth is not a perfect sphere, the Earth's rotation on itself gives the axis of rotation of our planet a movement of precession, similar to that of the axis of a spinning top. The main consequence of the phenomenon of precession is the displacement of the solstices and equinoxes in relation to the Earth's position in its orbit.

Thus the seasons were inverted around 10,000 years ago. In the Northern hemisphere, winter came when the Earth reached its aphelion (the point farthest from the Sun) and summer was when it passed its perihelion. This is the current situation in the Southern hemisphere, and the contrast between the seasons is less marked because the Southern hemisphere is essentially covered by oceans, whereas dry land is mostly found in the Northern hemisphere.

Reality is even more complex. In addition to the precession cycle (approximately 26,000 years), there is a roughly 20-year cycle of small oscillations of the Earth's axis around its mean position, known as "nutation" [OBSPM]. Nutation influences climate less than precession, but even so it is associated with variations in the height of the tides.
Again:

- Precession and nutation have no impact on the amount of heat received by the Earth as a whole in one year, but only on one particular hemisphere.

- Their durations are such that they have nothing to do with the current debate.

# III. Natural geothermal activity

Natural geothermal activity is the transfer of heat from the Earth's mantle and core to the oceanic and continental crust. Manifestations of geothermal activity have been observed for a very long time, as traces of human populations dating back over 15,000 years (to the third ice age) have been found in volcanic regions.

This heat source evidently has nothing to do with human activity. It is amazing that after 5 billion years the planet has not cooled down completely. Very few models attempt to describe the heat exchanges between the interior of the Earth and its surface. The persistence of geothermal activity is thought to result from the disintegration of radioactive elements present in the Earth's mantle. The temperature rises by approximately 3 °C with every 100 meters in depth (approx. 1.6 °F/100 ft.).

The gradient may be much steeper in regions known as geothermal fields, which are generally associated with volcanoes. In these areas, the thermal gradient may reach 100 °C per meter (55 °F/ft.).

The natural thermal power emitted by the Earth is estimated to be roughly 45 TW. If we take the power of a nuclear reactor to be 1.5 GW, the thermal power of the Earth is the equivalent of 30,000 nuclear power stations. The map below shows the global geothermal energy flow.

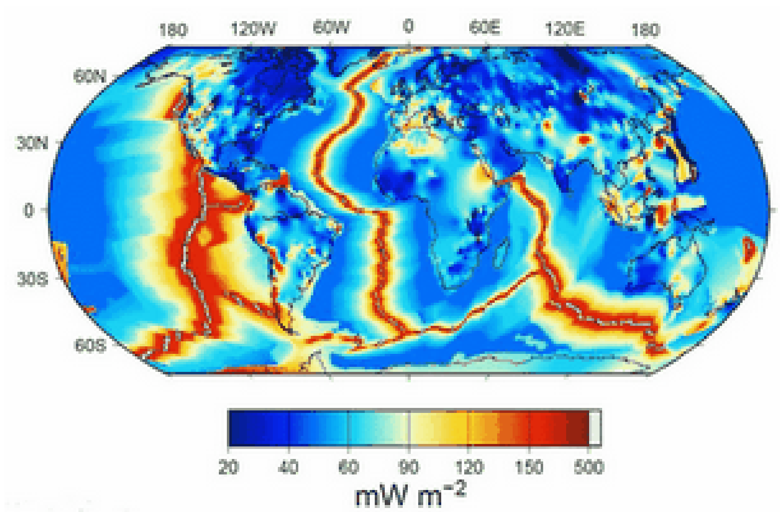



*Figure 2: Map of global geothermal energy flow*

The power released by the disintegration of the Earth's radioactive elements is estimated to be 20 TW (plus or minus 5 TW). That barely represents one-half of the heat released by the Earth.

Half of the power released by the Earth therefore appears not to be produced by a particular energy source but by the natural cooling of the center of the Earth, which is known as secular cooling.

If this cooling is assumed to be uniform everywhere on Earth, which is a highly simplistic hypothesis, this secular cooling may be calculated to be currently between 50 and 100 K per billion years, which is very low. The Earth's interior will have lost on average only 3–6 K since the disappearance of the dinosaurs 65 million years ago. Even though it is very slow, the natural cooling of the Earth's core generates more energy by itself than all the current human production!

The Earth's natural geothermal activity therefore plays a dominant role in that it influences movements in the Earth's mantle responsible for plate tectonics, as well as volcanic activity. In addition, it maintains the magnetic field around our planet.

It is important to note that natural geothermal activity is eminently variable. Chains of volcanoes appear or become active again, while others disappear, without anyone knowing why.

Unfortunately, geothermal activity (like solar activity) is practically absent from the academic studies that seek to analyze climate evolution. In terms of principles and the scientific method in the strict sense, any climate study that does not take solar or geothermal activity into account should in principle be rejected.

Geothermal activity could be one of the reasons why Greenland's ice is melting.

The German geoscience research center GFZ established that the effect of geothermal activity must not be ignored in models of icecap evolution. GFZ developed a "climate/ice/thermomechanics" model of the lithosphere (the Earth's crust together with the solid upper mantle) in Greenland. It was tested over a 3 million-year simulation period and agrees with the measurements taken. The thickness of the lithosphere and consequently the geothermal energy flow in Greenland vary considerably within narrow geographic bounds.

For example, GFZ found areas where the ice is melting next to areas where it remains very cold. The Earth's crust and mantle therefore play a significant role in the dynamics of surface processes.

Moreover, the discovery of an enormous subglacial canyon under the icecap through which liquid water flows may be evidence of the influence of geothermal activity [PS]. This canyon, which carries the (geothermal) meltwater to the ocean, may have influenced the evolution of the icecap by altering its topography and hydrography.

# IV. The composition of the atmosphere

The composition of the atmosphere is detailed in the following table:

<table>
<tr><th colspan="2">Composition of the atmosphere</th><th>(%)</th></tr>
<tr><td colspan="2">Nitrogen</td><td rowspan="8">78.087<br>20.95<br>0.93<br>0.04<br>0.000208<br>0.5 < ... <5<br>0.0001745<br>0.0208</td></tr>
<tr><td colspan="2">Oxygen</td></tr>
<tr><td colspan="2">Argon</td></tr>
<tr><td rowspan="5">GHGs</td><td>$CO_2$</td></tr>
<tr><td>$N_2O$</td></tr>
<tr><td>$H_2O$</td></tr>
<tr><td>$CH_4$</td></tr>
<tr><td>$O_3$ and CFCs</td></tr>
</table>

*Table 1: Composition of the Earth's atmosphere*

This composition may also have an effect on climate. Two major groups of gases are responsible for this influence: greenhouse gases (GHGs) and aerosols.

## *A. Principle of the greenhouse effect*

When solar radiation reaches the Earth's atmosphere, part of it (around 30%) is directly reflected back into space, part is absorbed by the atmosphere (20%), and the remainder is absorbed by the Earth's surface (50%) [CNRS].

Part of the radiation absorbed by the Earth's surface is in turn returned to the atmosphere. This transfer is performed by convection (air movements) and in the form of far-infrared radiation. The greenhouse effect only concerns this radiation, which is partly absorbed by greenhouse gases and helps to heat the atmosphere.

The greenhouse effect is therefore a combination of absorption, reflection, and emission of radiation.


Key :

| | |
|---|---|
| soleil | sun |
| atmosphère | atmosphere |
| gaz à effet de serre | greenhouse gases |
| terre | earth |
| source GIEC | source: IPCC |

*Figure 3: Schematic of the greenhouse effect [IPCC]*

The greenhouse gases (gaseous constituents of the atmosphere that contribute to the greenhouse effect) are: water vapor, carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide (or protoxide of nitrogen, $N_2O$) and ozone ($O_3$).

Their approximate contributions to the greenhouse effect are as follows [Kiehl & Trenberth]:

- water vapor: 60%,
- carbon dioxide: 26%,
- ozone: 8%,
- methane and nitrous oxide: 6%.

We review them below.

## *B. The main greenhouse gases*

### 1. Water vapor

The atmospheric concentration of water vapor is very variable and largely depends on temperature. Water vapor is a highly active component of the climate system and responds quickly to changing conditions by condensing as either rain or snow or evaporating to return to the atmosphere.

The water contained in the atmosphere is constantly being reduced by precipitation, but it is replenished from its main source, evaporation from seas, lakes, rivers and moist land.

Human activity does not affect water vapor concentrations significantly except on a local scale, such as in the vicinity of irrigated fields.

### 2. Carbon dioxide

Natural sources of carbon dioxide include:

- ocean–atmosphere exchanges,
- animal and plant respiration,
- respiration from soils and decomposition.

A small amount is also created by volcanic eruptions.

### 3. Methane

The main natural sources of methane include wetlands and the oceans.

### 4. Nitrous oxide

Natural emissions of nitrous oxide come from natural vegetation. Other sources include the oceans and atmospheric chemical reactions.

## *C. Aerosols*

The other group of gases that have an effect on climate are aerosols. An aerosol is a gas mixed with liquid or solid particles (for example, cloud, fog, smoke, and ash cloud). They can affect climate directly and indirectly.

The main consequences of aerosol presence in the atmosphere are the following:

*Warming or cooling of the atmosphere*

Aerosols reflect or absorb light depending on their particle composition.

The marked impact of carbon-containing aerosols on climate is basically due to the presence of carbon black, which absorbs solar radiation. It can be carried over long distances and settles on ice sheets, reducing their reflective power (albedo). Organic carbon, in contrast, tends to cool the atmosphere.

*Increased condensation of water vapor*

Certain aerosols (particularly sulfate aerosols) act as "condensation nuclei," which promote condensation of the water vapor in the atmosphere into droplets, leading to changes in cloud formation.

Aerosols have direct effects on radiation and indirect effects by promoting the formation of high or low cloud. Their effect, which is overall a "cooling" effect, is still the subject of intense scientific research.

However, the effects of aerosols do not last long after they are emitted. Their lifespan in the atmosphere is a few weeks, and so they do not accumulate in the atmosphere, unlike greenhouse gases.

## *D. Natural sources of greenhouse gases and aerosols*

### 1. Volcanic eruptions

During volcanic eruptions, large quantities of dust and sulfur particles reach the stratosphere, where they may combine with oxygen and act as aerosols. The particles block sunlight and temperatures fall. This phenomenon is termed "volcanic winter" or "volcanic forcing". Two types of particles are emitted: heavy particles (ash) and sulfur particles.
The ash increases the opacity of the atmosphere. The solar radiation reaching the ground is reduced and temperatures fall. The effect of ash is short lived, however, since it consists of rock particles that:

- either are too heavy and eventually fall back to the surface;
- or trigger the formation of raindrops, hailstones, snowflakes, etc., and thus also eventually fall to the surface.

The sulfur-based gases produced by volcanoes remain in the atmosphere for a long time. They react with other molecules and increase the albedo of the atmosphere.

Moreover, the degree of climatic disturbance will depend on the location of the eruption. If it takes place at the Equator (as in the case of Mount Pinatubo), it is liable to affect the overall climate of the Earth, since the predominant winds will carry the aerosols produced over very long distances.

The aerosols then prevent the Sun's radiation from passing through the lowest layer of the atmosphere (the troposphere) and thus reduce temperatures.

#### 2. Meteorite strikes

These phenomena have a very low probability of occurring. As with volcanic eruptions, a meteorite strike can give rise to climate change. In fact, the meteorite may throw up a cloud of dust when it impacts, increasing the opacity of the lower layer of the atmosphere. It is not known whether such phenomena occurred in the past or what impact they might have had. Accounting for the disappearance of the dinosaurs with a meteor strike (a commonly found explanation) is pure speculation.

Many people refuse to accept that nature is constantly getting rid of some species (and creating new ones), and for them the disappearance of a species cannot happen without an external cause. Of course, this view is totally refuted by the facts.

## V. Cloud cover and marine currents

### *A. Cloud cover*

As mentioned previously, the way the cloud cover behaves has a very large influence on the amount of solar radiation that reaches the ground. However, the influence of clouds is not confined to simply reflecting the Sun's rays.

#### 1. The dual action of clouds

We have seen that the reflectivity of clouds can be very important, with their albedo of up to 0.80. Clouds also have an effect on thermal infrared radiation.

Let us take the example of the natural cooling of the ground at night. The coldest nights are cloudless. That is due to the fact that the ground surface emits thermal radiation so as to lose its heat. When clouds are present, they will contain this heat emission and will therefore cause a greenhouse effect by preventing the ground from losing its heat to the upper atmosphere.

Clouds thus have a dual action on temperature variations. When present, they increase the planet's albedo and reduce the solar energy absorbed, which tends to cool the ground surface. Conversely, through their greenhouse effect, clouds prevent heat transfer from the ground to the upper atmosphere.

## 2. Lower and upper cloud layers

The clouds with the greatest effect on solar radiation are those that are most widespread and most persistent—stratocumulus. These clouds are low (500–2,500 m/1,600–8,000 ft. in altitude) and not very thick and continually cover a vast part of the globe, as shown by the map below from the ISCCP (International Satellite Cloud Climatology Project). This map shows the world distribution of low cloud layers.

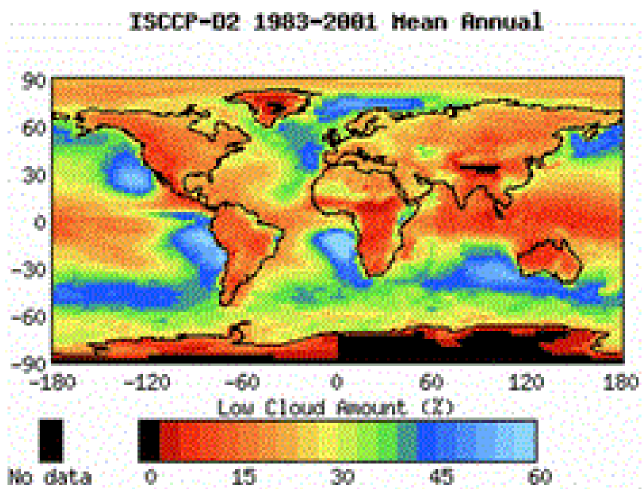


*Figure 4: Low cloud cover (ISCCP)*

Because these clouds are low, their temperature differs little from that of the surface and their greenhouse effect is limited. However, their reflectivity is over 50%, and therefore they have a strong albedo (reflection of solar radiation) effect.

Cirrus, in contrast, are clouds occurring at high altitudes (5,000–14,000 m/16,000–46,000 ft.). They are found in the upper part of the troposphere. They are the clouds seen first before the arrival of a disturbance. They are very extensive and cover around 20% of the Earth's surface. This is how they are distributed:

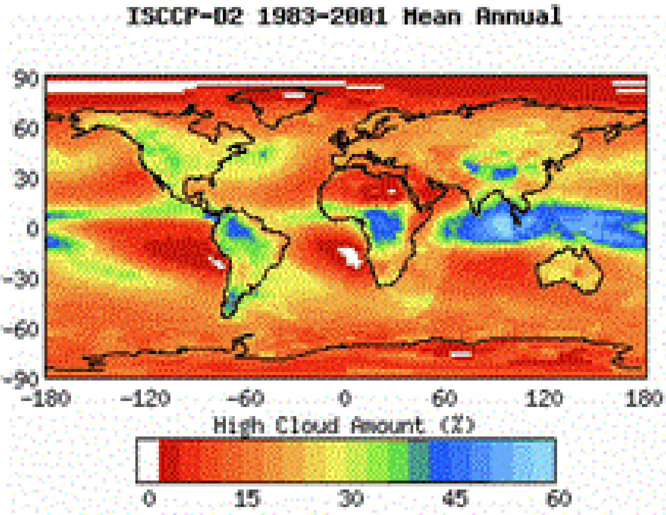



*Figure 5: High cloud cover (ISCCP)*

They are composed of ice crystals and their temperature may be very low; temperatures of −60 to −70 °C (−76 to −94 °F) are common. Their greenhouse effect is therefore very strong. In addition, cirrus are often quite transparent to solar radiation and their albedo effect is weak (but not negligible).

## *B. Marine currents*

A marine current is a regular, continuous, and cyclical movement of seawater. This kind of movement is due to the combined effects of wind and differences in temperature, density, and salinity between two areas of sea. They have a major effect on world climate, particularly by regulating and dispersing heat from the continents.

The oceans store heat on the Earth much more than the continents and the atmosphere. The oceans' albedo is in fact very low (0.05, compared with an average 0.30 for the Earth's surface). That is one of the main reasons why the oceans have such a large influence on climate.

In winter (in the Northern hemisphere), the temperatures are much lower on the continents (in Siberia and China, for example) than in the oceans (the Atlantic, for example). One can also see that temperatures are very high in the tropical belt. This temperature difference is the primary effect at the origin of temperate climates in oceanic areas. This is particularly evident on an annual scale.

## *C. The main climate oscillations*

There are natural oceanic oscillations that influence variations in climate variables (especially pressure and temperature). Some of them describe variations in the ocean-atmosphere regime (pressure and albedo), while others describe cycles of variation in ocean temperatures. These are the three main climate oscillations:

- North Atlantic Oscillation (NAO),
- Atlantic Multidecadal Oscillation (AMO),
- Pacific Decadal Oscillation (PDO).

The North Atlantic Oscillation (NAO) involves a pressure difference between the Azores high and the Icelandic low and characterizes an ocean–atmosphere regime. The consequences of this oscillation are [CNRS2]:

- pressure changes at the surface (and therefore changes in the intensity and position of the Azores high and Icelandic low),
- variations in westerly winds,
- influences on climate (temperatures and precipitation) around the whole Atlantic Basin.

The extreme variability of this oscillation makes it difficult to detect any cycles. However, two scales of periodicity may be distinguished, one decadal and one seasonal.

This oscillation has a considerable influence and is likely part of the reason for the melting of Greenland's ice.

On the basis of satellite images, in July 2012 NASA estimated that 97% of the surface layer of the ice consisted of meltwater.

A study [IJC] has shown that the unusual nature of this melting was linked to atmospheric anomalies—in other words, natural climate variability. It was due to a change in the jet stream (a wind blowing from west to east in the high troposphere), which led to anticyclonic conditions being blocked over the Arctic. A change in the seasonality of the North Atlantic Oscillation also influenced this melting. The result of these phenomena was as follows: high pressures in the mid-troposphere brought in southerly and therefore relatively warm winds to the western flank of the icecap, and they then formed a "heat dome" over Greenland.

In this study, the team showed that it was precisely this atmospheric configuration that led to the appearance of meltwater over almost the whole Greenland icecap. The study used data from a climate model, two weather stations based on the coasts of Greenland and stations on the edges of the icecap.

The Atlantic Multidecadal Oscillation (AMO), in contrast, characterizes a variation in ocean surface temperatures in cycles lasting several decades. A graph of temperature variations between 1856 and 2013 revealing the cyclic nature of this phenomenon is shown below.

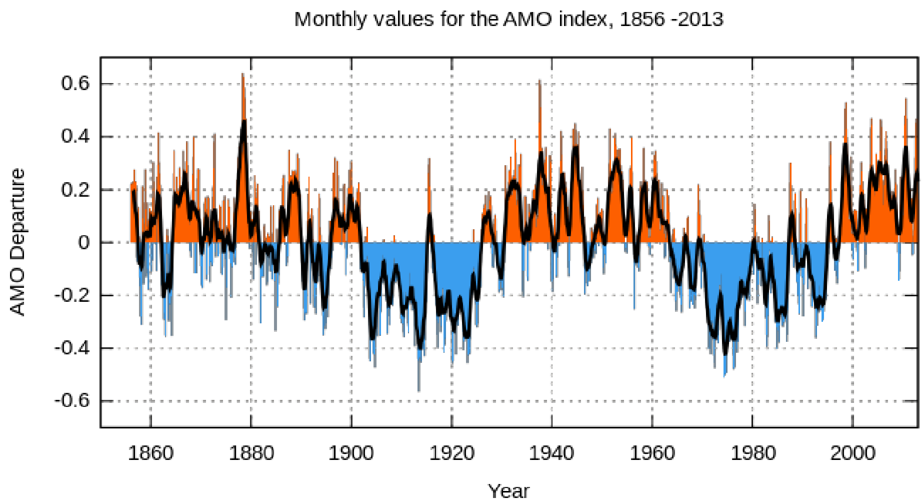



*Figure 6: The Atlantic Multidecadal Oscillation*

In terms of its impact on climate, the AMO seems to be linked to long-term rainfall and air temperature variability in the Northern hemisphere, particularly in Europe and North America [Kerr].

The rise in sea-surface temperatures in the North Atlantic also implies a fall in mean pressure in that region. The warmer air tends to dilate and pressure falls as a result.
Lastly, the intensity of tropical storms and hurricanes in the North Atlantic appears to be weakly linked to the AMO.

The Pacific Decadal Oscillation (PDO) is a 20–30-year fluctuation in sea-surface temperature. The effects of the cold and warm phases of the oscillation on the climate of North America were clearly observed in the last century.

The 20th century began with the cold phase and relatively low annual temperatures between 1900 and 1925. The following 20 years, between 1925 and 1945, corresponded to the warm phase and therefore milder temperatures. Another cold phase set in between 1945 and 1975, and then mild temperatures returned during the last quarter of the 20th century.

It seems there is a link between the PDO and El Niño. If El Niño starts during the cold phase of the oscillation, it tends to be less extreme and more unpredictable. If it starts during the warm phase, El Niño is shorter and its consequences easier to predict (as was the case in 1997–98) [Jamet].

The extent and origin of these natural climate oscillations are not precisely known. Even so, they must of course be taken into account in any study of climate change.

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# Chapter 2

## Human influence on the climate

## I. Human activity

While not claiming to be exhaustive, we present here some of the human activities that can influence the climate.

### *A. Industry*

Greenhouse gas emissions from industry worldwide account for 28.6% of total anthropogenic GHG emissions. The greenhouse gases emitted by industry are $CO_2$ (90%), nitrous oxide (far behind at 5.5%), and fluorinated gases (4.2%), according to [MEDDE1].
The three main fluorinated gases, namely hydrofluorocarbons (HFCs], perfluorocarbons or perfluorinated hydrocarbons (PFCs), and sulfur hexafluorides ($SF_6$), are basically used by human beings in industrial processes.

HFCs are used in refrigerators, air conditioners, and pressurized foams and aerosols. Emissions from these products are caused by gas leaks during manufacturing and during the lifetime of the product.

PFCs are created during aluminum production and semiconductor manufacturing processes.

$SF_6$ is mainly used by the electrical industry as an insulator and in circuit breakers, and also as a protective gas during magnesium production.

### *B. Land use, land use change, and forestry*

Land use, land use change, and forestry encompass *"forest growth, conversion of forests (clearance) and grasslands, as well as soils with a carbon content that is sensitive to the types of activities carried out on them (forest, grassland, cultivated land)"* (see [ACTUenvironnement]).

The greenhouse gases emitted by this sector account for 23.9% of total anthropogenic GHGs, according to the IPCC.

### 1. Deforestation

Deforestation results from the overexploitation of forest resources and/or destruction of forests by human beings. The end result is land use change, in that the forest is replaced with urban land, transportation routes, cultivated land, pastures, desert, etc. [Sciama & Noblet].

Forest covers 30% of the land surface of the globe. A remote sensing survey in 2010 estimated its area at 3.89 billion hectares (9.6 billion acres, or 15 million square miles).

The deforestation rate has accelerated in recent years. A study by the Food and Agriculture Organization (FAO) found that forest disappeared at a rate of 15.5 million hectares (38.3 million acres) a year between 1990 and 2010, or 155,000 $km^2$ (60,000 square miles) per year. This figure does not take account of reforestation, which FAO estimates at 102,000 $km^2$ (39,000 square miles) per year. The area of forest lost annually is therefore 53,000 $km^2$ (21,000 square miles) [ConsoGlobe].

In France, the area under forest increases regularly (see [IGN]).

Deforestation has an impact on climate because forests play a part in the greenhouse gas source/sink system.

Forests also have a role in regulating the local climate because of their interaction with the water cycle.

A large part of the energy that converts surface moisture into water vapor comes from solar radiation heating the earth's surface. The energy thus depends on the albedo of the surface, which in turn depends on the vegetation, which absorbs more heat than bare soil. Strong thermal currents above dense vegetation remove the moisture (supplied by the plant cover itself) into the atmosphere, where it condenses in the form of rain. Because of its influence on convection models and wind currents, as well as rainfall regimes, the albedo effect is an essential factor in climate regulation.

The disappearance of tropical forests changes the reflectivity of the earth's surface, which affects global climate by changing wind movements, marine currents and rainfall distribution.

Tropical deforestation can also have an effect in other parts of the world. A 2005 NASA study showed how deforestation in the Amazon region influences rainfall from Mexico to Texas and the Gulf of Mexico, while the loss of forests in Central Africa affects rainfall in the American Upper and Lower Midwest. Similarly, a study claims that deforestation in South Asia affects rainfall in China and the Balkans [Bettwy]. However, all these studies must be treated with caution.

### 2. Urbanization

Urban environments also have a major influence on their local climates. One of their best-known climatic effects is the formation of heat islands. Considerable temperature differences may thus be found within a single city, depending on relief, exposure (facing south or north), and also the type of land use (green areas, water surfaces, built-up areas, etc.), the ability of the Earth's surface to reflect solar energy, and even soil surface "roughness" (its ability to allow air to circulate).

Urban concentrations also cause local temperature variations, especially at night, partly because of locally increased energy use (heating in winter and air conditioning in summer, heavy traffic, etc.), and partly because of the thermal inertia of buildings (their resistance to temperature change).

### 3. Agriculture and forestry

Agriculture and forestry alone emit 19% of anthropogenic $CO_2$. Stock rearing and rice growing generate methane.

This sector also generates aerosol precursors in that agriculture produces nitrogen oxide ($NO_x$) emissions, leading to the formation of solid nitrate particles.

## *C. Construction*

Another sector of human activity that influences climate is construction since it accounts for 18.6% of world GHG emissions. It mainly produces $CO_2$.

In addition, burning coal or wood as fuel leads to the emission of fine particles and formation of carbon black, which are aerosols.

## *D. Transportation*

Transportation generates 14.4% of world GHG emissions. The main greenhouse gases emitted by the transportation sector are $CO_2$ (the $CO_2$ from transportation represents 26%

of anthropic $CO_2$), and HFCs (found particularly in vehicle air conditioning) (see [MEDDE2]).

It is the fastest-growing energy consumption factor in the world because of the increase in trade and travel.
This sector, with road traffic and coal and oil combustion, also causes aerosol formation.

### *E. Energy*

The energy sector represents 11% of world GHG emissions and in particular 13% of $CO_2$ emissions.

### *F. Waste treatment*

Waste treatment accounts for 2.9% of anthropic GHG emissions. Dumps produce $CO_2$ (3% of world emissions) and $CH_4$, in particular.

These sectors emit greenhouse gases and aerosols, alter the water cycle or the Earth's albedo, or create heat islands.

### *G. Human involvement in GHGs*

When reading this section one gets the impression of considerable human activity with in fact considerable influence on the climate. But here are the figures, as it is important not to grant us an importance that we do not have.

GHGs currently make up 1.04% of the composition of the atmosphere, as mentioned in part 2, chapter 1, section IV.

Annual anthropic GHG emissions are given in Gt $CO_2$-eq. We calculated what this amount represents in relation to the mass of the atmosphere, which is estimated to be $5.15 \times 10^6$ Gt.

The calculation is as follows:

$$\frac{Mass(GHG_{anthropic})}{Mass\ (atmosphere)} \approx \frac{49}{5.15 \times 10^6} \approx 9.51 \times 10^{-6}$$

i.e. $9.51 \times 10^{-4}$%

We also compared the proportion of anthropic GHGs to the GHGs globally present in the atmosphere, which is:

$$\frac{Mass(GHG_{anthropic})}{Mass(GHG_{atmosphere})} \approx \frac{49}{5.35 \times 10^4} \approx 9.16 \times 10^{-4}$$

i.e. $9.16 \times 10^{-2}$%

The mass used for anthropic GHGs is for 2010.

Both proportions are very small.

In addition, different gases influence the greenhouse effect differently: water vapor is the main greenhouse gas in the atmosphere, constituting approximately 60% of the total.

The human contribution to the amount of water vapor is extremely low, since the water vapor emissions generated by human beings in a year are less than 1% of the natural evaporation that occurs in a single day.

Moreover, anthropic water vapor emissions (mainly from the combustion of hydrocarbons) have only a local effect because the residence time of water vapor in the atmosphere is not more than ten days or so.

Thus the direct emissions of water vapor due to human beings do not contribute significantly to increasing the greenhouse effect. They are not taken into account in human GHG emissions even though water vapor is by far the most important greenhouse gas.

For a mathematician it is absurd and an aberration to try to solve a problem solely on the basis of the secondary variable while ignoring the primary variable. If one day we want to understand the greenhouse effect and its variations, we will have to begin by studying water vapor instead of focusing on the gases emitted by human activity.

### *H. The importance of urbanization and deforestation*

According to [ConsoGlobe], the area of forest that disappeared over a period of 20 years is approximately 2.7% of the total forest cover of the Earth. This area of forest as a proportion of the total area of the Earth's surface is 0.24%, which is very little. The result comes from the following calculation:

$$\frac{2.7}{100} \times \frac{30}{100} \times \frac{29.2}{100} \approx 0.0024$$

$\frac{2.7}{100}$ is the proportion of forest cover that disappeared between 1990 and 2010
$\frac{30}{100}$ is the proportion of land area covered by forest

$\frac{29.2}{100}$ is the proportion of land on the Earth's surface.

This cannot have altered the albedo significantly.

Urban areas occupy a small part of the Earth's surface. According to the SAGE GTAP database, urban infrastructure covers 1% of land, or 0.29% of the Earth's surface [Merlet]. On a global scale, therefore, urban areas play a very small part in reflecting the Sun's energy.

### *I. Conclusion*

On reading through this list, one has the feeling that human activity and civilization affect the climate in every possible way, and clearly in a negative sense. But after a little consideration one realizes that that is true for all species, both animals and plants. Every lifeform influences its environment, and to call this influence "negative" is a biased decision.

A recent article in *Science et Vie* [Chauveau] explains that "French cows emit as much gas in a year as 15 million automobiles!" What then? Should cows be killed? Should automobiles be banned?

It is a very one-sided process to list human activities and then for each one to check its environmental impact, presented as something negative. This approach is essentially dishonest. Any animal species modifies its ecosystem, so we see no reason why human beings should be banned from building towns because it is warmer in them. Penguins too gather in vast troops to limit heat loss – should they be banned from doing so?

## II. Can human beings change the climate?

What would be the consequences of a sudden halt to human activities? As we have seen in the preceding sections, human influence on the greenhouse effect and the albedo is very weak, almost negligible. Even though this influence is negligible, many try to reduce it. However, do we have the ability to do so?

For many environmental problems, we have a tendency to apply simple logic: once we stop the disturbance the problem will stabilize and things will get back to "normal". For example, when there are high levels of fine particulate pollution near a highway, limiting traffic may solve the problem.

Are we in a similar situation with greenhouse gas emissions? We are tempted to think so—if the situation gets out of hand, we merely need to cut emissions drastically (assuming that that is possible) and the climate will "recover" by itself.

Unfortunately that is impossible, and there is a simple explanation: the lifespan of the greenhouse gases in question ($CO_2$, methane, nitrous oxide and perfluorocarbons) is much greater than the timescales that interest us. The lifespans of the main greenhouse gases are given below:

| Gas | Lifespan (years) |
|---|---|
| Methane | 12 |
| $CO_2$ | 100 |
| Nitrous oxide | 114 |
| Sulfur hexafluoride | 3,200 |
| Perfluorocarbons | 2,600 to 50,000 |

*Table 2: Lifespans of the main greenhouse gases (source: IPCC)*

In practice, if we completely stopped all $CO_2$ emissions tomorrow morning (including breathing), the only effect it would have would be to make $CO_2$ levels in the atmosphere fall very slowly.

There is also a fundamental error of logic in this approach, which is to believe that nature is stable and that only human activities alter this stability. For example, one might believe that there is a natural, stable level for $CO_2$ which human activities have disturbed. That idea is essentially false: there is of course a $CO_2$ cycle, in which $CO_2$ is constantly being made, stored, and used. Human emissions are not added to this cycle; they are part of it.

Even if human beings were so stupid as to want to do so, they have no technological means to change the composition of the atmosphere. The "carbon sequestration" schemes that we often hear about are childish inanities that have no effect. Nor do they have any means to alter the composition or temperature of the oceans, the albedo of the Earth, etc.

Here is an example of a measure that no minister has yet thought of: to increase the albedo and reduce the greenhouse effect, one could ask the whole population of France, including the women, to shave their heads and paint their scalps white, or varnish them!

Another measure in the same vein would be to implement an alternate-day traffic scheme: only people with varnished pates would have the right to go out on very sunny days. The reflectivity of their heads would be checked annually with a special instrument based on the principle of frequency-domain reflectometry. They would also enjoy a special privilege called the "albedo tax credit". Other, hairy people, especially women, would only be allowed out at night, or on rainy days by special dispensation; they would be subject to a tax surcharge proportional to the thickness of their hair.

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# Chapter 3

## The consequences of hypothetical warming

Climate change is a “change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties (temperature, precipitation, etc.), and that persists for an extended period, typically decades or longer” [IPCC].

The IPCC goes on to say that climate change is due to “natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use.”

This approach links global warming to a change in the composition of the atmosphere (especially in its $CO_2$ concentration). However, in Part One of this White Paper we saw that currently there was no set of observations establishing such a link.

In this chapter we will assume that there actually is climate change, in the form of higher temperatures, increased precipitation, etc., and raised $CO_2$ levels, and we will examine what the consequences of that would be.

The impact will be highly unequal from country to country, depending on their geographic situation and economic development.

In desert or tropical areas, global warming will have negative consequences. In fact, for developing countries, agriculture is very important to the economy and this will be one of the sectors most affected. Conversely, in northern regions such as Canada or Russia, the same warming will have positive consequences.

We have a number of elements with which to evaluate the consequences of such a change:

- The analysis of existing events and extrapolation of these results, but it is difficult to determine the part really played by the influence of climate change and increased $CO_2$.

- Laboratory studies: it is difficult to know whether the results of such studies can be transposed to real activities. Generally they are conducted under precise conditions (i.e. a controlled atmosphere) and are based on unrealistic hypotheses.

We will review the major consequences on extreme climate events, climate types, world water reserves, fauna, flora, and human beings. It is a rough approach, but any quantitative approach is impossible.

# I. The direct effects of global warming

## *A. Extreme climate episodes*

The three main effects on climate are:

- An increase in the number and/or intensity of hot days and a reduction in the number of cold days;

- Reduced summer precipitation and increased winter precipitation;

- An increase in the frequency and intensity of extreme climate events: arid areas will be even drier (with accentuated heat waves, droughts, etc.) and, conversely, wet areas will be even wetter.

This last point is controversial: see below.

A global temperature rise would imply a direct increase in the number and/or intensity of hot days. In France, for example, the mean number of hot days was 5 for the period 1976–2005. For 2021–2050 Météo France is estimating that this figure will rise to 10–15 days in the Southeast and 5–10 days elsewhere. But these are just estimates.

Another consequence would be an increase in extreme climate events, such as cyclones and storms.

The argument used to justify that forecast is that a rise in sea surface temperature (SST) could trigger more hurricanes [Emmanuel, Emmanuel and Mann].

This approach is controversial. A recently published paper by [Vecchi and Soden] suggests that, instead, a warmer climate would lead to an increase in vertical wind shear, which would prevent the development of hurricanes. In the case of mid-latitude storms, global warming would lead to a reduction in temperature gradients between the Equator and the poles and, consequently, to less intense and/or less frequent storms [Legates, Khandekar].

It is already very difficult to predict the climate in the short term; it is impossible to do over several decades. Meteorological analysis depends on a large number of parameters (temperature, pressure, wind speed, etc.). Studies contradict one another.

### *B. Change in climate type*

Higher temperatures will logically result in a change in climate types in a particular region. In France, the mountain, continental and Atlantic climates are expected to retreat in favor of the Mediterranean climate [Roman-Amat].

## II. Consequences for water reserves

Under the global warming hypothesis, we would see the partial melting of snow and ice, resulting, according to the [IPCC], in:

- A change in runoff and water resources: ice melt in mountain areas leads to more water in streams and a change in flow rate;

- Higher sea levels as a result of melting freshwater ice (ice caps, glaciers, etc.). If all Antarctic ice melted, for example, it would raise sea levels by some 60 meters (200 ft.), according to the [CNRS].

Melting can only involve areas where the temperature is close to 0 °C (32 °F). The average temperature in the Antarctic is around −40 °C (−40 °F), so the total melting of Antarctic ice is science fiction and entirely unrealistic. Moreover, for the last three years observations have shown that the amount of ice in the Arctic ice sheet is increasing.

The consequences of a rise in sea level are the following, according to the [IPCC]:

- Coastal erosion and the disappearance of areas of land, such as the chalk cliffs of the Pays de Caux in Normandy, which are retreating at an estimated rate (which varies from place to place) averaging 0.30 m (1 ft.) each year [UNI];

- Migration of coastal populations inland;

- Contamination of rivers and water tables with sea water, which would have effects on fresh water reserves; thus the quality and quantity of water resources would be liable to decrease because of the rise in sea level [IPCC]. This phenomenon is already being observed on the shores of the Camargue. They are constantly being flooded by the sea, resulting in a reduction in the volume of fresh water [UNI];

- As we have seen previously, rising sea levels are an ancient phenomenon to which human beings have long been accustomed. It has nothing to do with global warming.

- Increased $CO_2$ may also lead to acidification of the oceans. Absorption of $CO_2$ by the oceans does indeed lower the pH of the water. That is a major threat to marine ecosystems, and particularly to polar and coral ecosystems. It may have effects on the physiology, behavior and population dynamics of various species, from phytoplankton to animals [IPCC].

- "When $CO_2$ dissolves in sea water, it leads to an increase in protons ($H^+$ ions) and also a reduction in certain molecules (carbonate ions, $CO_3^{2-}$) that are needed by numerous marine organisms to make their skeletons or calcareous shell (corals, mussels, oysters, sea snails, sea urchins, clams, etc.). These plants and animals will therefore find it increasingly difficult to make these calcareous structures." [CNRS]

There are errors of logic here. First, an increase in atmospheric $CO_2$ does not necessarily mean an increase in $CO_2$ in the ocean. Second, an increase in land temperatures (measured by weather stations, essentially) does not necessarily mean an increase in oceanic temperatures, which are hardly ever measured at deeper levels.

## III. Consequences for fauna and flora

The common effects of climate change and/or a rise in $CO_2$ on the fauna and flora are the following:

- Changes in geographic ranges, seasonal activities, migration patterns, abundances, and species interactions. With a warming climate, species tend to shift toward higher latitudes and altitudes. Because of their mobility, animals generally run less of a risk since they are able to move to more favorable habitats;

- Potential loss of certain marine and coastal ecosystems, affecting fishing communities in tropical and arctic regions [RFC1, 2, and 4];

- Potential loss of certain terrestrial and freshwater ecosystems and their biodiversity [RFC1, 3, and 4].

## *A. Fauna*

We will not detail the consequences by region (in contrast to the [IPCC]'s approach], but will confine our review to some changes that have already been seen. In fact there are too many uncertainties to take into account in every region.

The general trend referred to in the second part of the [IPCC] report for policymakers is that "Many terrestrial, freshwater, and marine species have shifted their geographic ranges, seasonal activities, migration patterns, abundances, and species interactions in response to ongoing climate change" [p. 4].

Take coral reefs, for example. The temperature rise increases the calcification rate (the transformation of calcium ions $Ca^{2+}$ into calcium carbonate $CaCO_3$) and allows coral reefs to develop better because of "an enhancement in coral metabolism and/or increases in photosynthetic rates of their symbiotic algae" [McNeil et al.]. This contradicts what was seen in the previous paragraph.

Research on the Great Barrier Reef showed that "the mid-twentieth century included the period with the second highest average coral growth in the past 237 years" [Lough and Barnes].

However, increased $CO_2$ leads to acidification of the seas, which can damage the calcification of marine species [CNRS]. Above a certain acidity threshold, seawater begins to corrode calcium carbonate, the material skeletons and shells are made of. A NOAA study showed that more than 50% of small planktonic snails or pteropods studied off the coasts of Washington, Oregon and California had dissolved shells, while young oysters have not survived there since 2005 [FY]. The influence of each parameter taken separately can be observed, but no study shows a trend because the two phenomena are observed simultaneously. Global warming and increased $CO_2$ may well have an impact on the fauna, but studies are contradictory on what that impact is.

## *B. Flora*

The effects of global warming (changes in rainfall regimes and cloud cover) associated with increased $CO_2$ concentrations have an impact on the flora, with direct consequences for agriculture and forestry (the growing, tending and harvesting of forests).

### 1. General considerations about $CO_2$ and its impact

As we saw in Part 2, chapter 1, section IV, the concentration of $CO_2$ accounts for 0.04% of the atmosphere as a whole, which is very little [CFCAT].

Plants absorb $CO_2$ during photosynthesis and give off the oxygen necessary for life as "waste". Conversely, if plants die, they release $CO_2$. Measurements taken on Mauna Loa illustrate this phenomenon. $CO_2$ levels change with the seasons, falling in the spring and summer due to plant development and rising in the fall and winter.

The concentration of $CO_2$ plays a part in plant growth, but this role has not yet been clearly identified because only laboratory studies have been conducted.

The results of these studies show that the growth rates and yield of plants grown in $CO_2$-enriched media are improved and that there is:

- Stronger plant growth (more branches, leaves, roots, etc.) [Woodward];

- Lower production of stomata (pores allowing exchanges between the air and the plant) on the leaves per unit area [Morison].

These two changes enable plants to tolerate "adverse" conditions and lead in particular to:

- Better resistance to excessive soil salinity (under low light levels or in low-fertility soils [Idso and Idso]), chilling-induced stress [Boese et al.], oxidative areas [Badiani et al.], and herbivore stress (insect attacks and overgrazing) [Gleadow et al.];

- Reduced water requirements (increasing plant resistance to drought, heat, and pollution) [Tuba et al.];

- Increased carbon capture;

- More intense soil micro-organism activity;

- Improved density of tree wood;

- Increased photosynthesis rate and $N_2$ fixation.

Paul Driessen mentions several studies showing that enhanced $CO_2$ in a greenhouse encourages plant growth [CFCAT]. Enhanced $CO_2$ concentration increases photosynthesis by 30% in wheat and rice and 15% in maize [Quaderni].

Studies under real conditions have also been conducted on pine trees in Catalonia. Their diameter increased by 84% between 1900 and 2000. The study concluded that that was due to the fertilizing effect of increased $CO_2$ in that region, combined with higher temperatures. These studies should be interpreted with caution, since they deal with only a single given site and a very specific tree species. Moreover, the causal link is not clear, since we cannot be sure that $CO_2$ enhancement was the only factor leading to the increased diameter of the pine trees.

These mechanisms are complex and the impact of $CO_2$ cannot be determined precisely.

Take photosynthesis, for example. It is not regulated solely by $CO_2$ but also by other parameters, such as temperature. Plants have an optimal temperature for their photosynthesis.

Moreover, laboratory studies do not allow conclusions to be drawn on the effects of enhanced $CO_2$ under real conditions and over the long term. Many different scenarios are possible under real conditions, and increased $CO_2$ could cause acidification of the oceans, which would prevent any beneficial effect on plants.

Finally, the outcome in terms of biomass production will depend simultaneously on the type of plant, the weather and the methods used to grow or tend the plants. The impact of adventitious plants (weeds), insects and fungal diseases cannot be taken into account since it is particularly poorly understood.

## 2. Consequences for agriculture

In this part we reveal the two main consequences for agriculture: productivity changes and shifting crops.

### a) Productivity changes

Increased atmospheric $CO_2$, a longer growing season (the period in the year when the temperature is high enough for plants to grow), and more favorable temperatures will initially provide better growing conditions. However, at higher levels of global warming (2–3 °C, or 3½–5½ °F) the trend will be reversed and productivity will fall [Lousteau et al.].
Studies have been conducted mainly on staple crops (such as wheat, maize, and rice) and on fruit trees in the case of France (apricots and grapevines). Results of simulations performed by the French National Agricultural Research Institute (INRA) on wheat and maize crop models [Delecolle] showed slightly positive effects on wheat, with 2.5–5.7% increases in yield, and more variable effects on maize (+10% to −16% in the case of an irrigated crop in Southeast France). This study is in agreement with other studies around the world [Easterling].

For apricots, in contrast, mild winters are liable to cause physiological problems (bud drop and aborted fruits). Moreover, higher temperatures would result in earlier flowering and paradoxically could lead to the risk of frost damage. Similarly, fertilization and pollination could suffer under less favorable weather conditions (less sunshine and more wind) despite rising temperatures.

Alterations in the timing of fruit tree development following recent warming have already been observed. In France (see [P. Debaeke]), the ears of wheat appear 8–10 days earlier than 20 years ago, and the start of the Chateauneuf du Pape grape harvest has been brought forward by three weeks in 50 years.

The set of results presented above only take average temperatures and $CO_2$ levels into account. Extreme events and the variability of the factors may result in different impacts that are still poorly understood.

A factor that has not been considered is the availability of water, whether water stored in the soil or water for irrigation. The strategies used for farming to respond to drought [Amigues et al.] will be decisive.
In conclusion, increased $CO_2$ and higher temperatures will have positive effects on agriculture, while changes in seasonality and water availability will have a negative impact if they are not controlled.

b) Shifting crops

Temperature and climate change will result in new plant distribution ranges or extinctions. Plants must shift to areas with a favorable climate for their development.

Unlike animals, plants will take longer to adapt to any climate change, since they lack the ability to migrate immediately. Human beings have the necessary means to shift crops.

If global warming occurred, it would make it possible for new crops to grow in some areas while, conversely, other areas would see crops disappear. A rise of 2 °C (3½ °F), for example, would have a negative effect on staple crops (wheat, rice, and maize), according to the [IPCC]. Since the change in average temperature cannot be predicted at a regional level, it is impossible to say precisely what types of crop would be favored or disfavored in any particular case.

### 3. Consequences for forestry

Global warming has three main consequences for forestry:

- wildfire damage,
- disease vulnerability,

- range shifts.

a) Wildfire damage

An increase in the frequency and intensity of wildfires and a longer fire season in areas already subject to fires are envisaged.

The chain of events is as follows:

- Precipitation is less than 100 mm (4 in.) per month and it has not rained for two weeks or more;

- The forest vegetation gradually loses its leaves as the drought sets in;

- What falls to the ground is loose and helps surface fires start and spread.

This chain of events favors devastating fires such as the ones in East Kalimantan, Indonesia, in 1982–83; they destroyed over 3.5 million hectares (8.6 million acres, or 13,500 square miles) of primary and secondary rainforest.

b) Disease effects

Global warming may cause the insect populations to move and spread diseases, but other determining factors may play a decisive role.

The following are factors that have negative effects on forest health:

- Higher temperatures result in greater numbers of harmful insects;

- The number of insects bred is greater than the number of insects killed (by their natural predators). That means more insects and more damage;

- Forests are more sensitive to attacks because of extreme climate events;

- Insects feed more because of increased $CO_2$ levels [CNES PV];

- More fuel (leaves on the ground) increases the risk of wildfires.

Positive effects can also be observed:

- Higher growth rates enable forests to tolerate greater insect damage and diseases without their growth being affected;

- The increased vigor of trees and forests growing in an enhanced-$CO_2$ atmosphere could make them more resistant to insect attacks and diseases;

- A high $CO_2$ level could benefit plant health and productivity by changing their morphology and physiology to the detriment of pathogenic (disease-causing) organisms.

The consequences for forestry are highly uncertain, since studies contradict one another.

c) New ranges

Plants must shift to areas with a favorable climate for their development.

Take the birch *Betula pubescens*, for instance. The phenomenon has been observed in Sweden, where the natural distribution range of the birch reacted quickly to warming during the first half of the twentieth century by extending northward into the tundra (Peters, 1990).

In France, climate change is shown by the disappearance of spruces and oaks from some areas and an increase in maritime pines and evergreen oaks, according to [INRA]. Holly, for example, doubled its range in the Ardennes between 1980 and 1990, according to National Forest Inventory data.

Plants are fixed and have to rely on the dispersal of their seeds from areas that are no longer favorable to new areas, which leads to a gradual shift in their natural ranges. That is not always possible, which may result in the extinction of that plant species.

# IV. Consequences for human beings

The groups that are already most vulnerable today would be the ones worst affected by global warming, since they cannot easily afford preventive measures and they already live in the areas most at risk.

## *A. Food security*

The consequences of global warming and increased $CO_2$ that would most affect the food security of humankind are logically the effects on water and on agriculture.

Reduced food production and restricted access to drinking water would result in a reduction in supply. Spatial inequalities would be greater, which could lead to conflict (in fishing areas, for example).

### *B. Health consequences*

It is very difficult to evaluate the effect of global warming on disease. Higher temperatures could, however, lead to:

- A rise in the number of heat-related deaths and a fall in the number of cold-related deaths. Winters would be milder and summers hotter [IPCC]. We cannot reach any conclusions as to whether the effects would be positive or negative. Studies are contradictory on the ratio of heat-related deaths to cold-related deaths ([NIPCC], [SkeptikalScience]);

- Increased risk to health due to extreme climate events (floods, storms, fires, etc.);

- An increase in existing health problems, especially in developing and low-income countries (diseases, injuries, malnutrition, etc.);

- Migrations of disease-carrying insects. France has already begun to see the appearance of new diseases and new scourges characteristic of hot climates [SkeptikalScience] (e.g. dengue fever). The correlation with global warming has not yet been demonstrated. In parallel, many diseases are disappearing as a result of advances in hygiene.

### *C. Economic consequences*

The impacts of global warming on the economy are difficult to quantify. Some studies emphasize positive effects [NIPCC] and others negative effects [IPCC]. The areas that could be influenced are:

- Infrastructure—extreme weather events lead to the deterioration of infrastructure systems and essential services such as electricity, water supply, healthcare and emergency services [IPCC];

- Agriculture—difficulties with water resource management impact on agricultural production, reducing incomes in rural areas [IPCC]. However, increased yields due to higher $CO_2$ levels should also be taken into account [CFACT];

- Energy—the demand for energy increases in summer and falls in winter. Winters are milder and the energy needed for heating is less;

- Insurance—Extreme weather events could be more frequent and material damage also. Insurance companies will have to adapt so as to offer different products depending on the region;

- Tourism—climate change affects tourism. A possible example is glacial melting in mountainous areas;

- The war on poverty—the budget allocated to global warming is not used to help poor people. That maintains existing pockets of poverty and tends to create new ones.

## V. Conclusion

One should beware of any apocalyptic presentation of the consequences of possible global warming. Studies contradict one another, and it is important to remember above all that there have been countless climate changes in the past and that the fauna and flora have grown accustomed to them. In particular, the ice age that affected the planet 20,000 years ago (very recently, in geological terms) certainly had more consequences than everything we have described above.

When it was discovered (in the tenth century), Greenland was green, as it name tells us; but it is not any more. The changes in Europe's fauna and flora over the last 2,000 years are well documented.

There is confusion, which is skillfully fostered by the IPCC and the media. We are presented with a stable world at a constant temperature, and only human action has managed to upset this fine balance. In reality it is very different: the temperature is constantly changing (but nobody understands why) and all species feel the consequences. Species adapt or disappear: that is the law of nature, and it is a waste of time to try to break it.

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# Part Three

# The IPCC

*Let us send Jean-Jacque to hard labor and Voltaire to the kennel*
*Victor Hugo: Les Châtiments*

# I. Introduction

IPCC reports are divided into three parts, corresponding to three working groups:

- The physical science basis,
- Impacts, adaptation and vulnerability,
- Mitigation of climate change.

The IPCC has drafted reports in several formats addressing different audiences:

- The full report, amounting to 5,000 pages, drafted by the scientists,
- The technical summary, which is more accessible for the general public,
- The summary for policymakers, drafted jointly by politicians and some scientists chosen from the original panel.

The contents of the reports fit together in the order given above. Thus the report designed to support politicians in their decision making is just a summarized (or truncated) version of the works originally published.

The first part of the report sets out the conclusions of studies by the scientists who have contributed to the IPCC.

We will now analyze the IPCC's conclusions in light of the factors described in the first part of this report, particularly temperatures, $CO_2$, cyclones, and sea levels.

We saw that current data were insufficient in quantity and quality to reach a reliable conclusion; the same (or worse) is clearly true for older data. Nevertheless, the IPCC believes conclusions can be drawn.

The IPCC takes a highly biased approach to its methodology, in that natural variability is never considered. Responsibility is arbitrarily attributed to human beings.

# II. The "Physical Science Basis" report

We compare the IPCC's conclusions with the data analyzed in the first part of this White Paper.

## *A. Temperatures*

### 1. Comments on the Summary for Policymakers

*"Observations of the climate system are based on direct measurements and remote sensing from satellites and other platforms" [p. 4].*

We have shown that temperature measurements made by satellites are much less precise than those made by weather stations. We do not know which datasets are used by the IPCC. We will address this point by using a specific example taken from the IPCC report (see part 2, temperatures).

*"Global-scale observations from the instrumental era began in the mid-19th century for temperature and other variables, with more comprehensive and diverse sets of observations available for the period 1950 onwards" [p. 4].*

Data are usable from 1880 onward depending on the location. Figure 1 in Part One, chapter 1, shows the distribution of ground-based weather stations and their recording periods.
Records have been kept in the United States, Europe and Japan for over 100 years. For Europe and the United States, reliable measurements well distributed in space and time from 1880 onward are available.

The IPCC applies the situation of areas recently equipped with sensors to the whole world. Its claim that *"sets of observations are more comprehensive and diverse for the period 1950 onwards"* is true for Australia, Africa and South America, but totally false for the areas mentioned above (Europe and the United States). With this statement the IPCC is depriving itself (and us) of more than 70 years' worth of data for these areas.

*"The globally averaged combined land and ocean surface temperature data as calculated by a linear trend, show a warming of 0.85 [0.65 to 1.06] °C, over the period 1880 to 2012, when multiple independently produced datasets exist" [p. 5].*

Everything depends on the dataset on which the IPCC is basing itself. We saw above that the temperature anomaly graph for the United States prepared by NASA [Hansen et al., 1999] showed no linearity at all. However, after the graph was updated in the first decade of the new millennium, linearity is present. These updates are neither transparent (taking account of station moves and observation times) nor justified: why change a raw dataset and only present the anomalies?

Obviously, the global warming issue needs to be examined with as old a dataset as possible. Eliminating 70 years' worth of data on principle is certainly strange in methodological terms.

The result mentioned by the IPCC (approximately 0.85 °C [1.53 °F] in 130 years) is compatible with the graph of the trend in recent years referred to above. With so little warming, we do not understand why "urgent action is needed" to prevent warming from exceeding 2 °C (3.6 °F), since that level would only be reached in 300 years.

*"Continental-scale surface temperature reconstructions show, with high confidence, multi-decadal periods during the Medieval Climate Anomaly (year 950 to 1250) that were in some regions as warm as in the late 20th century" [p. 5].*

We can question the IPCC's intellectual honesty about the *"high confidence"* of temperature reconstructions for the period 950–1250. In fact, on the one hand the IPCC recognizes that *"sets of observations are more comprehensive for the period 1950 onwards"* and therefore that these data are more reliable. On the other hand, the IPCC states with a high degree of confidence that in some regions of the world temperatures were just as high in an ancient period of history (950–1250) as in the late 20th century. What is even more questionable is the IPCC's *"medium confidence"* conclusion that *"1983–2012 was likely the warmest 30-year period of the last 1400 years."* In short, we have no way of knowing what is involved in *"high confidence"* for the IPCC or even what it means scientifically.

*"It is virtually certain that globally the troposphere has warmed since the mid-20th century. More complete observations allow greater confidence in estimates of tropospheric temperature changes in the extratropical Northern Hemisphere than elsewhere" [p. 5].*

Satellites must necessarily be used to obtain measurements in the troposphere. Satellite measurements involve a high degree of uncertainty (measurements need correcting, and they are difficult to take when it is cloudy). We can question the reliability of the measurements and the meaning of the *"greater confidence"* announced by the IPCC. This is contradicted by our analysis.

With regard to weather buoys, we are aware that they are not distributed equally in the Northern and Southern hemispheres.

There are currently 17 geostationary satellites and 13 orbiting satellites. Each one is able to sweep vast areas periodically from one pole to the other. However, since they are regulated and calibrated by reference to surface stations, they are better regulated in the north than in the south (since there are many more stations in the north).

The average temperature is calculated from anomalies in relation to a reference period (1961–1990). It is not justifiable to base one's reasoning on temperature anomalies rather than on absolute temperature or mean temperature and to choose an arbitrary reference period. This is a non-scientific form of presentation that is liable to deceive the public.

| Phenomenon and direction of trend | Likelihood of further changes | |
|---|---|---|
| | Early 21st century | Late 21st century |
| Warmer and/or fewer cold days and nights over most land areas | *Likely* {11.3} | *Virtually certain* {12.4}<br>*Virtually certain*<br>*Virtually certain* |
| Warmer and/or more frequent hot days and nights over most land areas | *Likely* {11.3} | *Virtually certain* {12.4}<br>*Virtually certain*<br>*Virtually certain* |
| Warm spells/heat waves. Frequency and/or duration increases over most land areas | Not formally assessed[b] {11.3} | *Very likely* {12.4}<br>*Very likely*<br>*Very likely* |
| Heavy precipitation events. Increase in the frequency, intensity, and/or amount of heavy precipitation | *Likely* over many land areas {11.3} | ***Very likely*** over most of the mid-latitude land masses and over wet tropical regions {12.4}<br>*Likely* over many areas<br>*Very likely* over most land areas |
| Increases in intensity and/or duration of drought | *Low confidence*[g] {11.3} | ***Likely*** *(medium confidence)* on a regional to global scale[h] {12.4}<br>*Medium confidence* in some regions<br>*Likely*[e] |
| Increases in intense tropical cyclone activity | *Low confidence* {11.3} | ***More likely than not*** in the Western North Pacific and North Atlantic {14.6}<br>*More likely than not* in some basins<br>*Likely* |
| Increased incidence and/or magnitude of extreme high sea level | *Likely*[l] {13.7} | ***Very likely***[l] {13.7}<br>*Very likely*[m]<br>*Likely* |

*Figure 1: Excerpt from table "Extreme weather and climate events" [p. 7]*

Let us look at the table of extreme weather and climate events [p. 7]. In the last column headed "Likelihood of further changes", it is surprising that the degrees of confidence and likelihood in the "Early 21st century" column are lower than those in the "Late 21st century" column.

*"It is likely that the ocean warmed between 700 and 2000 m from 1957 to 2009. Sufficient observations are available for the period 1992 to 2005 for a global assessment of temperature change below 2000 m. There were likely no significant observed temperature trends between 2000 and 3000 m for this period. It is likely that the ocean warmed from 3000 m to the bottom for this period, with the largest warming observed in the Southern Ocean" [p. 8].*

All these "likely" statements make no scientific sense. They are not documented with data, observations, or measurements. There is nothing to justify them. They are merely expert judgments that purport to be scientifically meaningful.

There are three kinds of tools for measuring deep sea temperatures. The first is the profiler, an improved version of the drifting buoy since it is able to carry out preprogrammed sink cycles to measure ocean parameters to depths of 2,000 m (6,560 ft.). However, this kind of buoy is not in widespread use, and the 1,250 drifting buoys currently used are not all fitted with this functionality.

The second undersea measuring tool is the moored buoy, which is much more expensive and difficult to put in place than a drifting buoy. There are very few in the oceans (not enough to form a measuring network), and those that are in place are only able to measure temperatures to a maximum depth of 500 m (1,640 ft.).

The last temperature measuring tool is the ship-deployed sonde, which can be lowered to 1,500 m (4,920 ft.). Again, this measuring device is not widely used, since the number of research vessels in operation is declining.

Therefore there is no means of physically measuring temperatures at great depths, and the IPCC draws its conclusions from measurements that can only be acquired by satellites, with all the errors that entails (models, insufficient sampling at the poles, etc.).

*"Since the early 1970s, glacier mass loss and ocean thermal expansion from warming together explain about 75% of the observed global mean sea level rise (high confidence). Over the period 1993 to 2010, global mean sea level rise is, with high confidence, consistent with the sum of the observed contributions from ocean thermal expansion due to warming (1.1 [0.8 to 1.4] mm $yr^{-1}$ ), [...]" [p. 11].*

We have seen (in Part One, chapter 1, section IV) which factors account for sea level rise: buoyancy, soil erosion, etc. The thermal expansion of the oceans is far from being the only or even the main one. The IPCC's "high confidence" conclusion does not make scientific sense.

*"Projections of changes in the climate system are made using a hierarchy of climate models ranging from simple climate models, to models of intermediate complexity, to comprehensive climate models, and Earth System Models" [p. 19].*

Simple models are the best, because when we do not understand a phenomenon any modeling of it has to remain rough. Yet the IPCC refers to complex models that have not been validated, and presents them as proof.
*"Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions [p. 19].*

The IPCC states that increasing greenhouse gas emissions will result in global warning and draws direct conclusions about what measures to take.

There are three flaws in this logic: global warming has not been demonstrated, the link with GHGs is hypothetical, and the effectiveness of these measures is questionable (see above). The IPCC does not call in any way for further scientific studies—more data and observations. It considers they are sufficient to draw a conclusion, and this conclusion is "We have to act." That is unacceptable in terms of scientific method (see the basic rules of scientific research in the Annex).

| | | 2046–2065 | | 2081–2100 | |
|---|---|---|---|---|---|
| | Scenario | Mean | *Likely* range[c] | Mean | *Likely* range[c] |
| Global Mean Surface Temperature Change (°C)[a] | RCP2.6 | 1.0 | 0.4 to 1.6 | 1.0 | 0.3 to 1.7 |
| | RCP4.5 | 1.4 | 0.9 to 2.0 | 1.8 | 1.1 to 2.6 |
| | RCP6.0 | 1.3 | 0.8 to 1.8 | 2.2 | 1.4 to 3.1 |
| | RCP8.5 | 2.0 | 1.4 to 2.6 | 3.7 | 2.6 to 4.8 |
| | Scenario | Mean | *Likely* range[d] | Mean | *Likely* range[d] |
| Global Mean Sea Level Rise (m)[b] | RCP2.6 | 0.24 | 0.17 to 0.32 | 0.40 | 0.26 to 0.55 |
| | RCP4.5 | 0.26 | 0.19 to 0.33 | 0.47 | 0.32 to 0.63 |
| | RCP6.0 | 0.25 | 0.18 to 0.32 | 0.48 | 0.33 to 0.63 |
| | RCP8.5 | 0.30 | 0.22 to 0.38 | 0.63 | 0.45 to 0.82 |

*Figure 2: Projected change in global mean surface air temperature and global mean sea level rise for the mid- and late 21st century relative to the reference period of 1986–2005 [p. 23].*

*"Notes:*

- *a: Based on the CMIP5 ensemble; anomalies calculated with respect to 1986–2005.*
- *b: Based on 21 CMIP5 models; anomalies calculated with respect to 1986–2005."*

The scenarios drawn up by the IPCC are all based on a reference period—1986–2005. There is nothing to justify this choice.

The temperature rises mentioned in the table above are not compatible with the IPCC's previous statements of a 0.85 °C rise in 130 years. Here we can see 1 °C (or more, depending on the scenario) in 20 years (2046–2065).

## 2. Specific case study—Figure SPM.1, p. 6

a) Analysis

Our remarks on the IPCC's scientific approach basically concern the datasets used.
The SPM (Summary for Policymakers) and TS (Technical Summary) chapters put forward conclusions based on figures. Using a figure presented to policymakers (see figure below), we have tried to refer back to the source data with the help of the information provided by the IPCC in the captions.

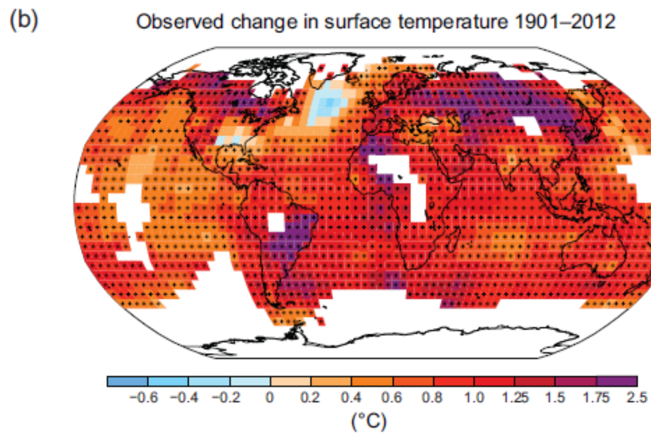


*Figure 3: Observed change in surface temperature 1901–2012 [p. 6]*

This figure refers back to three figures in the TS part:

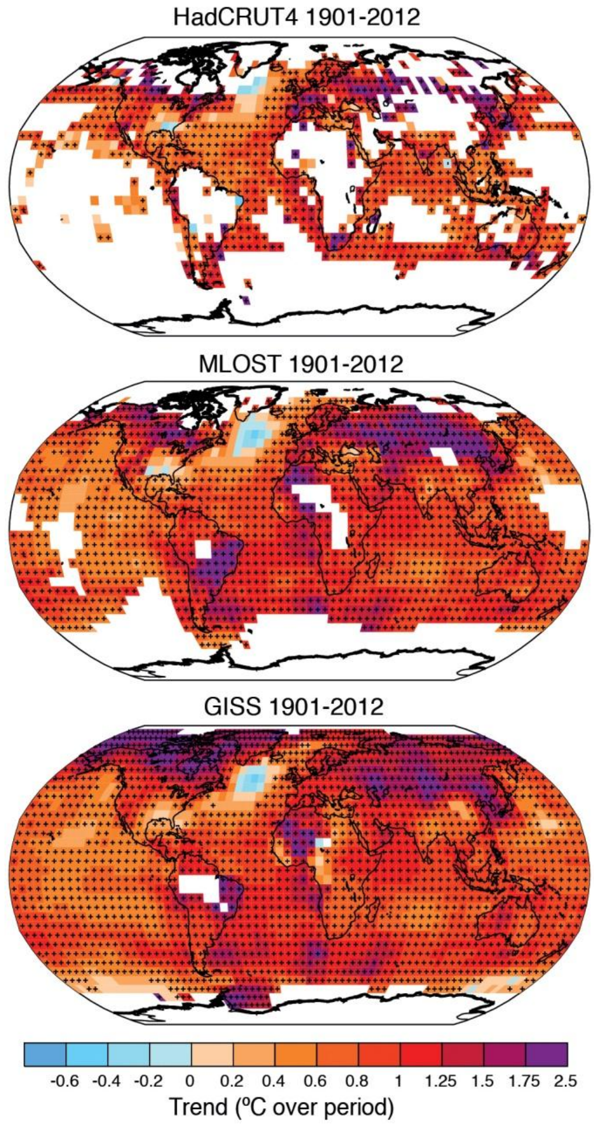


*Figure 4: Change in surface temperature over 1901–2012 as determined by linear trend for three data sets [p. 39]*

First remark: the figure presented to policymakers corresponds to the second dataset used by the IPCC. Three datasets resulted in the three figures above:

- Figure 1 "HadCRUT4": data from the Hadley Centre (UK Meteorological Office),
- Figure 2 "MLOST": NCDC data,
- Figure 3 "GISS": NASA data.

The three figures show different data. The first has the least data and the third has the most. We know that weather stations are not distributed evenly over the Earth; datasets 2 and 3 therefore cannot come solely from weather stations, but probably also from satellites and/or data reconstructions (they are models in both cases, with all the limits and uncertainties that that entails).

Details of the sources and methods used to generate the three maps are as follows:

- Figure 1 “HadCRUT4”: Hadley Centre data

The HadCRUT database combines sea surface temperature measurements from the Hadley Centre (UK Met Office) and ground temperatures from the Climatic Research Unit (University of East Anglia). The data are therefore from surface stations and do not appear to be satellite data. They may be downloaded from the Met Office website at <hadobs/crutem4/data>. They are in simple text format, accessible to everybody.

Uncertainties regarding the measurement methods are taken into account when the temperature anomalies are calculated (particularly for research vessels).

However, the Met Office states that the data are available from January 1850, although only certain areas were supplied with sensors at that time (especially in Europe). It is not known whether the maps were based only on the available data or whether missing data were supplied by a suitable mathematical model.

- Figure 2 “MLOST”: NCDC data

MLOST (Merged Land-Ocean Surface Temperature) is an analysis carried out by the National Climatic Data Center (run by NOAA). It uses different datasets than those used by the Met Office: MLOST draws on the surface temperature records of the Global Historical Climatology Network (the largest network of land sensors), while records at sea are from the International Comprehensive Ocean-Atmosphere Data Set.

In contrast to the HadCRUT4 figure, the NCDC tried to stretch the data as far as possible to cover the whole globe by making use of appropriate mathematical models to reconstitute missing data. Thus NOAA seems not to use the original measurements from stations, even though it does not use satellites. Coverage at the poles is of course poor (there are hardly any surface stations at the poles).

It is very difficult to obtain access to the raw data (due to a maze of links and files in formats that are inaccessible to the general public), and NOAA merely provides a formula for choosing the temperatures to observe.

- Figure 3 “GISS”: NASA data.

NASA’s GISS analysis uses three datasets: the GHCN database (the same one used in MLOST), the ERSST (Extended Reconstructed Sea Surface Temperature—NOAA) database, and the SCAR (Scientific Committee on Antarctic Research) databases.

Difficult to access, these databases were subjected to a large number of adjustments before being plotted. The database of maritime records itself resulted from a sampling reconstruction and cannot therefore be regarded as a raw dataset.

Moreover, NASA uses satellites to determine whether a particular station is close to an urban area and, if so, adjusts the data. The type of adjustment is not known.

NASA also uses surface station data, but adjusts them a posteriori with satellite data (although the opposite method would seem more logical, since satellites should be calibrated from surface stations), and one of the databases (sea surface stations) itself results from data extrapolation, which is obviously subject to the uncertainties that such an algorithm may generate.

b) Conclusion

In its Summary for Policymakers (SPM), the IPCC presents its conclusions by relying on a figure, and states: *“For a listing of the datasets and further technical details see the Technical Summary Supplementary Material.”* In the Technical Summary there are no data but three figures. After analyzing the data and technical resources used to produce these figures, we can classify them in order of reliability:

| | Technical resources used | Reliability |
|---|---|---|
| Figure 1 (Hadley Centre) | Stations | Most reliable |
| Figure 2 (NCDC) | Stations, complex models | Least reliable |
| Figure 3 (NASA) | Stations, satellites | Moderately reliable |

For the SPM, the IPCC chose to show figure 2, the one which apparently makes use of most data (the measurement points cover the whole globe). However, to achieve this result, the NCDC relies on station measurements but also on complex mathematical models to process the data before plotting them. These models are not known and are not validated in any way.

The IPCC uses this figure to arrive at the following conclusions:

- *“Each of the last three decades has been successively warmer at the Earth’s surface than any preceding decade since 1850 (see Figure SPM.1)” [p. 5].*

- *"For the longest period when calculation of regional trends is sufficiently complete (1901 to 2012), almost the entire globe has experienced surface warming (see Figure SPM.1b)" [p. 5].*

- *In addition to robust multi-decadal warming, global mean surface temperature exhibits substantial decadal and interannual variability (see Figure SPM.1)" [p. 5].*

Although presented as precise, these conclusions are obtained from a figure in which the data are highly questionable. They result from reconstitutions, models, and extrapolations, and do not reflect the reality of the observations at all.

In terms of scientific method, such a procedure is unacceptable.

### B. $CO_2$

*"With very high confidence, the current rates of $CO_2$, $CH_4$ and $N_2O$ rise in atmospheric concentrations and the associated increases in RF are unprecedented with respect to the 'highest resolution' ice core records of the last 22 kyr" [p. 50].*

The data come from Antarctica Dome C ice cores and are not "highest resolution" over the last 22,000 years. In fact they are averaged over 250-year periods, much longer than the industrial era!

Current $CO_2$ levels are not unprecedented. Chemical measurements made since 1812 and compiled by Ernst Beck show that levels up to 400 ppm have been measured in the past (see Part One, chapter 1, section II). However, these measures are ignored by the IPCC report.

*"Past changes in atmospheric GHG concentrations are determined with very high confidence from polar ice cores" [p. 50].*

Changes in concentration cannot appear in ice core data, since these are time-averaged over long periods and display many methodological artifacts. A core can only represent the concentration at the location where it was taken—in the ice—which in no way determines concentrations elsewhere. We have seen that $CO_2$ concentrations, like temperatures, can vary widely from one place to another.

*"There is medium confidence that the rate of change of the observed GHG rise is also unprecedented compared with the lower resolution records of the past 800 kyr. {2.2.1, 5.2.2} [...] Current $CO_2$ concentrations, the highest for at least 800 kyr, are likely to continue to rise" [p. 131].*

Data from 800,000 years ago are averaged over more than 5,000 years. They come from Antarctica Dome C ice cores. It is therefore inaccurate to state that $CO_2$ changes never took place in the past and that a maximum was never reached previously. We do not have the means to know.

*"Of the 555 [470 to 640] PgC released to the atmosphere from fossil fuel and land use emissions from 1750 to 2011, 240 [230 to 250] PgC accumulated in the atmosphere, as estimated with very high accuracy from the observed increase of atmospheric $CO_2$ concentration from 278 [273 to 283] ppm in 1750 to 390.5 [390.4 to 390.6] ppm in 2011" [p. 50].*

The value of 278 ppm is based on ice core records, while the second, 390 ppm, comes from infrared measurements on Mauna Loa. The comparison is incorrect, as it involves two different places and two different measuring methods.

The values of 278 ppm and 390 ppm put forward by the IPCC are based solely on two specific points on the globe and cannot in any way reflect the global concentration of $CO_2$.

An estimate of global concentration would require measuring the $CO_2$ in every cubic hectometer of the globe.

The changes in $CO_2$ concentration over the ages are unknown since we do not have sufficient numbers of reliable measurements. The IPCC, however, regards ice core measurements as evidence and infrared measurements on Mauna Loa as a baseline for global concentration.

There is clearly an error of logic in this reasoning and these conclusions would not be acceptable if they were submitted for publication in a scientific journal.

Another error of logic committed by the IPCC concerns the very nature of the carbon cycle. The IPCC argues as if the cycle were reduced to emissions, which should be controlled or reduced. Yet nature performs a "carbon cycle" in which carbon is emitted and then used in many natural processes, which are completely ignored in the IPCC's work.

Natural $CO_2$ exchange flows are estimated on the basis of our shaky knowledge of these natural processes. The absorption capacity of carbon sinks, particularly the oceans, is not known with any certainty. The earth-atmosphere flow since 1750 is estimated at 30 PgC with an uncertainty of 45 PgC. The effectiveness of the various sinks and sources is variable and unknown. The rise in $CO_2$ concentration may very well be due to natural variability in one of these sinks.

In other words, a local rise in $CO_2$ concentration may perfectly well derive from the fact that the ocean is absorbing less in the local area, for one reason or another, without human beings being involved at all.

The IPCC acts as though there were a natural equilibrium that human beings alone are disturbing. In fact, there is no such natural equilibrium, but rather constant and largely unknown variations.

*"The total amount of anthropogenic $CO_2$ released in the atmosphere since pre-industrial [times] (often termed cumulative carbon emission, although it applies only to $CO_2$ emissions) is a good indicator of the atmospheric $CO_2$ concentration and hence of the global warming response" [p. 102].*

The IPCC demonstrates that the rise in $CO_2$ is the primary cause of a global energy imbalance and hence of global warming. But such a balance does not exist, and it is impossible to achieve one because of the high degree of uncertainty surrounding the various energy flows (solar radiation, reflection from cloud cover, cooling effect of aerosol/cloud interactions, etc.). It is subject to major natural changes.

The IPCC's demonstrations in fact rely on simplified numerical models that have never been validated. Using such models as a political decision-making aid is both dishonest and illogical.

The IPCC foresees mechanisms that will amplify the reaction of the climate to the increased $CO_2$ concentration, including ocean warming, ocean acidification, and changes in convection mechanisms within clouds. Yet all these mechanisms are entirely hypothetical. They have never been observed and are derived solely from simplistic and nonvalidated mathematical models.

## *C. Cyclones*

We processed the cyclone data for the North Atlantic basin ourselves and found that there was no increase in cyclone frequency (a slight increase in high-intensity cyclones, but no conclusions could be drawn from that because of uncertainty about data quality).

Cyclones are a very special case of extreme weather events (which also include droughts and very hot or very cold days, etc.). They are not dealt with explicitly in the Summary for Policymakers, and so we examined the Technical Summary. We were thus able to compare our conclusions with those put forward by the IPCC.

*"In the North Atlantic region there is medium confidence that a reduction in aerosol forcing over the North Atlantic has contributed at least in part to the observed increase in tropical cyclone activity there since the 1970s" [p. 73].*

The IPCC claims the number of cyclones in the North Atlantic has increased since the 1970s. That conclusion by the IPCC is contradicted by the facts.

In addition, it attributes this increase to a reduction in aerosol forcing. Aerosols consist of very fine particles in suspension in the atmosphere and are believed to have an effect contrary to the greenhouse effect. That conclusion has no scientific basis.

*"There is low confidence in basin-scale projections of changes in intensity and frequency of tropical cyclones in all basins to the mid-21st century. This low confidence reflects the small number of studies exploring near-term tropical cyclone activity, the differences across published projections of tropical cyclone activity, and the large role for natural variability. There is low confidence in near-term projections for increased tropical cyclone intensity in the Atlantic; this projection is in part due to projected reductions in aerosol loading" [p. 88].*
There is very high natural variability in these phenomena, which the IPCC does not take into account.

*"North America: Monsoon precipitation will shift later in the annual cycle; increased precipitation in extratropical cyclones will lead to large increases in wintertime precipitation over the northern third of the continent; extreme precipitation increases in tropical cyclones making landfall along the western coast of USA and Mexico, the Gulf Mexico, and the eastern coast of USA and Canada" [p. 106].*

*"Central America and Caribbean: Projected reduction in mean precipitation and increase in extreme precipitation; more extreme precipitation in tropical cyclones making landfall along the eastern and western coasts" [p. 106].*

Both these apocalyptic statements are based on nothing, because there is no increase in the number of cyclones in the North Atlantic.

*"Projections for the 21st century indicate that it is likely that the global frequency of tropical cyclones will either decrease or remain essentially unchanged, concurrent with a likely increase in both global mean tropical cyclone maximum wind speed and rain rates (Figure TS.26). The influence of future climate change on tropical cyclones is likely to vary by region, but there is low confidence in region-specific projections. The frequency of the most intense storms will more likely than not increase in some basins. More extreme precipitation near the centers of tropical cyclones making landfall is projected in North and Central America, East Africa, West, East, South and Southeast Asia as well as in Australia and many Pacific islands (medium confidence)" [p. 107].*

Statements like “more likely than not” are disconcerting for a scientist, since they mean absolutely nothing. It is a kind of pseudoscientific jargon that puts probabilities where they do not belong.

This passage contradicts several earlier statements in that it says we are unable to make region-specific projections, but it does so all the same. It also claims that the frequency of extreme cyclones will diminish.

*“The global number of extratropical cyclones is unlikely to decrease by more than a few percent and future changes in storms are likely to be small compared to natural interannual variability and substantial variations between models. [...] It is unlikely that the response of the North Atlantic storm track in climate projections is a simple poleward shift” [p. 108].*

That is all “crystal ball gazing” without any scientific basis. The words “are likely to be” should be rephrased as “The IPCC wants us to believe that ...”.

*“Tropical and Extratropical Cyclones*

*There is low confidence in long-term (centennial) changes in tropical cyclone activity, after accounting for past changes in observing capabilities. However over the satellite era, increases in the frequency and intensity of the strongest storms in the North Atlantic are robust (very high confidence). However, the cause of this increase is debated and there is low confidence in attribution of changes in tropical cyclone activity to human influence owing to insufficient observational evidence, lack of physical understanding of the links between anthropogenic drivers of climate and tropical cyclone activity and the low level of agreement between studies as to the relative importance of internal variability, and anthropogenic and natural forcings. {2.6.3, 10.6.1, 14.6.1}” [p. 113].*

Changes in cyclone number cannot be analyzed over 100 years because the measurement tools did not exist. For the last 30 years in the North Atlantic our conclusions are clear: there has been no increase.

The IPCC then accepts that if there has been an increase it cannot be attributed to human influence: *“there is low confidence in attribution of changes in tropical cyclone activity to human influence”*, but this is only said in the Technical Summary and not in the Summary for Policymakers.

*“There is low confidence that any reported long-term (centennial) changes in tropical cyclone characteristics are robust, after accounting for past changes in observing capabilities” [p. 114].*

We have no knowledge of changes in cyclones over 100 years, so this statement is entirely meaningless.

*"In some aspects of the climate system, including changes in drought, changes in tropical cyclone activity, Antarctic warming, Antarctic sea ice extent, and Antarctic mass balance, confidence in attribution to human influence remains low due to modelling uncertainties and low agreement between scientific studies" [p. 115].*

*"There is generally low confidence in basin-scale projections of significant trends in tropical cyclone frequency and intensity in the 21st century" [p. 115].*

Here the IPCC admits that its cyclone projections are unreliable, but it says the opposite elsewhere, calling its projections "robust."

The following comment was taken from the Frequently Asked Questions:

*"Over periods of a century or more, evidence suggests slight decreases in the frequency of tropical cyclones making landfall in the North Atlantic and the South Pacific, once uncertainties in observing methods have been considered. Little evidence exists of any longer-term trend in other ocean basins. For extratropical cyclones, a poleward shift is evident in both hemispheres over the past 50 years, with further but limited evidence of a decrease in wind storm frequency at mid-latitudes. Several studies suggest an increase in intensity, but data sampling issues hamper these assessments" [p. 219].*

This clearly shows intellectual dishonesty in the presentation. An essential point is hidden away in the FAQ while the report says the opposite. Yet it is the cyclones that make landfall (as opposed to those that dissipate at sea) that are of interest to the public and to policymakers. If their frequency is decreasing it should have been stated clearly from the outset!

The multiple parts of the report (SPM, TS, FAQ, etc.) allow the IPCC to choose different conclusions as needed.

## *D. Sea level*

### 1. Comments on the Summary for Policymakers

*"Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass, glaciers have continued to shrink almost worldwide, and Arctic sea ice and Northern Hemisphere spring snow cover have continued to decrease in extent (high confidence)" [p. 9].*

There has been a recent increase in Arctic ice thickness—see [Cryosat], above. There is considerable natural variability in these elements.

*"There is medium confidence from reconstructions that over the past three decades, Arctic summer sea ice retreat was unprecedented and sea surface temperatures were anomalously high in at least the last 1,450 years" [p. 9].*

Sea ice thickness is currently measured by satellite. There were no reliable measurements prior to that, and any conclusion over 1,450 years is totally absurd. There is reliable evidence that at certain times in the past the northern ice shelf melted to a greater extent than it is melting today. We discussed that in Part One, chapter 1, section IV.

*"The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia (high confidence). Over the period 1901 to 2010, global mean sea level rose by 0.19 [0.17 to 0.21] m (see Figure SPM.3)" [p. 11].*

*"Proxy and instrumental sea level data indicate a transition in the late 19th to the early 20th century from relatively low mean rates of rise over the previous two millennia to higher rates of rise (high confidence). It is likely that the rate of global mean sea level rise has continued to increase since the early 20th century. {3.7, 5.6, 13.2}" [p. 11].*

That contradicts the study by [Christy-Spencer] and data referred to in Part One above. There has been no recent acceleration in sea level rise since 1800.

*"It is very likely that the mean rate of global averaged sea level rise was 1.7 [1.5 to 1.9] mm $yr^{-1}$ between 1901 and 2010, 2.0 [1.7 to 2.3] mm $yr^{-1}$ between 1971 and 2010, and 3.2 [2.8 to 3.6] mm $yr^{-1}$ between 1993 and 2010. Tide-gauge and satellite altimeter data are consistent regarding the higher rate of the latter period. It is likely that similarly high rates occurred between 1920 and 1950" [p. 11].*

The ballpark figure for the period 1992–2010 corresponds to the one we gave above (see the general figure provided by the University of Colorado) and probably comes from satellite measurements. However, we have seen discrepancies between the different measuring methods: 1 mm per year for tide gauges and 3 mm per year for satellites. The IPCC is wrong to claim the two methods are consistent with one another.

*"Since the early 1970s, glacier mass loss and ocean thermal expansion from warming together explain about 75% of the observed global mean sea level rise (high confidence). Over the period 1993 to 2010, global mean sea level rise is, with high confidence, consistent with the sum of the observed contributions from ocean thermal expansion due to warming (1.1 [0.8 to 1.4] mm $yr^{-1}$), from changes in glaciers (0.76 [0.39 to 1.13] mm $yr^{-1}$), Greenland ice sheet (0.33 [0.25 to 0.41] mm $yr^{-1}$), Antarctic ice sheet (0.27 [0.16 to 0.38] mm $yr^{-1}$), and*

*land water storage (0.38 [0.26 to 0.49] mm yr$^{-1}$). The sum of these contributions is 2.8 [2.3 to 3.4] mm yr$^{-1}$" [p. 11].*

We saw above (Part One, chapter 1, section IV) which factors lie behind sea level rise. Recent studies have attributed the Greenland ice melt to geothermal activity (Part Two, chapter 1, section V).

*"There is very high confidence that maximum global mean sea level during the last interglacial period (129,000 to 116,000 years ago) was, for several thousand years, at least 5 m higher than present, and high confidence that it did not exceed 10 m above present. During the last interglacial period, the Greenland ice sheet very likely contributed between 1.4 and 4.3 m to the higher global mean sea level, implying with medium confidence an additional contribution from the Antarctic ice sheet. This change in sea level occurred in the context of different orbital forcing and with high-latitude surface temperature, averaged over several thousand years, at least 2 °C warmer than present (high confidence)" [p. 11].*

It is absurd to have such a degree of confidence about periods so long ago. In fact, as explained previously, the information we have on sea levels 18,000 years ago must be used with caution and relates to only a small number of coastal observations. Here the IPCC's conclusions go back to periods well before that.

*"Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes (see Figure SPM.6 and Table SPM.1). This evidence for human influence has grown since AR4 [Assessment Report 4]. It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century" [p. 17].*

In reality, evidence for human influence has not grown—far from it. The studies are all contradictory, showing that we do not understand anything about the phenomena in question. The IPCC is implying that we have scientific certainties and that these certainties point to a single culprit: humankind. That is just being dishonest.

*"It is very likely that there is a substantial anthropogenic contribution to the global mean sea level rise since the 1970s. This is based on the high confidence in an anthropogenic influence on the two largest contributions to sea level rise, that is thermal expansion and glacier mass loss. {10.4, 10.5, 13.3}" [p. 19].*

There are several errors of logic here. The reality of global warming is not proven, nor is the link with sea level rise or glacier mass loss. In fact, no link at all has been established with human activities.

*"Anthropogenic influences likely contributed to the retreat of glaciers since the 1960s and to the increased surface mass loss of the Greenland ice sheet since 1993. Due to a low level of scientific understanding there is low confidence in attributing the causes of the observed loss of mass from the Antarctic ice sheet over the past two decades" [p. 19].*

This statement seems to contradict the previous one somewhat. How can the IPCC say *"This is based on the high confidence in an anthropogenic influence on the two largest contributions to sea level rise, that is thermal expansion and glacier mass loss,"* on the one hand, and *"Due to a low level of scientific understanding there is low confidence in attributing the causes of the observed loss of mass from the Antarctic ice sheet over the past two decades"* on the other?

*"It is very likely that the Arctic sea ice cover will continue to shrink and thin and that Northern Hemisphere spring snow cover will decrease during the 21st century as global mean surface temperature rises. Global glacier volume will further decrease" [p. 24].*

The IPCC's predictions have now been refuted by observations: Arctic ice thickness has increased since 2012, as explained in Part One, chapter 1, section IV.

*"Global mean sea level will continue to rise during the 21st century (see Figure SPM.9). Under all RCP scenarios, the rate of sea level rise will very likely exceed that observed during 1971 to 2010 due to increased ocean warming and increased loss of mass from glaciers and ice sheets" [p. 25].*

The IPCC is basing its models on an increase in glacier mass loss. Yet precisely the opposite is happening in the Arctic according to recent observations.

*"In the RCP projections, thermal expansion accounts for 30 to 55% of 21st century global mean sea level rise, and glaciers for 15 to 35%. The increase in surface melting of the Greenland ice sheet will exceed the increase in snowfall, leading to a positive contribution from changes in surface mass balance to future sea level (high confidence). While surface melting will remain small, an increase in snowfall on the Antarctic ice sheet is expected (medium confidence), resulting in a negative contribution to future sea level from changes in surface mass balance. Changes in outflow from both ice sheets combined will likely make a contribution in the range of 0.03 to 0.20 m by 2081–2100 (medium confidence). {13.3–13.5}" [p. 25].*

This is a mass of incomprehensible jargon. The stated outcome will be a rise of 3–20 cm (1¼–8 in.) by 2100! And with these figures the IPCC wants to make us believe we must take urgent action!

*"The basis for higher projections of global mean sea level rise in the 21st century has been considered and it has been concluded that there is currently insufficient evidence to evaluate the probability of specific levels above the assessed likely range. Many semi-empirical model projections of global mean sea level rise are higher than process-based model projections (up to about twice as large), but there is no consensus in the scientific community about their reliability and there is thus low confidence in their projections. {13.5}" [p. 26].*

If there is disagreement about sea level projection models within the IPCC itself, how much is there in the scientific community as a whole? Why is it that, despite all the uncertainties about projection models and all the discrepancies in their results, the IPCC still presents conclusions for policymakers to use?

## 2. Data processing errors

The IPCC states on page 11 of the SPM:

*"It is very likely that the mean rate of global averaged sea level rise was 1.7 [1.5 to 1.9] mm $yr^{-1}$ between 1901 and 2010, 2.0 [1.7 to 2.3] mm $yr^{-1}$ between 1971 and 2010, and 3.2 [2.8 to 3.6] mm $yr^{-1}$ between 1993 and 2010. Tide-gauge and satellite altimeter data are consistent regarding the higher rate of the latter period. It is likely that similarly high rates occurred between 1920 and 1950" [p. 11].*

The IPCC is saying that there was an acceleration: sea level rise was getting faster and faster. We decided to play the game and look in the main report and technical summaries for the figures from which this information was taken.

This is what we found in section 3.7:

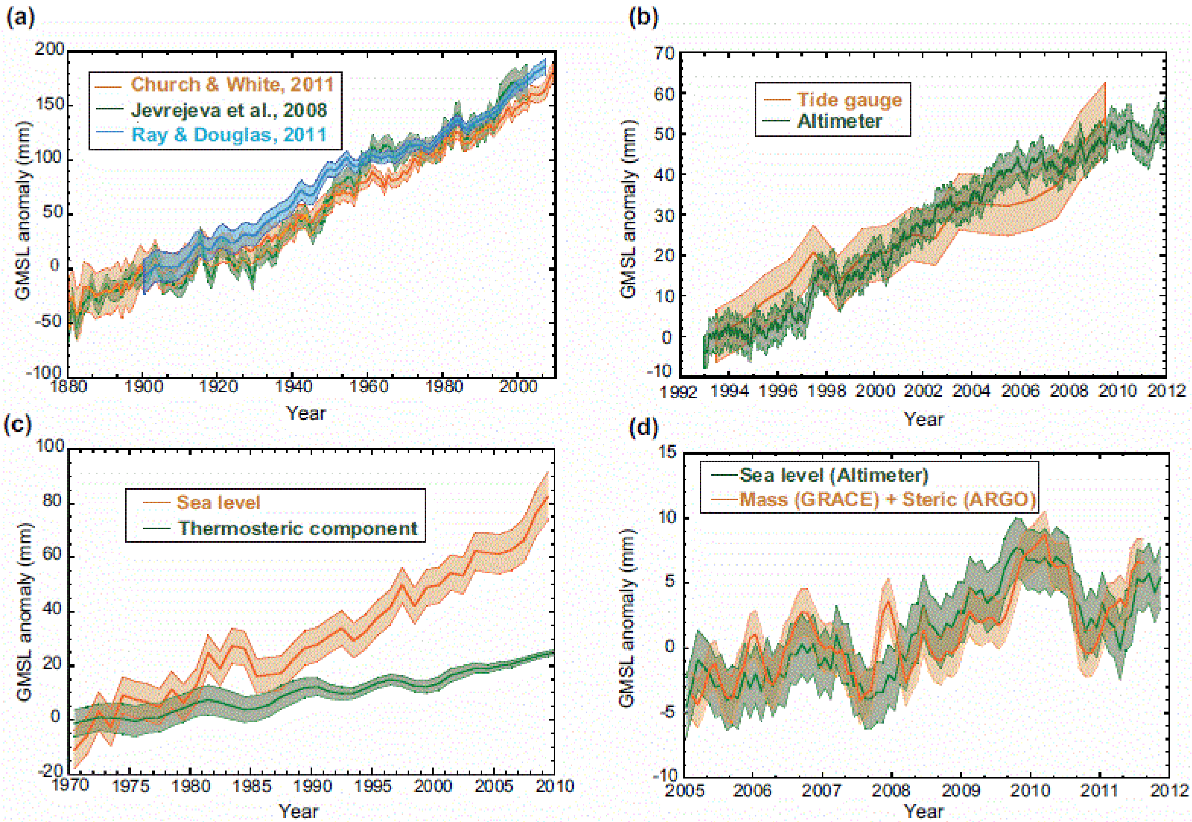


*Figure 5: Sea level according to different techniques, 1970–2010*

These graphs show no acceleration in sea level rise. There is a steady rate of increase.

## III. Critical analysis

The IPCC report is totally flawed in terms of basic scientific method, since it ignores the natural variations in the variables that it seeks to analyze: temperature, precipitation, $CO_2$ concentration, etc. The IPCC argues as if the globe were in a constant, steady state that is disturbed only by human activities.

The IPCC report is equally flawed in terms of data acquisition, since in principle it chooses the data or datasets that support its theses and discard all the rest, which are simply ignored.

The IPCC report is highly ideologically biased. It does not follow any of the basic rules of scientific research (which are detailed below), and could certainly not be published in a peer-reviewed journal.

# Annex

The basic rules of scientific research

These were already known to the Greeks, but it is worth recalling them again today.

- R1. All the available data must be analyzable by all researchers.

- R2. Every investigation must be carried out with the sole purpose of enhancing understanding of a law of nature, and without initial bias; scientific research can only progress through experimentation, which relies on a spirit of curiosity. This experimentation must be conducted honestly, without favoring the desired result.

- R3. All results of experiments must be made public and not only those that support the desired theory.

- R4. All laws and all models must be validated on other data than those that were used to develop them.

- R5. The quality of a scientific study depends on the pertinence of the data that support it and the logic of the reasoning developed in it; it is independent of the prestige of its author and its sources of funding.

- R6. The validity of a law is judged on its predictive and explanatory power; it is completely independent of any popular or democratic consensus.

A detailed presentation of these laws may be found in the address titled "Cargo Cult Sciences" given by Richard Feynman (Nobel Prizewinner for Physics) to students at Caltech in 1974.

A law of nature is usually transcribed into mathematical language (see the article on the role of the mathematician, on the SCM website). To critique its conclusions, one will therefore have to:

- analyze and formalize the question to be solved,

- critique the pertinence of the input data,

- critique the validity of the reasoning and the pertinence of the quantification,

- assess the consistency of the reasoning (including the importance of the uncertainties).

Today research is believed to result from social consensus. Historical analysis shows that it does not. Research on whatever subject has always been done by isolated individuals inspired by curiosity, who felt that the knowledge available was unsatisfactory and did not take account of natural phenomena.

Consensus, in contrast, means accepting what there is. For example:

- Nobody wanted to let Christopher Columbus set sail,

- All physicians opposed the research done by Claude Bernard and then Pasteur,

- All physicists opposed Einstein's work.

Even when discoveries are made, most scientists continue to oppose them. This is a quotation from Max Planck (Nobel Prizewinner for Physics and the originator of quantum theory):

*"A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it."*

(Max Planck, *Scientific Autobiography*)

Scientific research is motivated and justified by data, observations, facts. Research can only be validated by challenging it through experiment; no expert consensus could ever replace that.

The assessment of a risk is a scientific problem that requires an appropriate level of expertise. It must be done separately, and kept carefully out of any public debate. Management of that risk is another matter entirely (concerning how society adapts to it); it is political but must be supported by data from the scientific assessment. Before deciding whether to build on the side of a volcano, it is important to find out whether it is still active or not; the answer is scientific and is based on measurements.

Scientific expertise is also needed to evaluate the results. It must address the end effect that is to be controlled rather than the degree of compliance with a regulation or standard.

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