

# Thinking about climate change (16th-21st centuries)

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*The issue of climate change is now feeding into public debate. Every week, there is not an event that is not, rightly or wrongly, brought back to this question. However, this has not always been the case. For a long time, people did not "think" about climate change. This was postulated to be stable, only disturbed by "bad weather" to which men gave anthropocentric interpretations of a religious nature. It was not until the 18th century that the idea that human action could have an impact on the climate emerged. During the 19th century, the idea emerged that the increase in CO<sub>2</sub> resulting from the combustion of fossil fuels favoured global warming. But the phenomenon was not perceived as a real threat until the 1970s. Since then, particularly after the creation of the IPCC in 1988, the issue of global warming has continued to gain prominence in national and international public debates.*

## 1. The birth of modern science and the search for climate rules (17<sup>th</sup> -18<sup>th</sup> centuries)

### 1.1. People and climate

People have always been concerned about the climate. In societies where most of the resources and wealth come from the land, such attention should not be surprising. This statement applies to all civilizations, from ancient China to the Inca world. Questions everywhere give rise to scholarly astronomical observations or the development of empirical knowledge. In Transoxiana\*, Ulugh Beg built the world's largest observatory at the beginning of the 15<sup>th</sup> century. In the Inca world, the solar and lunar calendar is used to manage agricultural cycles. In the West, countless observations provide an empirical knowledge of atmospheric phenomena, often concentrated in the form of sayings, sentences and proverbs, in an attempt to predict the weather and organize ploughing, sowing and harvesting in the most effective way possible [\[1\]](#).

This cycle of nature, whose rhythms popular knowledge tends to understand, is however periodically disrupted by accidents whose exceptional character, unknown "in human memory", is affirmed by witnesses. But these accidents upset the ordinary balance and constitute "bad weather", in the sense given by the *Dictionnaire de Trévoux* in the 18<sup>th</sup> century: "Disruption, bad constitution, lack of a fair temperament, qualities required in certain things. We say it first of all about the air. The *bad weather* of the air, of this climate, makes it deserted... The *bad weather* of the seasons had left a malignant impression in the air.

Popular knowledge struggles to explain these "bad weather" - disturbances, torrential rains, extreme cold, droughts, storms - which are often interpreted in anthropocentric perspectives. God intervenes in the course of things to punish or warn people. Heaven "has sent against us, to punish our ingratitude, disease, mortality, extreme famine, an astonishing bad weather...." says Bossuet [2]. In the second half of the 17<sup>th</sup> century, preachers placed less emphasis on the negative significance of the plagues, and more on their saving value. If God remains at their origin, his mercy prevails over his vengeance. In the winter of 1709, it was mainly the miraculous spring barley harvest that was greeted by contemporaries: "God granted it to us [his Mercy] by giving us a favourable time for the barley and oats that were collected in abundance," notes the priest of Asquins. "This abundance is a blessing visible from heaven and a prodigious multiplication of divine Providence" adds Velaines' [3].

However, in addition to these miraculous interpretations, scientists began, as early as the 17<sup>th</sup> century, to give more rational explanations to climatic events.

## 1.2. The birth of modern science

The **history of meteorology is inseparable from the birth of the modern scientific movement**. However, since Descartes, scientists began in the 17<sup>th</sup> century to seek purely scientific explanations for meteorological phenomena [4] (see [Meteorological observations over the past centuries](#)). But if the bad weather does not fail to challenge them, it is first of all **to understand the rules of the climate** that they are working on. At the Academia del Cimento in Florence, the Royal Society in London, the Académie des Sciences in Paris, they multiplied their observations and developed the first physical laws on air compression and solar radiation. With regard to climate in particular, this research aims first and foremost to shed light on regulatory mechanisms. They participate in the work carried out by the physics of the Enlightenment to understand the rules of nature, as God had created it. The search for these rules requires the use of increasingly precise instrumentation that we are trying to standardize (thermometer, barometer, hygrometer, rain gauge, anemometer), and a multitude of readings whose character is as necessary as it is tedious.



Source gallica.bnf.fr / Bibliothèque nationale de France

Figure 1. Miller's Nautical Atlas of the World, work by Lopo Homen, Portuguese cartographer (1519), Manuscript on Velin. [Source: gallica.bnf.fr, Bibliothèque nationale de France].

But if these scientists are wondering about climate variations, we would be seriously mistaken if we thought they gave this expression a contemporary meaning. For 17<sup>th</sup> and 18<sup>th</sup> century men, "climate" refers first and foremost to a geographical area [5]. For the *Dictionary of the Académie française* of 1694, as for Richelet, the word "climate" is first of all "an estenduë of the globe of the Earth between two parallels". It was only belatedly, in its 1762 edition, that the *Dictionary of the Academy*, which is associated with this meaning, that of "atmospheric conditions", before taking, under the growing influence of medical circles, the meaning of "temperature": "Doctors consider climates particularly by their own temperature or degree of heat" [6]. It is not so much the rules of climate as "climates" that observers are concerned with. **Studying a climate means examining meteorological phenomena and specifying their rules in a perfectly spatially delimited geographical space.** The



establishment of observer networks thus responds to the desire to observe the variations of "climates", i.e. the regimes specific to different regions and countries, and to try to find scientific explanations for them. Comparing his observations with those of the Zurich native Scheutzer, La Hire noted in 1710: "By comparing these observations, we know that it rains much more in Switzerland than in Paris. I had already noticed by the observations of the rain made in Lyon that it rains much more than in Paris, and I attributed the cause to the mountains of Switzerland, which are not very far from it; and this is what is confirmed by these last observations.

To ensure that comparisons are solid, both are working on increasing the number of annual observations to better specify the rules of each climate. "**Everything is movement and everything changes in Nature, but everything also tends to balance and the very inconsistency of its laws,**" said Duhamel du Monceau in 1743, "If we had weather observations of several centuries in the same country, there is every reason to believe that the total sum of rains that have fallen in this country for a century is not significantly different from that of another century, or that if there are marked differences, an even greater number of centuries will reveal their progress and compensation. Because finally, the parts of the machine of our globe and its atmosphere are not infinite, their revolutions must give us back about the same effects, or indicate to us the cause of the variation and decline that disturbs the returns. "It is clear," he added, "that the greater the number of years, the closer the adopted average will be to the true one [7]. In fact, the rainfall averages recorded at Paris Observatory were modified several times in the first third of the 18th century. In this context, the exceptional years were not interpreted as a sign of a disruption or an announcement of a possible change, but only as a sign of insufficient knowledge of the laws being sought to define.

## 2. From anthropogenic origins to climate change?

If for scientists, climate is thus a regulated physics whose mechanisms should be decoded, if for mountain observers, the advance of glaciers does not in any way testify to major changes, it cannot be said that 18<sup>th</sup> century men, despite their postulate of climate stationarity, completely ignore the very idea of change, and in particular **the possibility of anthropic action**.

### 2.1. Observation of past changes

The **debate on the origins of the Earth**, which from Woodward to Buffon gives rise to heated clashes, hardly affects climate issues. In 1765, Duhamel du Monceau pointed out that the Earth had "suffered considerable changes, floods, fires and terrible upheavals; that entire continents had been swallowed up and replaced by new seas, while elsewhere and from the bottom of the sea, mountains and new continents had risen, where marine productions were still visible. "But the observation of these old changes does not change the prospects: "The parts of the earth machine are not infinite, and their revolutions must sooner or later give us about the same effects".

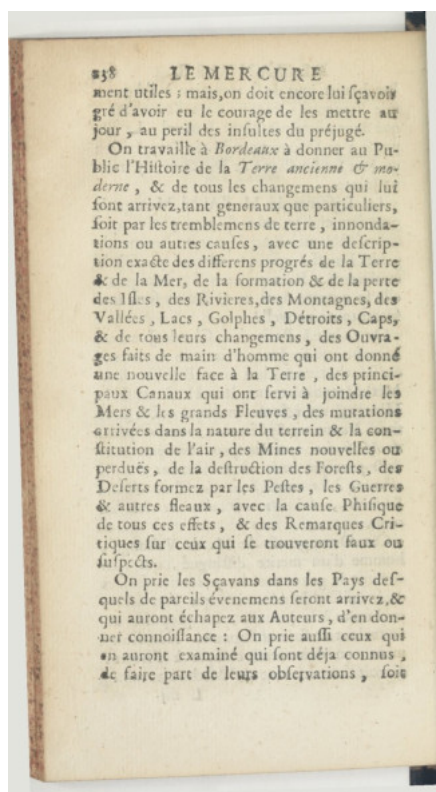


Figure 2. *Le Mercure de France*, January 1719.

It is undoubtedly at **Montesquieu** that we find the first questions on this subject. We know the role that philosopher attributed to the climate as a producer of differences that were transposed into morals. But it also implicitly questions the role of human action in climate change. As early as 1719, the idea appeared in a *Project of an ancient and modern history of the Earth*, which was first announced in *Le Nouveau Mercure* in January (under the heading "Book"), then in a slightly different version in *Le Journal des sçavans* on March 6 under the title "Avis aux savans" [8]. The objective was to investigate the physical causes of Earth's change, i.e. a natural, geographical, geological and climatic history, to study, in addition to changes at the Earth's surface, the variations and alterations in the natural balance produced by human activity. Emphasizing the effect of the changes made "by man's hand that have given a new face to the Earth", means for him to emphasize the problems of the relationship between "physical" and "moral" (between nature and history).

In the 18<sup>th</sup> century, several philosophers or scientists began to question whether human action could have consequences on the climate. In his memoirs to the Académie des Sciences, Duhamel states: "There is every reason to believe that there is little climate that does not change significantly from one century to the next, either by the landings that accumulate there, or by the floods that remove part of the land; and if it is cultivated, by the drying up of ponds and marshes, by the cutting or planting of wood, and by a hundred other causes of this species" [9].

Taking up the old hypothesis of the Greek philosopher Theophrastus that forest degradation could favour the multiplication of bad weather, John Woodward concludes that there is a possibility of local impacts on the climate. But it was undoubtedly **Buffon who first** formulated the most precise answers to Montesquieu's questions in *Les Époques de la Nature*. For him, the development of human settlements, the drying up of marshes and the clearing of forests were the conditions for global warming. "A single more or less forest in a country is enough to change its temperature" [10]. This would explain the warming of the climate in Western Europe since Roman times.

## 2.2. The colonial world and climate change

The **installation of Europeans in the colonies would provide observable evidence of this**. The idea that economic development would promote climate change began to emerge as early as the mid-17<sup>th</sup> century in English Virginia or French Canada [11]. At the Royal Society, Robert Boyle raised the issue as early as 1671. Taking the same ideas, Buffon argues at the beginning of the 18<sup>th</sup> century that the clearing of Guyana would result in a warming of the temperature, "while in all other wood-covered lands it is cold enough at night to be forced to light the fire". In 1745, the observations of Dr. Gautier, the Academy's correspondent in Quebec, were in the same vein: "We said that in Canada we notice that spring begins earlier, and winter later than before, and that this change in air temperature is attributed to the amount of wood that has been cut down and the amount of land that is now being cultivated. The elders of the country also assure us that in the past the harvest of the bleeds only began on the 15<sup>th</sup> or 16<sup>th</sup> of September, and that they rarely reach perfect maturity" [12]. In the 1760s, the idea tended to become more widespread. The conclusion of the "climate" article in the *Encyclopedia of Medicine* in 1792 goes in the same direction: "However, we can calculate a change that is due to cultivation, clearing, forest abbots, and the drying up of ponds and marshes. Do we want demonstrative proof of this truth? Let us look at America, wherever culture has not won, thick forests that light never penetrates, swamps that the heat of the sun cannot dry up, cover the whole Earth and cool the atmosphere so much that when you have to spend the night there, you have to light a fire.

## 2.3. The birth of historical climatology

In the last third of the 18<sup>th</sup> century, attempts to reconstruct the climate for distant periods emerged, not on the basis of old measurements, but on indicators revealing the historicity of the climate: the state of rivers, vegetation, glaciers, extreme meteorological events, the "climate proxies", which today have become "the pillars of historical climatology" [13].



*Figure 3. "View of the glacier and the Argentière needle in the Chamounis valley", Colourful engraving by Samuel Grundmann from the early 19th century [Source: Paul Payot Conservatory of Art and History Collection, Annecy].*

A privileged field of observation, the **considerable advance of glaciers** during the Little Ice Age does not encourage observers to consider any climate change either. A particularly attentive observer of the upheavals that occurred in the Pyrenees and then in the Alps, Ramond de Carbonnières concludes that there is a physical cause (the accumulation of ice in high altitude areas and a gravitational phenomenon) to explain the advance of glaciers in the lower valleys: "I will not say that their increase is due to the cooling of the globe," he emphasizes, adding pessimistically: "It must be admitted, however sad this truth may be, that ice tends to cover the entire surface of the high Alps, and to isolate the more temperate valleys they contain [14]. "For contemporaries of the "Little Ice Age", the advance of glaciers bears no evidence of climatic cooling, but only confirms the hypothesis of a constant accumulation of ice in the coldest parts of the mountains since the beginning of the Earth's formation (see [Mountain glaciers, sentinels of climate change](#)). The idea is widely shared. For César Bordier, they slide "like softened beeswax". Saussure doesn't really say anything else.

However, in response to the competition launched by the Berne Economic Society, the son of a pastor from the Grindelwald Valley, Bernhard Kuhn is becoming more observant. Based on the examination of the moraines, he shows that the glaciers would have reached their maximum size by the end of the 16<sup>th</sup> century, and after a decline in the early 18th century, would have resumed their advance, thus contradicting the thesis of a gradual cooling [15].

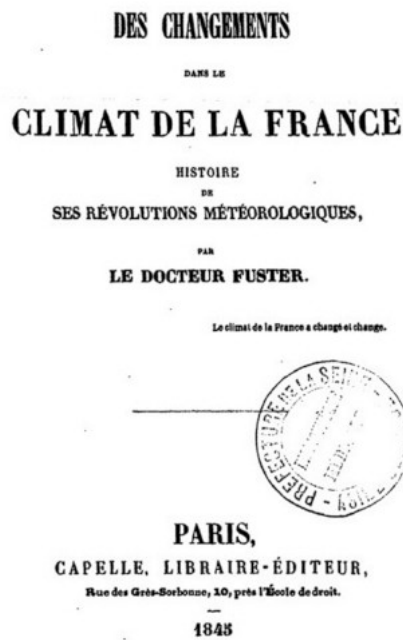


Figure 4. Changes in the climate of France, Paris, 1845.

More than any other, however, it is the **forest** that tends, at the end of the 18<sup>th</sup> century, to become the main marker of climate change. However, the conclusions that observers draw from them are not all the same. In contrast to those who see in the clearing of colonial forests the assurance of a favourable transformation of the climate, and the guarantees of a much more profitable exploitation, the engineers of the Water and Forests for their part express the fear that deforestation, especially in mountainous countries, will negatively affect the climate, with changes in wind direction and rainfall patterns, and will constitute an aggravating, if not triggering, factor in the flooding that could occur in the forelands. It is undoubtedly **the agronomist Rougier-Labergerie**, prefect of Yonne, who in the year IX (1801) best expresses this new concern: "We already believe we are observing transformations in wind direction, temperatures and precipitation. The felled forests... have changed the climate, opened a passage to the winds that destroy the flowers of trees and vines, turned rains into floods, mountains into rocks, plains into burning fields" [16]. At the same time, the prophetic engineer **François-Antoine Rauch** sounded the alarm: "As soon as man carried his sacrilegious axe, or war torch in the forests, he began by altering the heat and fecundity of the Earth, by reducing the domain of animals... by destroying plants, in which the fire of life was constantly flowing [17]." Hurricanes and storms, the growing threat of glaciers are the result of the devastation of forests.

Overall, however, there were still many questions at the beginning of the 19<sup>th</sup> century, and the idea of a global change was discussed. In 1845, after a first highly contested brief addressed to the Academy of Sciences, **Dr Fuster** in turn intended to establish the proof of man's action on climate [18]. "I'm not writing a meteorology book," he wrote in the preface. "My only goal is to shed light on an obscure strong point in the history of our climate. Has the climate in France changed and is it changing? A question so many times agitated and never resolved was well worth being captivated. "For him, the history of climate is the combined result of meteorological phenomena and human action on nature, in particular "forest clearing, crop development, land extension and water reduction", usually linked to government quality: "Weather phenomena and industrial efforts conspire in various ways to change our climate. Weather phenomena apply directly and by themselves; industrial work contributes only indirectly and through these phenomena. Moreover, the two actions unite, mix and complicate each other. Their irresistible power gradually wears out, deteriorates and destroys the old climatological elements; in the long run, it must even completely rebuild the climate. »

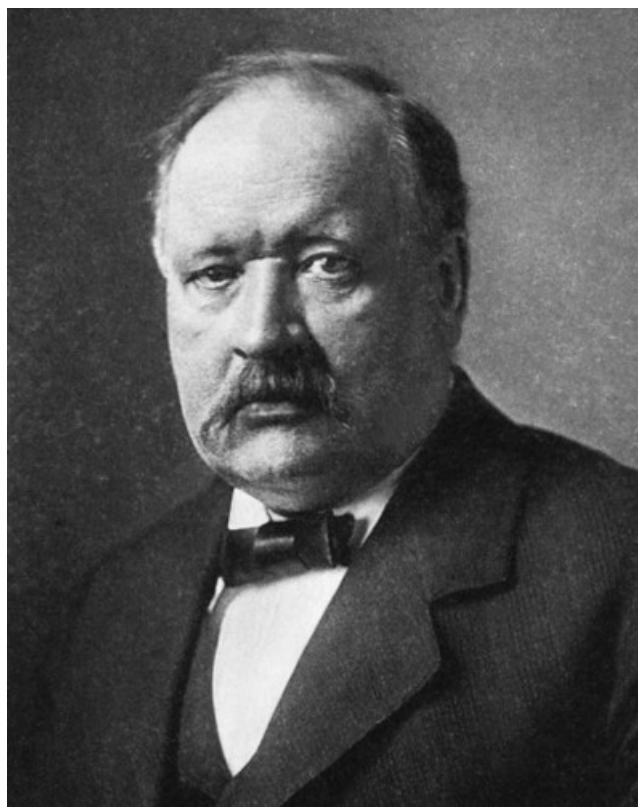
### 3. From empirical observation to scientific discourse

However, alongside empirical observations and prophetic discourses, the work of physicists gradually began to confirm the reality of climate change, and the hypothesis that it could be the consequence of human action, at the beginning of the 19<sup>th</sup> century. It is the physicist **Joseph Fourier**, former Prefect of Isère, who, in his *General Remarks on Earth and Space Temperatures* published in 1824, first placed the problem of Earth's temperatures in a cosmological context, and developed the idea that all the earth's effects of the sun's heat were modified by the interposition of the atmosphere and the presence of the



### 3.1. From climate history to global warming

Although Fourier's data did not allow him to quantify this "greenhouse effect", the work of geologists and physicists gradually confirmed the reality of the historicity of the climate in the 19th century. In the early 1830s, Charles Lyell's work on geological layers confirmed the hypotheses about the Earth's very long history. In the 1850s, Lord Kelvin developed his research on cooling based on the work of Joseph Fourier. However, he concludes that the Earth's history is 10 to 20 million years old, incompatible with the geological data developed by Lyell. It was not until the 20th century that nuclear physics made it possible to report geological observations and establish its age in billions of years. On another level, in 1873, the Irish **John Tyndall** made a decisive contribution to the issue of glacier flow.



*Figure 5. Portrait of Svante Arrhenius. (Public domain, via Wikimedia Commons)*

After having been the first to situate the greenhouse effect in the carbon cycle, it was **Svante Arrhenius who in 1903 was responsible for linking the issue of global warming to that of the use of fossil fuels**. But for him, as for Quebec doctor Gautier a century and a half earlier, the warming generated by this combustion becomes the guarantee of future safety. It gave the Earth the assurance of repelling a hypothetical new ice age and its inhabitants the promise of a bright future:

"As a result of the increase in carbonic acid in the air, we can expect periods that will provide more equal temperatures and milder climatic conditions for mankind. This will probably happen in the coldest regions of our Earth. These periods will allow the soil to produce significantly higher harvests than today, for the benefit of a population that appears to be growing faster than ever [\[19\]](#). »

At the beginning of the 20<sup>th</sup> century, Arrhenius' ideas were widely shared in the scientific sphere. In the 1930s, George Stewart Callendar of the Royal Meteorological Society of England estimated that the 10% increase in CO<sub>2</sub> observed in the atmosphere from [1890](#) to [1938](#) (in 52 years of the [industrial revolution](#) based on coal combustion) was one of the causes of the warming trend observed during the same period. In the second half of the 20<sup>th</sup> century, "the progress of digital systems and the increasingly numerous and varied observations of the state of the atmosphere and related environments..., the development of supercomputers" allowed considerable advances in the knowledge of climate and its variations, defined statistically "in terms of means and variability" over periods usually 30 years (see [The climate machine](#) & [Introduction to weather forecasting](#)).

However, the issue of climate change is hardly entering the media sphere. And never unambiguously. If the French science

magazine *Science et Vie* mentions in May 1959 the hypothesis of global warming in an article ("The Earth is getting warmer"), it is only anecdotally in comparison with the many others on the atomic threat, or water skiing. From the 1950s to the end of the 1970s, it was more the **fear of a return of the great cold** that the American or European media echoed. The concern is partly based on the mathematical theories of climate developed by the Croatian geophysicist Milutin Milankovic, who predicts the cyclical return of major glaciation periods as a function of (known) variations in the orbit and Earth's rotation (variable eccentricity of the orbit, variable obliquity of the ecliptic, and precession of the Earth's axis) (see *The Astronomical Theory of Climates*). But it mainly reflects cyclical phenomena: a buoyant international context (the "Cold War", fear of the nuclear winter [20]), a drop in temperatures (between 1940 and the end of the 1970s or the energy crisis in the 1970s. During the great winter of 1954, Abbé Pierre's call moved all of France. While the vast majority of scientific articles published between 1965 and 1979 predicted that the Earth would warm up as carbon dioxide levels increased - as it did - *Time* made several headlines (December 1973, January 1977, December 1979) on "The Big Freeze". In June 1974, the same magazine, as in France *Science et Vie*, mentioned the possibility of a new Ice Age, the French magazine even proposing to fight against this evolution... by melting the Arctic! *Newsweek* is not to be outdone in a 1975 article entitled "The cooling world": "After three quarters of a century of extremely mild conditions, the Earth's climate seems to be cooling down" [21].

### 3.2. From the IPCC to COP 21

At the same time, however, another debate was beginning to take shape in the scientific world. Researchers are beginning to **warn of the potential dangers of CO<sub>2</sub> emissions**: for example, Germany's Hermann Flohn [22] or Sweden's Bert Bolin. Others remain even more nuanced. In 1973, in the television program *Les dossiers de l'écran*, Claude Lorius, a French pioneer in polar ice, agreed to discuss the "possibility of a change of 2 to 3° centigrade due to CO<sub>2</sub>. There are many people who think it is overrated. But when he talks about the 20 billion tonnes of CO<sub>2</sub> released into the atmosphere, his opponent, Commander Cousteau, reacts: "Oh, this is bullshit... People are starting to break my ears with this CO<sub>2</sub> thing. There are much more serious risks that are slag rains" [23].



Figure 6. Cover of the "Time" of April 9, 2007, "The Global Warming survival guide".

However, the concerns of scientists were reflected in the 1972 *Meadows Report*, commissioned by the Club of Rome two years earlier, in particular the depletion of non-renewable natural resources and environmental degradation, in relation to the acceleration of industrialization and the strong growth of the world population. But in 1979, the first *World Climate Conference*, held in Geneva, received little attention in the political or media sphere.

It was not until the **early 1980s, particularly after the very hot summer of 1983, that the issue emerged in the public arena.**



In 1979, President Jimmy Carter received a report commissioned in 1979 from the American Academy of Sciences and produced under the direction of Jule Charney, Director of the Meteorological Service of MIT. The report concludes that there is a reality of human-induced climate change and rising CO<sub>2</sub>: "If carbon dioxide continues to accumulate in the atmosphere, the expert group sees no reason to doubt that climate changes will result, nor any reason to believe that they will be negligible... Waiting to see before acting means waiting until it is too late" [24]. Although Ronald Reagan's new American administration did not follow up on this report, in France a first international meeting on global climate change was held in 1984 at the École des Mines, at the initiative of Pierre Lafitte. Political ambitions took shape in 1988 with the creation of the **IPCC (Intergovernmental Panel on Climate Change)**, chaired by Bert Bolin, one of the authors of the Charney report, who issued his first report in 1990. At the 1992 Rio Conference, its second report led to the elaboration of Agenda 21 (2500 recommendations to be implemented in the 21<sup>st</sup> century, and two framework conventions on climate and biological diversity).

Gradually, the **media took over the issue**. In France, the magazine *Géo* published in October 1984 "La Terre se réchauffe", but the main article still has a question mark: "Does the planet of men burn? "Ultimately," concludes the author of the article, "there is no evidence that the planet's climate today is due to these natural fluctuations, which may only be the distant aftermath of the last deglaciation, oscillations around a new equilibrium point. If we have any difficulty in perceiving it in this way, it is simply because, in view of geological time, human life is decidedly too short. In 1988, *Newsweek* was more positive: "Greenhouse effect. Danger. No more hot summers in sight. "The Global Warming. Survival Guide: 51 Things you can do make a Difference" title for its part *Time* in April 2009.



Figure 7. Laurent Fabius, President of COP 21, 7 December 2015.[ Source Photo COP PARIS, via Flickr, public domain].

From then on, the climate became a political issue. In 1997, the **Kyoto Protocol** committed states to reduce the production of greenhouse gases. While many States, including some important ones, refuse to sign the protocol, twenty years later, **COP 21** in December 2015 is the occasion for a first universal agreement, unanimously approved by 196 delegations, which reflects a growing consensus in the scientific world on the anthropogenic origins of current global warming.

In 2007, the IPCC's 4<sup>th</sup> report states that the probability that global warming is due to human activities is more than 90%. In its 5<sup>th</sup> report, it insists, alongside CO<sub>2</sub>, on the role of methane (produced by ruminants, rice paddies, natural gas leaks and thawing permafrost). For the same amount, methane produces a more powerful warming than CO<sub>2</sub>, but methane emissions are much lower, and therefore CO<sub>2</sub> emissions induced by human activities have a much greater influence on global warming.

The political success of the COP 21 agreement, however, does not mean unanimous support for the objectives. While China has deliberately engaged in the implementation of the agreement, US President Donald Trump, elected at the end of 2016, ignores ecological and economic arguments. In June 2017, he announced his intention to withdraw from the Paris Agreement. In addition to strategic and political issues, these oppositions are driven by the development of so-called "**climatosceptic**" **discourses**, and cover two realities. The first is the very questioning of global warming by certain commercial interests ("Climate change is a Chinese invention to harm the American economy"), certain churches (American Evangelists) or certain scientists, particularly in France, with Claude Allègre [25] and Vincent Courtillot. It is a global cooling that awaits us, and not a warming, also continues to say some Russian scientists [26]. But this discourse is having less and less resonance among the world's citizens. The second reality is the ability of societies to accept the role of man in this evolution and, against the selfish defence of economic interests or individual comforts, the changes in behaviour essential to face the climate challenge.

As a result, collective action remains very uneven across countries. While China seems to be persevering with the commitment

made in Paris in December 2015, US President Donald Trump has chosen to withdraw from the climate agreement. The new Brazilian President Jair Bolsonaro announced in the fall of 2018 that he wanted to do the same. Even in countries where people are most sensitive to the climate threat, governments often struggle to get the necessary measures and the efforts they impose accepted. "The house is burning and we are looking elsewhere," President Jacques Chirac told the Earth Summit in Johannesburg on 2 September 2002. His call is still relevant.

## 4. Messages to remember

Until the 18<sup>th</sup> century, the idea that climate could change permanently over time remained outside the representation of individuals. Only the "bad weather", violent disturbances, challenged men who gave them anthropocentric interpretations of a religious nature

With the birth of meteorology, scientists sought to understand the "rules" of climate, just as Newton had found those of attraction

From the mid-18<sup>th</sup> century onwards, observations suggested that human action could influence the climate. For some, particularly in the colonial world, deforestation favoured global warming and was favourable to agricultural development; others, on the contrary, denounced the destructive nature of this human intervention from the beginning of the 19<sup>th</sup> century onwards.

In the 19<sup>th</sup> century, physicists began to link climate change to human action in more certain ways, particularly the increase in CO<sub>2</sub> resulting from fossil fuel combustion and industrial development. Nobel Prize winner in 1902, Svante Arrhenius sees this warming as the promise of a bright future.

While in the first two thirds of the 20<sup>th</sup> century, the development of scientific observations led to considerable advances in knowledge of the climate and its statistically defined variations, the fear of a return of extreme cold remains largely present in the collective imagination

From the 1970s, researchers (including Bert Bollin) began to warn of the potential dangers of CO<sub>2</sub> emissions. The creation of the IPCC in 1988, of which Bert Bollin became the first president, embodies the international recognition of this threat. In 2015, at COP 21, a first universal agreement was unanimously approved by 196 delegations, reflecting a growing consensus on the anthropogenic origins of current warming.

However, this awareness has come up against economic, religious or political interests, as evidenced by the difficulties faced by States in implementing the COP 21 mechanisms and, even more so, the election of President Donald Trump in the USA.

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## Notes and references

**Cover image.** Colbert presents to Louis XIV the members of the Royal Academy of Sciences created in 1667, oil on canvas by Henri Testelin (1616 - 1695), Château de Versailles (Public domain).

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