



## Arguments from Global Warming Sceptics

**Scepticism is the foundation of scientific work, because scientific findings must be verifiable. However, the scepticism of climate sceptics is problematic, because climate sceptics accept scientific evidence only selectively.**

The voices of climate sceptics cannot be overheard. They deny the human influence on the climate or consider it as unproblematic. In November 2009, climate scepticism received a boost: A hacker attack on the climate research institute of an English University, the so-called Climate gate, caused a flash in the pan. Hundreds of documents and e-mails were made public. Simultaneously, prominent climate sceptics accused scientists of the University concerned of having manipulated or concealed data. Meanwhile, a research committee of the British House of Commons has come to the conclusion that the accusation of deliberate manipulation was unfounded.

In January 2010, climate science, and in particular the IPCC, came again under fire: The IPCC report 2007 contained a false statement about the melting of the Himalayan glaciers. Thereupon, climate sceptics claimed that the IPCC report contained a large number of other errors. An agency, mandated by the Dutch Minister for the Environment, concluded that the IPCC conclusions drawn in the Synthesis Report

were not undermined by the errors found. However, the agency's report criticized that the basis or sources of conclusions were partly missing. As a response to this criticism, the IPCC decided to evaluate the review process and to refine it where necessary.

The public is increasingly aware of the results of climate research and the finding that global warming is caused by human beings has found widespread acceptance. On the other hand, arguments to the contrary receive great attention in the media. Because the more climate change is accepted as a fact the more attention is paid to contrary statements.

The arguments of climate sceptics are numerous, but often contradictory. In a more or less complex form, the basic facts of climate change are questioned. The arguments have either already been disproved or are, upon closer inspection, scientifically untenable. Still, they are brought up again and again. In the meantime, extensive explanations on the different arguments are available on websites. A look at the collection of arguments shows that almost all of them follow one of the patterns mentioned below. In accordance with these patterns, links on statements by climate science on the website [www.skepticalscience.com](http://www.skepticalscience.com) are given on the last page of this publication. This website offers a good overview on the scientific background.

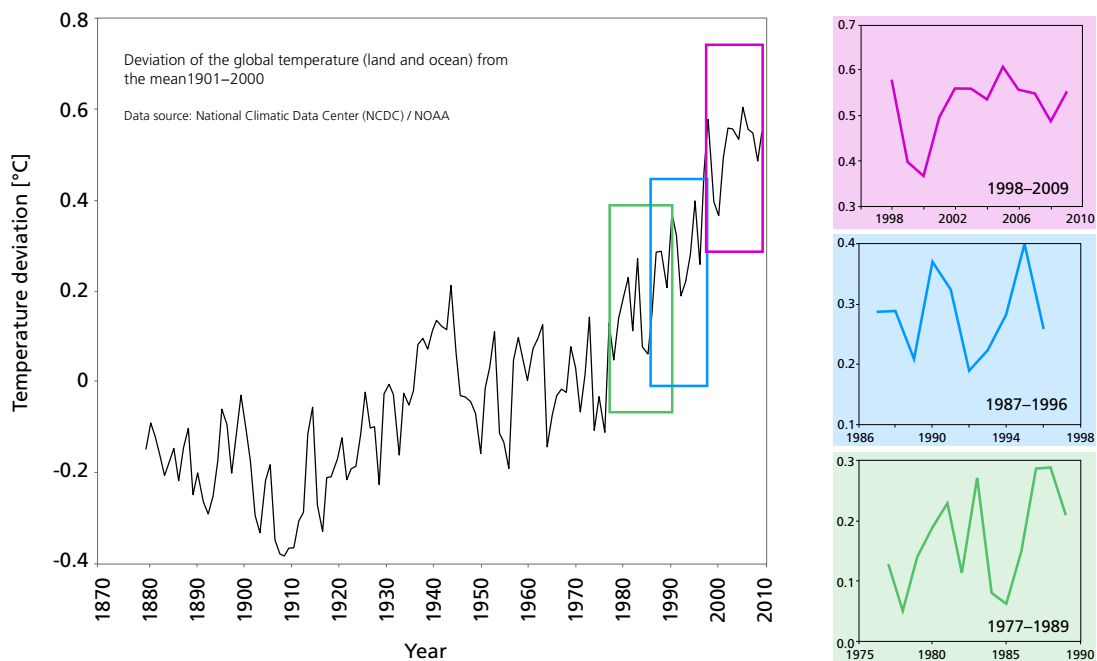


Figure 1: «Cherry picking»

In any time series, there are sections during which the temperature appears to remain constant. The true course of temperature can only be identified if the time series is sufficiently long.

(Graph: according to Easterling and Wehner, 2009)

### Pattern 1: Climate science is imprecise and uncertain.

It is true that climate scientists do not have precise answers to many questions. Uncertainty is expressed by bandwidths and probabilities. However, the fact that there are uncertainties should not lead to the conclusion that climate scientists do not know anything or that their statements are wrong.

In fields other than climate science, decisions are often based on well-founded assumptions or on predictions: Thus, the national banks control the prime rate based on economic forecasts, and insurances determine insurance rates depending on risk analyses. In comparison to economic forecasts and risk analyses, the predictions of the future climate are more reliable. The statements of researchers largely coincide with regard to direction of the trend (increase or decrease) and with regard to the order of magnitude.

Climate predictions are clearly different from weather forecasts, which is uncertain even in the prediction of the weather for a couple of days. In contrast to the weather, the climate describes the average atmospheric condition over a long period of time (for instance, years, decades, centuries). This removes the chaotic element of the weather. The reason why climate predictions are not entirely exact is that not all parts of the climate system are entirely understood. Feedback mecha-

nisms in the climate system increase these uncertainties. Furthermore, we still do not know how much greenhouse gas we will emit in the coming decades. Scientists take these uncertainties into consideration by repeating the calculations, using different models and slightly changing the initial conditions. The different results allow to predict the most probable development and to estimate possible deviations.

### Pattern 2: Misinformation or cherry picking

With regard to climate scepticism, cherry picking means to focus on a detail and to neglect the context. Cherry picking is misleading – be it on purpose or not. Climate indicators, for instance temperature, amount of snow and sea level, are meaningful only if they are looked at over a sufficiently long period of time. A cold January in Switzerland is neither an indication nor a proof against climate change. Sinking sea levels at a certain coast or the growth of a particular glacier are no more a proof. Because climate change does not rule out cold winters and large amounts of snow, neither does it rule out wet and cool summers. In fact, large amounts of snow are to be expected in certain regions, namely as a consequence of climate change. In very cold regions, the air, heated up due to climate change, will contain more humidity in the future. This will mean larger amounts of snow as long as the tem-

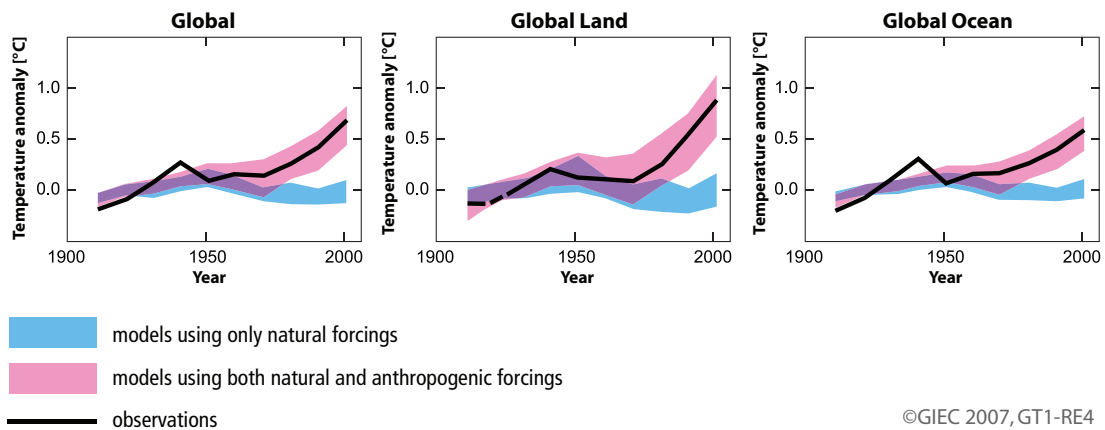


Figure 2: «It's not our fault...»

Comparison of the observed changes of the earth's surface temperature with the results simulated by climate models. Blue shaded bands show the results of the models using only natural forcings due to solar activity and volcanoes. Red shaded bands show the results of the models using both natural forcings and anthropogenic greenhouse gas emissions. (Source: IPCC 2007, WG1-AR4)

temperatures remain below the freezing point. Sea level also changes differently in different regions. The sea level surface is not even, but forms valleys and hills as a result of ocean currents. If ocean circulation changes, sea level will rise above average in certain regions and below average in others. In the case of geological uplifting, sea level may even sink regionally. However, on a global scale the trend is clear: Glaciers and ice shields are melting due to the temperature increase. The increasing amount of sea water and the extension of the water volume as a result of global warming lead to rising sea levels around the world.

### Pattern 3: It's not our fault...

The arguments that follow the third pattern give causes for climate change. The temperature change is said not to be caused by humans, but for instance by water vapour, the sun or cosmic rays. Variations of this pattern question the relationship between  $\text{CO}_2$  and temperature or they claim the temperature increase to be the cause of, and not the result of the  $\text{CO}_2$ -increase.

These arguments are more difficult to disprove. They are scientifically more complex and contain partly correct findings. Thus, for instance, it is a fact that the  $\text{CO}_2$ -concentration has changed in the past for natural causes. Since temperature and  $\text{CO}_2$  interact, temperature does not necessarily follow  $\text{CO}_2$ . It is also possible for the  $\text{CO}_2$  to follow a temperature increase, such as happened at the end of the ice ages. Furthermore, water vapour actually is the most important greenhouse gas and natural factors like the sun or volcanism do affect the climate.

How is it possible to conclude that climate change is human-induced in spite of these facts? The reason is that all natural causes (including water vapour) do not suffice to explain the current warming. Natural causes have either not changed at all or not changed sufficiently to serve as an explanation. On the other hand, since the beginning of industrialization, humans have considerably changed the concentration of the greenhouse gas  $\text{CO}_2$  in the atmosphere. For 800'000 years, the  $\text{CO}_2$ -concentration in the atmosphere has been fluctuating between 180 ppm during ice ages and 280 ppm during warm periods. Since the beginning of industrialization, it has increased from 280 ppm to about 390 ppm, primarily based on the use of fossil fuels. Only if this increase of  $\text{CO}_2$  (as well as of other anthropogenic greenhouse gases, e.g. methane, laughing gas) is taken into consideration, the global temperature increase in the course of the last decades can be explained.

### Pattern 4: Climate change is positive!

Arguments that follow this pattern acknowledge climate change as a fact. The effects of the warming are considered as primarily positive. Among the positive effects is, for instance, the agricultural use of land previously unfit for cultivation. Plants and forest will grow more quickly due to the increased  $\text{CO}_2$ -concentration. With regard to shipping, there will be new opportunities because the arctic sea ice is receding.

The positive effects of climate change largely depend on the degree of warming. Thus, Swiss agriculture will profit from a slight increase of

### **Scepticism is the basic attitude of science**

The results of climate research can easily be denied in case of contrary interests. First, the causes, processes and effects are very complex. Second, the human-induced greenhouse effect cannot be observed directly. Third, the effects are also only partly visible, and the changes take place very slowly.

The term climate sceptic refers to people who deny global warming or doubt the human influence on climate change or at least consider it as irrelevant. Climate sceptics can be categorized into three types: Trend sceptics doubt the warming trend, attribution sceptics doubt the relationship between temperature and CO<sub>2</sub>-content of the atmosphere, and impact sceptics deny that global warming has negative consequences. The reasons for scepticism may be economic interests, the fear of costs or constraints, the refusal of governmental interference or unease about (inevitable or necessary) changes.

Climate sceptics criticise that climate science is not sufficiently transparent, that it avoids critical questions and that it defends its "hypotheses" dogmatically due to political and financial interests. What are the arguments of climate science, and in particular of the IPCC, to face these accusations?

#### *Transparency*

The transparent communication of the facts of climate science is a challenge simply due to their complexity. It is difficult to present the correlations comprehensively and understandably at the same time. In addition, the uncertainties with regard to the future development of the climate make a clear representation of the facts even more difficult. These uncertainties are not only due to knowledge gaps, but also due to uncertainties regarding the development of society. Human action determines the amount of emissions and therefore influences the expected changes in the climate system.

The IPCC is obliged to transparency. What regards uncertainties, knowledge gaps and existing discrepancies, this principle is certainly being observed. Already today, the data on which IPCC-reports are based are largely disclosed (e.g. the results of climate models). Based on the most recent criticism of the IPCC, which was particularly fuelled by climate sceptics, the demand for a comprehensive disclosure in climate research should be considered.

#### *Doubts and questions*

Doubt is the basic attitude in science and it is the motivation for research. Science proposes a hypothesis based on a problem. This hypothesis is then tested by means of experiments and models. The expression "sceptic" is misleading because climate sceptics not only ask questions, but adhere to a statement even after it has been scientifically refuted.

Uncertainties and discrepancies in the climate debate were one of the reasons for the foundation of the IPCC, an international, broad-based, scientific committee. The IPCC compiles and evaluates the scientific information about climate change. The mission of the IPCC is to communicate existing uncertainties and controversial views within the science community.

#### *Political and financial interests*

For the reasons mentioned (cf. Pattern 7: Politically motivated alarmism) it is difficult to rule out political and financial interests altogether. Without doubt there are persons in climate research who try to use climate change for their political and/or economic benefit. However, it is questionable whether or not this justifies a sweeping blow against all climate scientists, while the existence of such an attitude among sceptics is ruled out. Anyhow, the economic interest to play down climate change is much greater than to exaggerate it. Emission cuts would cause much larger losses for CO<sub>2</sub>-intensive economic sectors than any possible profit drawn from climate protection measures.

the mean temperature due to the prolongation of the vegetation period. However, depending on the extent of the global warming, the negative effects may outweigh the positive ones. In addition, extreme events, such as heat waves, drought and heavy precipitation have a negative effect on harvests. These extreme events will increase with global warming.

In the discussion about negative and positive effects of climate change, there are two other important aspects: First, the regions of the world are affected differently by the effects of climate change. Particularly poor countries of the southern hemisphere will suffer from the negative effects. Scarce food and water resources will lead to political and social problems. The consequenc-

**The claims about climate change are to be questioned critically**

With regard to many arguments, the layperson is able to find out him-/herself whether or not a statement is based on science.

*Time series*, that is, measurements of temperatures, precipitation, extreme weather events etc.  
Is the time series sufficiently long and does it last until today?

*Measuring station / measuring site*

Do data represent just one measuring station or a few selected stations? Is the selection of station representative?

*Relevance*

How relevant are the processes described in comparison to the greenhouse effect?

*Speculation or calculation?*

Are the results precisely calculated, or are they rough estimates or even speculation?

*Quotes*

Are the statements of scientists or the content of scientific articles comprehensively and correctly represented? Is the source reliable and politically/economically neutral?

*Professional competence*

Do experts comment on questions in fields in which they have professional expertise?

*Objectivity*

Are the statements polemic or objective?

es, such as migration, war and hunger will also affect other regions that are not directly affected by climate change.

Second, temperature rise lags behind CO<sub>2</sub>-increase. The temperature will continue to rise for some time even if we succeed in stabilizing CO<sub>2</sub>-concentration. However, we are far from that. The longer we delay effective measures, the more severe the consequences will be. If today, the consequences in certain regions appear to be positive or negligible, this could change with a sharp rise in temperature. Therefore, all regions are at risk of negative consequences, be it as a result of a sharp rise in temperature, be it due to the changes in the frequency of extreme events.

**Pattern 5: It's nothing new.**

The climate also changes for natural reasons and therefore has also changed in the past. Glaciers have receded and advanced in former times. The CO<sub>2</sub>-concentration has always fluctuated and sea level has risen and sunk. This is undisputed. However, between the described changes and today's climate change, there are two important differences:

The most important factor for today's climate change is humankind or rather anthropogenic greenhouse gas emissions. Natural factors, which have caused climatic changes in the past, still

play an important role. However, their influence is small in comparison to the human influence. Furthermore, even a naturally caused change may be harmful. For instance, three million years ago, it was significantly warmer than today, which meant that the sea level was 20 m higher. It does not seem advisable to provoke such a change.

There is another difference between past and present climate change: Nowadays, the climate changes very rapidly. This is, in fact, the real difficulty. Humans, animals and the environment may adapt to changes, but they need time to do so. The faster a change takes place, the greater the challenge to adapt to it. Global warming of the expected extent would most probably be unique in climate history so far.

**Pattern 6: Climate protection does not make sense.**

Climate protection is argued against by saying it is too expensive, ineffective and needless. Ethical and economic considerations determine how climate change should be encountered. Do we feel responsible towards countries that will suffer from more severe consequences than us? Do we want to leave the problem and therefore the costs to future generations? How much will it cost to slow down climate change and to stop it in the long term? How much will it cost to bear the



effects of climate change in comparison? To what extent can these costs be reduced by early action?

Ethicists and economists may give some indication of how these questions are to be answered. However, there is no “right” or “wrong” to taking or financing this or that measure. Scientific insights will not provide us with conclusions whether we are ready to change our behaviour or whether we, as a rich nation, should support other countries with a more limited potential to adapt to climate change. These questions will be answered at the level of the individual, of society and of the world community.

### Pattern 7: Politically motivated alarmism

For those who doubt the reality of climate change, the “Climategate” was the ultimate proof for the political motivation of climate scientists and in particular of the IPCC. Climate scientists were accused of having manipulated data and of having excluded dissenting scientists. A research committee concluded that these accusations were untenable. Nevertheless, the IPCC mandated an independent committee to examine the internal processes. In principle, the committee confirmed the credibility of the IPCC. At the same time, the committee emphasized that the IPCC should adapt to the changed conditions since its foundation and made suggestions of how the management, the review process, the communication of uncertainties as well as transparency could be improved.

### Contact point:

*ProClim – Forum for Climate and Global Change*  
Schwarztorstrasse 9  
3007 Bern  
Phone: 031 328 23 23, e-mail: [proclim@scnat.ch](mailto:proclim@scnat.ch)

The accusation that climate research is politically or economically motivated cannot generally be ruled out. First of all, scientists are not without weaknesses and therefore, misconduct cannot be excluded for a particular case. Secondly, it is difficult to prove political or economical motives, and it is just as difficult to disprove them. However, there are reasons that speak against the accusation that climate scientists exaggerate the risks of climate change, be it for political motives or in order to get research funds.

In principle, scientists are not an organized community, but work individually or in small groups. It is therefore unlikely that a majority of them would manipulate their findings for non-scientific reasons in the same way. Furthermore, research funds are not given based on findings but based on the scientific quality of research. A researcher would jeopardise his reputation as well as future funding of his work, if his results and argumentation turned out to be wrong later on.

Also with regard to the IPCC there are strong arguments that speak against a political motivation. It is true that the IPCC reports are addressed to political decision-makers, among others. However, the reports are compiled by scientists

Concentration of CO<sub>2</sub> of the last 800'000 and the next 100 years

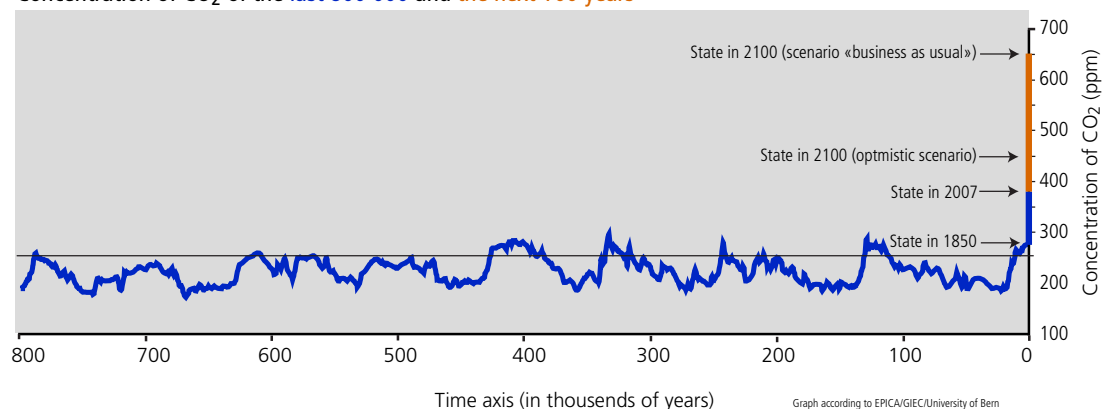


Figure 3: «It's nothing new.»

Atmospheric CO<sub>2</sub>-concentration has always been fluctuating. For at least 800'000 years, it has varied between 180 and 300 ppmv (ppmv = parts per million by volume). In the 19th century, CO<sub>2</sub>-concentration moved beyond this range for the first time. Whereas fluctuations used to be caused by natural factors, the change since 1850 has been caused by human emissions. The burning of fossil fuels has provoked a massive increase in CO<sub>2</sub>-concentration. Today, the CO<sub>2</sub>-concentration is in the range of 390 ppmv. The temperature follows the CO<sub>2</sub>-increase with a time lag.

and no political authority controls their work. Further on, the IPCC does not conduct research, but reflects the status of knowledge. The reports are based on the research results of a large number of scientists. Finally, the IPCC reports go through a double review process. A large number of scientists are involved in that process. In case of contradictory scientific results, the IPCC attaches great importance to revealing controversial findings.

## Answers to sceptics' arguments: web links

### **Pattern 1: Climate science is imprecise and uncertain**

*Models are unreliable*

[www.skepticalscience.com/climate-models.htm](http://www.skepticalscience.com/climate-models.htm)

*Climate is chaotic and cannot be predicted*

[www.skepticalscience.com/chaos-theory-global-warming-can-climate-be-predicted.htm](http://www.skepticalscience.com/chaos-theory-global-warming-can-climate-be-predicted.htm)

*Scientists can't even predict weather*

[www.skepticalscience.com/weather-forecasts-vs-climate-models-predictions.htm](http://www.skepticalscience.com/weather-forecasts-vs-climate-models-predictions.htm)

### **Pattern 2: Misinformation or cherry picking**

*Antarctica is gaining ice*

<http://www.skepticalscience.com/antarctica-gaining-ice.htm>

*Oceans are cooling*

[www.skepticalscience.com/cooling-oceans.htm](http://www.skepticalscience.com/cooling-oceans.htm)

*It's freaking cold!*

[www.skepticalscience.com/global-warming-cold-weather.htm](http://www.skepticalscience.com/global-warming-cold-weather.htm)

### **Pattern 3: It's not our fault...**

*It's the sun*

<http://www.skepticalscience.com/solar-activity-sunspots-global-warming.htm>

*It's cosmic rays*

<http://www.skepticalscience.com/cosmic-rays-and-global-warming.htm>

*Water vapor is the most powerful greenhouse gas*

[www.skepticalscience.com/water-vapor-greenhouse-gas.htm](http://www.skepticalscience.com/water-vapor-greenhouse-gas.htm)

*CO2 effect is weak*

[www.skepticalscience.com/empirical-evidence-for-co2-enhanced-greenhouse-effect.htm](http://www.skepticalscience.com/empirical-evidence-for-co2-enhanced-greenhouse-effect.htm)

*CO2 lags temperature*

[www.skepticalscience.com/co2-lags-temperature.htm](http://www.skepticalscience.com/co2-lags-temperature.htm)

### **Pattern 4: Climate change is positive!**

*It's not bad*

<http://www.skepticalscience.com/global-warming-positives-negatives.htm>

*Animals and plants can adapt*

[www.skepticalscience.com/Can-animals-and-plants-adapt-to-global-warming.htm](http://www.skepticalscience.com/Can-animals-and-plants-adapt-to-global-warming.htm)

### **Pattern 5: It's nothing new**

*Climate's changed before*

<http://www.skepticalscience.com/climate-change-little-ice-age-medieval-warm-period.htm>

*It's a 1500 year cycle*

<http://www.skepticalscience.com/1500-year-natural-cycle.htm>

*Arctic icemelt is a natural cycle*

[www.skepticalscience.com/Arctic-sea-ice-melt-natural-or-man-made.htm](http://www.skepticalscience.com/Arctic-sea-ice-melt-natural-or-man-made.htm)

*Medieval Warm Period was warmer*

[www.skepticalscience.com/medieval-warm-period.htm](http://www.skepticalscience.com/medieval-warm-period.htm)