

# Controversial Science? Investigating Climate Change Online

## Introduction

Teachers often play devil's advocate. In this exercise the teacher takes the role of advocate for the idea that there is nothing significant in global climate change that should be attributed to human activity. A powerpoint with speaker notes is available for use when presenting this case. Activities consist of exercises on how to determine fact from opinion in general, and then an exercise on researching and countering the arguments made in the initial presentation.

## Resources

Exploring climate change is a subject ideally suited to the use of the internet as there is a very large resource base and although the activity can be done quite adequately without it, the practice of research skills will be constrained and the sense of the scope and controversial nature of the issue will be limited.

## Method

### Teacher presentation

The teacher makes a quite serious and straightforward presentation around the powerpoint presentation. To fulfil its purpose it should not be presented as 'one view among many' or a 'minority view'. It is presented as an authoritative science briefing. The teacher provides a summary of the main points and then asks if anyone has any questions? If there is no response or perhaps a request for clarification question, then use an OHT of some absurd situation – e.g the 'World War 2 Bomber found on Moon' Sunday Sport front page or a photograph of pigs flying, without comment. Then wait a little while repeating the initial question with supplementary questions along the lines of 'Do you always believe what you read?' Can information be trusted? This leads to an examination of the general case.

**10 minutes**

Split the class into largish groups of 4 or 5.

### The task:

As investigative journalists you have 10-15 minutes to discuss general ways of checking if statements, reported facts and relationships are likely to be true or false, and whether something can be relied upon or trusted.

After a period of reflection and comment by groups a summary sheet can be provided but ideally the summary list should be developed by taking what groups provide in feedback and shaping and adding to it through asking further questions – to the group feeding back and then more generally. A completed summary is provided for guidance [Resource 1]

**15 minutes**

## References

### Textbook

chapter 12

### Specification

10.4 Fuels and the Global Environment

Changes in the level of CO<sub>2</sub>

Evidence of changes in average global temperature

12.1 a-c

12.3a

## Resources

### Web addresses

<http://www.greenpeaceusa.org/climate/>

<http://www.ipcc.ch/>

[http://www.ucsusa.org/global\\_environment/global\\_warming/](http://www.ucsusa.org/global_environment/global_warming/)

[page.cfm?pageID=793](http://www.greenpeace.org/global_environment/global_warming/page.cfm?pageID=793)

<http://climatechange.unep.net/>

<http://archive.greenpeace.org/~climate/index.html> [see

Debate with Industry]

[http://www.agu.org/sci\\_soc/attitude\\_study.html#GlobalWarming](http://www.agu.org/sci_soc/attitude_study.html#GlobalWarming)

For ease of research most of the items selected for the OHP series were taken from the Waiting for Greenhouse site at <http://www.vision.net.au>

Other contrarian sites include

<http://www.osu.edu/researchnews/archive/nowarm.htm>

<http://www.globalclimate.org/>

<http://www.co2andclimate.org/>

<http://www.co2science.org/temperatures/msu.htm>

These web addresses will be periodically checked and updated in the resources section of the web site on a page dedicated to the handbook.

*Hints*

There is an exercise on web site evaluation - some students may find this activity easier if they have done the exercise first. Both are excellent preparation for coursework.

*Hints*

Students may need reminding that they are searching specifically for evidence to refute or support the information in the teachers presentation. Make sure they also make notes on the questions in Resource 2 as they are reading.

**An Investigation**

Returning to the group work a second task is provided.

Choose one of the following.

As journalists you are now investigating your teacher's ideas on climate change. You think there might be problems. You are provided with:

- just an internet connection\*
- these three articles\* (Resource 2) or
- checklist of five web addresses (see resources)

You have 30 minutes to decide as a team

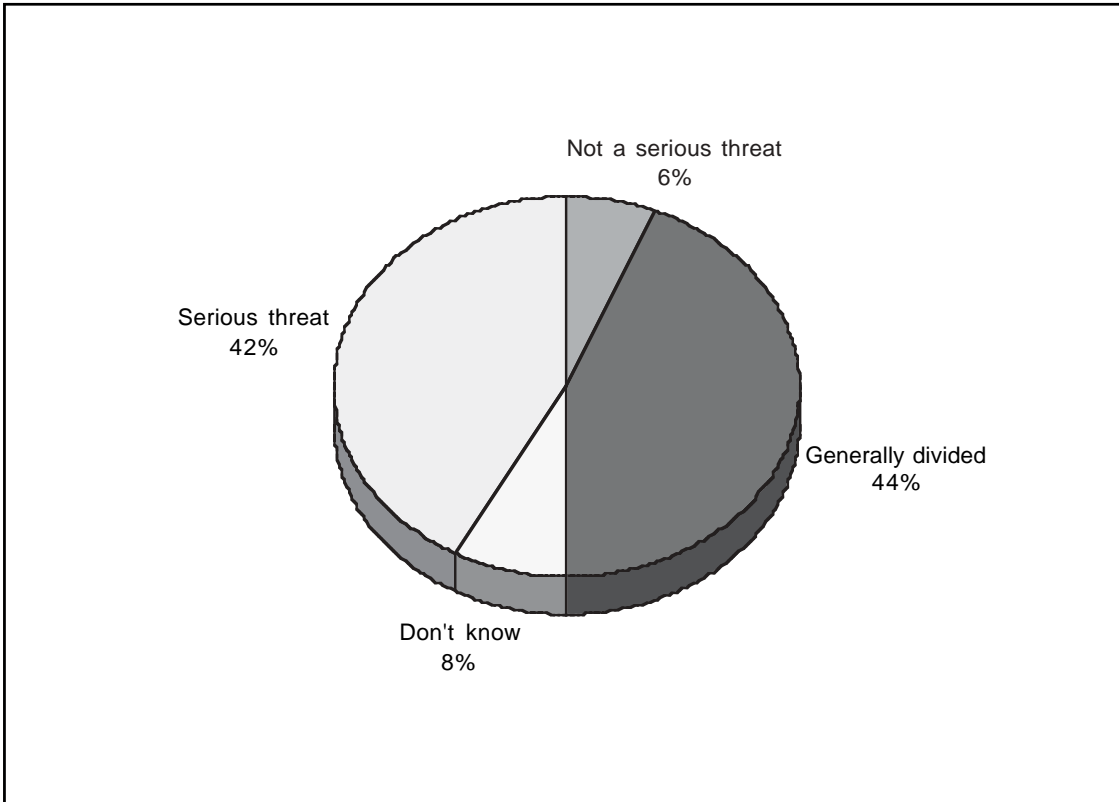
- who is going to research the initial presentation, identifying key statements which might be questioned
- who will research alternative or counter arguments and how
- who will bring these ideas together for a SHORT presentation by one or more members of the group. (\*delete as necessary)

A debrief of the presentation could focus on how well the students are handling evidence and why they chose the counter arguments they did. It may help to ask supplementary questions about the source of their information; why they think this is more reliable than the original; perhaps ask naive questions such as 'well does this prove that climate change has a human element?' Encourage the response that 'proof' is a difficult and elusive idea whereas in real life science (usually) works with evidence and this may never satisfy the demands of proof since there is no opportunity to control all the variables (or even some!)

**Commentary**

A problem with global warming in particular is that an adequate evaluation of the evidence requires a depth of understanding which may be well beyond that which is appropriate for an SPU course. The students will not be able to make up their own mind based on the evidence but will do so on other criteria. The issue of public understanding of this issue was the subject of a detailed study at: [http://www.agu.org/sci\\_soc/attitude\\_study.html#GlobalWarming](http://www.agu.org/sci_soc/attitude_study.html#GlobalWarming) It seems that the public believe scientists are divided on the role of human actions in climate change [see diagram on next page] when it is not the case, with the overwhelming majority supporting the IPCC position. This is itself a mark of the effectiveness of vocal minorities - they don't have to win an argument, just sow enough doubt to create a stalemate in public opinion.

We'd like your impression of what scientists believe about global warming. From what you've heard or read, do scientists mostly believe that global warming is a serious threat, mostly believe that it is not a serious threat, or are scientists generally divided on this issue?



Source: Gallup Organisation/CNN/USA Today 11/97

NOTE: This diagram is included at the end of the powerpoint presentation.

This document has been downloaded from the Science for Public Understanding website [www.scpub.org](http://www.scpub.org)

## Resource 1

.....  
• A lie gets halfway around the world before  
• the truth has a chance to get its pants on.  
.....  
*Winston Churchill*

Truth, mused Tolstoy, is like gold, in that it is obtained by washing away from it all that is not gold.

*Some key questions for investigators*

**Does it make sense?** Is the argument rational and comprehensive?

**Is there objective evidence on offer?** What has been measured? Or is it supposition? What are the sources and references? Are they genuine?

**Can we see the data?** If there are graphs - where is the data? If there is data how was it collected? Is it up to date anyway?

**Is the evidence complete?** Even scientists have been accused of only selecting results they approve of, or which match their beliefs

**Who is saying it?** Are they qualified or experienced? Do they belong to a 'recognised' institution? Have they been published in peer reviewed journals? Who else agrees or disagrees?

**Who paid for it?** If it is research, is there financial support from people with a vested interest e.g. green groups, a coal business, government?

**Is there personal vested interest/belief?** Individualists are often suspicious of all government schemes. Some cults look for evidence to support their beliefs

**Is it meaningful?** Is an argument being built on a cause or a *correlation*? Sunspots were fewer in the Mini Ice Age but does this mean there is a causal link?

**What are the other arguments on offer?** What has been the criticism or support?

## Resource 2 Three Short articles/items

### A

#### Climate Sceptics

The Climate Sceptics are a handful of scientists, many directly subsidised by the fossil fuel lobby and promoting what numerous mainstream scientists regard as blatant misinformation on climate science, thereby contesting the urgent need to tackle the problem of global warming.

Most of the sceptics have neither the credibility nor the science to mount a plausible challenge to the consensus of 2,500 scientists - including eight Nobel Laureates - who comprise the UN Intergovernmental Panel on Climate Change (IPCC). Whilst some of the sceptics are credible scientists they have chosen to align themselves with one side of the debate over global warming and have promoted viewpoints which have been found to lack credibility. However, many of the sceptics have been able to access industry funding in order to promote their on-going work aimed at undermining the UN Climate Summit in Kyoto.

During 1997, most of the world's major oil, coal and automobile multinationals have gathered forces behind a host of industry front groups and mounted a multi million dollar campaign world-wide to derail agreement on global climate protection. One single US advertising and internet initiative alone reportedly cost US \$13 million. A few weeks before the Kyoto summit, several members of this small group of sceptics were known to be on a world tour. This was part of an increasingly intensive campaign, re-inforced by the fossil-fuel and automobile industries backed campaign in order to prevent any mandatory CO<sub>2</sub> or other greenhouse gas emissions being agreed at that meeting.

The so-called science on which most of the sceptics base their arguments is in the main a combination of deliberate misrepresentation of IPCC reports, contextual inaccuracy and unsubstantiated conclusions.

Source: Greenpeace UK, [www.greenpeace.org.uk](http://www.greenpeace.org.uk)

## B

## Fact and Fiction?

*We've just had the coldest day in June — so much for global warming!*

**Fiction:** Just look at X: it's the coldest day/month/year on record ... or: Region X has cooled by  $Y^{\circ}\text{F}$  over the past two years! There is no global warming!

**Fact:** Statements like the one above are deliberate attempts by climate contrarians to confuse and mislead the public. It's an attempt to disprove the reality of global warming with a cold weather anomaly. This is not only scientific bogus, comparing apples and oranges, but outright dishonesty.

**Weather** is the state of the atmosphere at a given time and place, defined by variables such as temperature, moisture, wind, and barometric pressure. It is **highly variable** from day to day. By contrast, **climate** describes long-term weather patterns, with **average** temperatures and precipitation totals as well as typical occurrences of climatic extremes (such as normal dry periods or tropical storms) being used to characterize the climate for a particular region. This distinction is very important. Averages are always made up of numbers differing from the mean. Global warming is about the average going up. Over time this will make extreme colds become less likely.

*Oh, what's a few degrees?*

**Fiction:** A few degrees temperature increase won't matter much, and besides, warmer is better — fewer cold-related deaths, longer growing seasons, lower heating bills. How many people actually notice the difference between  $86$  and  $88.5^{\circ}\text{F}$ ?

**Fact:** Considering that in some regions people experience large daily temperature ranges ( $20$ - $30^{\circ}\text{F}$ ), climate sceptics try to convince the public that global warming by a few degrees is nothing to worry about. This is another version of deliberately confusing weather and climate (see above). A small increase in the **average** temperature, however, obscures extremes and **patterns of warming** that are quite troubling: night time temperatures increase more than daily averages; there are already and will be more extreme heat but less extreme cold events; poleward latitudes warm more than other areas, etc. While the benefits of warming pointed out in the sceptics argument are certainly among the potential impacts of climate change, the potential negative impacts — such as heat-related illnesses and deaths, increased heat stress for crops, greater energy needs for cooling etc. — are strategically omitted. Moreover, it bears emphasis that the difference in global average temperature between the last ice age and the present day is about  $9^{\circ}\text{F}$ ! This puts the IPCC's projected range of climate change-related global average temperature increases of  $2.5$ - $10.4^{\circ}\text{F}$  in an entirely different light.

*Human CO<sub>2</sub> emissions are small compared to natural CO<sub>2</sub> exchange.*

**Fiction:** The 4.5% of the world's greenhouse gases that humans generate is insignificant when compared to the 95.5% generated by nature.

**Fact:** It is indeed true that human emissions of CO<sub>2</sub> are a small percentage of the total carbon cycled through the different components of the Earth system: plants, soils, rocks, the oceans, and the air. But these human emissions are by no means insignificant. For the last 420,000 years, until the beginning of the industrial revolution (~1750), this cycle of carbon exchange was in a quasi-stable equilibrium, i.e., the continual release and uptake of carbon kept CO<sub>2</sub> concentration in the Earth's atmosphere fluctuating between 180 ppm (parts per million) and 280 ppm. Since 1750, the atmospheric concentration of carbon dioxide has increased by 31%, to a present level of 367 ppm. This increase in the CO<sub>2</sub> concentration of the atmosphere is mainly due to the burning of fossil fuels and large-scale deforestation and land-use change. These human activities have forced the carbon cycle out of the state of equilibrium and out of the known range of variation.

*Satellite temperature records don't show any global warming.*

**Fiction:** Satellite temperature records do not show a warming trend over the past 20 years, and ground-level data are incorrect and exaggerate the warming.

**Fact:** It is true that temperature records derived from satellites show either less warming than surface temperature data or even a cooling trend. Recent studies (most notably a study by the National Academy of Sciences published in 2000) found, however, that satellite data needed to be adjusted for some measurement and calibration problems. These adjustments bring surface and satellite records into better agreement, both showing a warming trend. It is important to note that many surface temperature records date back to 1860, while satellite records only date back to 1979. With such a short data record, observed trends can be strongly affected by extreme conditions — such as the 1991 eruption of Mt. Pinatubo which decreased atmospheric temperatures for several years. In addition, satellite and surface data differ in what they record: surface thermometers measure the air temperature at the Earth's surface, while satellite data take temperatures of different slices of the atmosphere. Including records for the upper atmosphere — where the depletion of the ozone layer has had a cooling effect — will lower the overall temperature trends observed from satellites.

*The observed warming is all due to solar variation, not human activities.*

**Fiction:** An increase in solar irradiance is the main cause of the Earth's current warming trend. Therefore, reducing fossil fuel emissions would not impact the Earth's temperature.

**Fact:** Current scientific understanding leaves little doubt that the sun's radiant output impacts the Earth's climate on both decadal and centennial time scales. However, it is only one of many components affecting terrestrial climate. According to the findings of the Intergovernmental Panel on Climate Change, the warming effect due to increases of greenhouse gases in the atmosphere is estimated to be more than 8 times greater than the effect of solar irradiance. This page is from the Union of Concerned Scientists website <http://www.ucsusa.org>

## C

Scientists believe they have identified a mechanism which can explain the thinning of the Arctic sea ice.

They say the thinning, which in summer reaches more than 40% in some areas, has two causes.

Rising air temperatures, possibly the consequence of global warming, are melting the ice from above. And warmer water is also rising from the depths to attack the ice from below.

Professor Peter Wadhams, of the Scott Polar Research Institute in Cambridge, UK, said that submarine measurements showed that over 20 yrs a large area of the sea ice, stretching from the North Pole to the Fram Strait between Svalbard and Greenland, had thinned by 43% during the Arctic summer.

US data from the other side of the Arctic, between the Pole and the Bering Strait, found a similar thinning over the same period.

**Vulnerable in summer**

The reported melting has been questioned by some scientists who believe the ice is still there, concentrated in areas where the submarines have not looked for it.

But Professor Wadhams says the thinning he has detected, from 16ft (4.8m) 20 years ago to 9ft (2.7m) today, is scientifically explicable.

He told BBC News Online that people say global warming can't be raising air temperatures enough to melt the ice, because the Arctic winter temperature is around -30C anyway, and a one-degree warming would be irrelevant.

He suggests that it's the summer temperatures that matter. Arctic summers are getting longer, so there is longer for the warmer air to melt the snow and affect the ice beneath.

The other mechanism is the warming of one or two degrees in the water under the ice. This is enough to increase the bottom melting quite considerably.