PreSEES

UNIVERSITY OF Southampton

Climate change

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Aims for today

- To discuss the implications for teaching and learning about climate change by
  - exploring some common misconceptions and myths associated with climate change
  - considering the barriers are to enabling students to understand the issues with respect to climate change
  - considering what opportunities exist within the curriculm to include climate change
  - thinking about productive pedagogical processes to facilitate learning about climate change

Ninety-seven percent of climate scientists agree that climate-warming trends over the past century are very likely due to human activities and most of the leading scientific organizations worldwide have issued public statements endorsing this position.

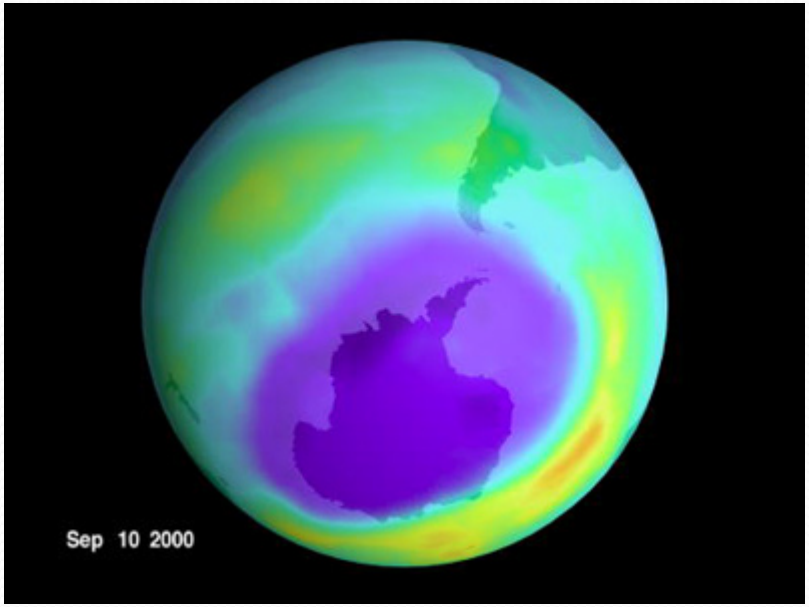
(NASAhttp://climate.nasa.gov/scientific-consensus/)

BUT

Many myths and common misconceptions exist

Common misconceptions

Global warming is caused by the hole in the ozone layer



Global warming is caused by increased greenhouse gases in the atmosphere. These gases include carbon dioxide and water vapor, which trap infrared radiation from the warmed surface of the Earth.

Common misconceptions

Aerosol spray cans are a major contributor to climate change

In the past, aerosol spray cans contained CFCs which contributed to the depletion of the ozone layer which is not the same as climate change

Common misconceptions

General pollution and toxic chemicals are major contributors to climate change

The burning of fossil fuels, such as coal and oil, to produce energy for electricity, heat and transportation is the primary source of carbon dioxide, which is the most important contributor to global warming. Carbon dioxide does not contribute to general air pollution

Common misconceptions

It's already too late to stop climate change

In the next decade global emissions need to reach their peak and then decline to well below current levels to avoid dangerous climate change. This can be achieved with technologies that are available now but delaying action will make it more difficult and expensive to reduce emissions in the future, as well as creating higher risks of severe climate change

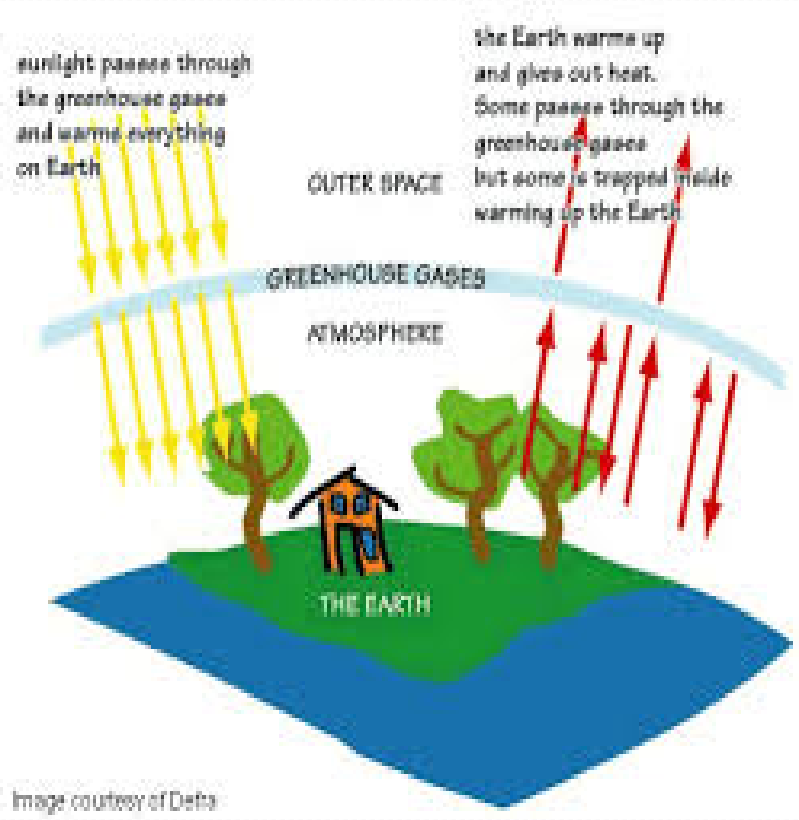
Common misconceptions

Technology will solve the problem for us

Removing CO_2 and other greenhouse gases from the atmosphere, are very unlikely because the technology is not currently available and are not an alternative to reducing emissions but we can all make a difference now by reductions in emissions

The science behind climate change

- 'Greenhouse gases' (e.g. water vapour, methane and carbon dioxide) absorb some infrared radiation preventing heat escaping/radiating into space, so the atmosphere warms up.
- The main causes of global warming are deforestation and increased use of fossil fuels
- Atmospheric CO_2 and global temperatures have shown corresponding increases over the last 150 years
- This leads to: melting polar ice, thermal expansion of sea water, crop failure



Barriers to understanding

- **Knowledge is not enough because the media and politicians influence attitudes and beliefs about climate change**

Lord Christopher Monckton (critic of anthropogenic climate change):

- **The IPCC's climate summary overstated CO_2's impact on temperature by 500-2000%**
- **CO_2 enrichment will only add 0.6 °C to global mean surface temperature by 2100**
- **The IPCC's values for key variables are taken from only four published papers, not 2,500**
- **Global warming halted ten years ago, and surface temperature has been falling for seven years**
- **The IPCC overstated the effect of ice-melt by 1000%**
- **It was proved 50 years ago that predicting climate more than two weeks ahead is impossible**
- **Mars, Jupiter, Neptune's largest moon, and Pluto warmed at the same time as Earth warmed**
- **In the past 70 years the Sun was more active than at almost any other time in the past 11,400 years**

*www.**youtube**.com/watch?v=rL-qX2GI7dc*

Barriers to understanding

- These influences lead to:
  - Disempowerment
  - Scepticism
  - Confusion
  - Disbelief
  - Emotional overload

Barriers to understanding: Disempowerment

It's not my responsibility to solve climate change and anyway I can't make a difference

Barriers to understanding: Scepticism

Barriers to understanding: Confusion and disbelief

Barriers to understanding: Emotional overload

Climate literacy

- A climate-literate person:
  - understands the essential principles of Earth's climate system,
  - knows how to assess scientifically credible information about climate,
  - communicates about climate and climate change in a meaningful way
  - is able to make informed and responsible decisions with regard to actions that may affect climate

(Climate Literacy. www.climatescience.gov)

If we want students to fully grasp the consequences of climate change then addressing the social consequences and complexity of the issue is inescapable

Busch, K.C. and Osborne, J. (2014: 28

The national curriculum

Opportunities to teach about climate change

- Key Stage 3
  - Biology: Material cycles and energy
  - Chemistry: Earth science
  - Physics: Fuels and energy resources
  - Geography: Human and physical geography
  - Citizenship: Community action

- Key stage 4
  - Biology: Energy flow and material cycles
  - Chemistry: Earth science
  - Physics: Energy
  - Geography ?
  - Citizenship: Community action

Teaching approaches

Class discussion

- A very popular approach
- Danger of students being rushed into making up their minds on the issue, and forming their opinions too soon
- Danger that some students dominate the discussion
- How do you 'chair' the discussion?
  - Do you stay neutral?
  - Do you declare your views?
  - Do you present an opposing view for balance?

Teaching approaches

Role play

- Another very popular approach
- Students can explore other peoples' perspectives
- But do they really empathise with other peoples' perspectives?

http://www.youtube.com/watch?v=HF9LNuH3IpU

Teaching approaches

Decision making frameworks

To promote systematic and critical risk-benefit discussions among students.

Present students with some background on a socioscientific issue, maybe as brief text with some visual stimulus.

Teaching approaches

Decision making frameworks

Climate change is one of the biggest issues facing the world today. According to the vast majority of scientists, it is caused by human activities (e.g. burning fossil fuels, deforestation, and factory faming) that create greenhouse gases (e.g. carbon dioxide (CO_2), methane (CH_4) & nitrous oxide (N_2O). These gases are released into the atmosphere and prevent heat from escaping into space, making the environment unnaturally warm. So the polar icecaps are melting, sea levels are rising, species are threatened with extinction, crops are failing due to changes in weather patterns.

What should be done about climate change? How and Why?

Teaching approaches

Decision making frameworks

Students first spend 5 minutes alone thinking quietly about how and why the problem should be solved. This enables them to start forming their own views to draw on in the subsequent discussion.

A DECISION-MAKING FRAMEWORK FOR LEARNING ABOUT SOCIOSCIENTIFIC ISSUES (AFTER RATCLIFFE AND GRACE, 2003)

Follow these steps, consider the questions and complete the table as you go.

1. OPTIONS
What are the options?
Discuss and list the possible solutions to the problem
2. IMPORTANT THINGS TO CONSIDER
Discuss and list **important** things to consider about each option
3. INFORMATION
What science and non-science information do you need about each option?
4. ADVANTAGES/ DISADVANTAGES
Discuss and list the advantages and disadvantages of each option
5. CHOICE
Which option does your group choose?
6. REVIEW
What do you think of the decision you have made?
How could you improve the way you made the decision?

Teaching approaches

Evaluating media reports

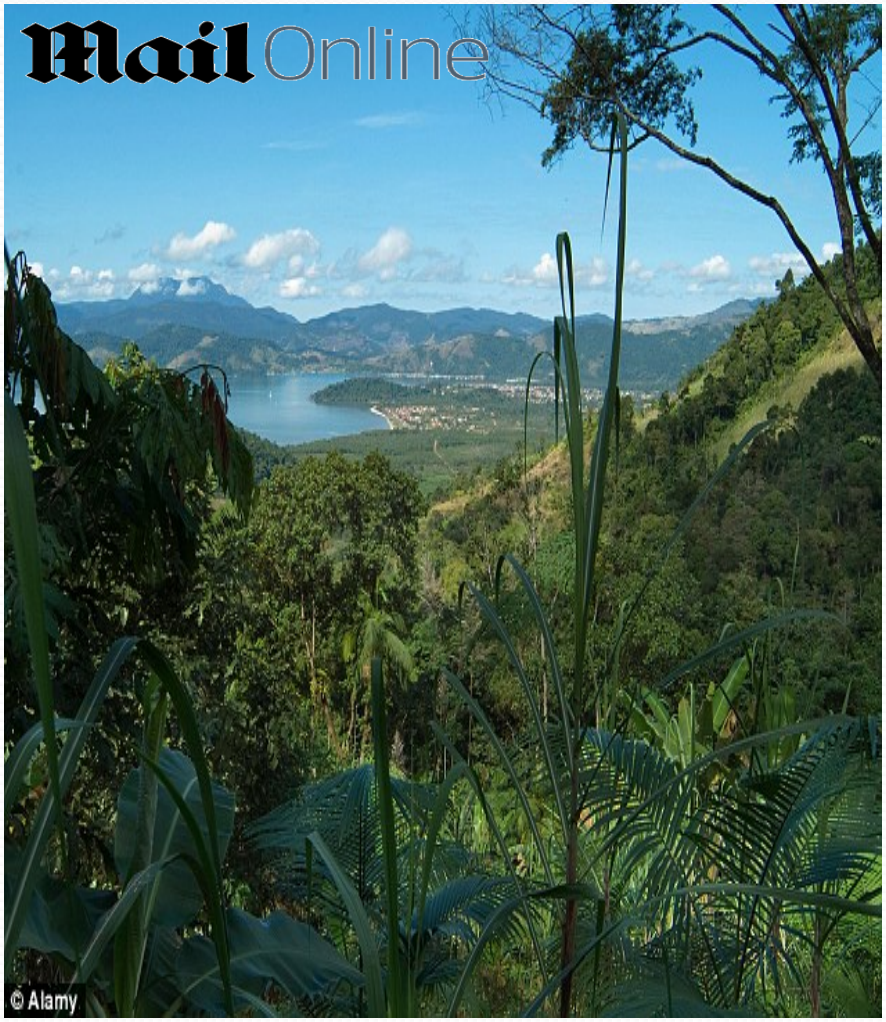
Get students to answer the following questions:

- what are the scientists/researchers claiming? (i.e. what are their conclusions?)
- what evidence is provided to support their conclusions?
- does the evidence provided convince you that the conclusion is correct?
- what extra evidence is needed? How might this be collected?

And to highlight the socially-framed nature of scientific research:

- Who did the research?
- Who do they work for?
- How certain are they about their conclusions?
- Do other scientists agree with their conclusions?

Evaluating media reports



Climate change is being slowed by plants far more than expected, researchers reveal

- **Researchers say impact of rising CO_2 levels on plant growth has been underestimated by 16 per cent**
- **Claim this has led to overestimates of how much of the greenhouse gas is left in the atmosphere**

October 14th 2014

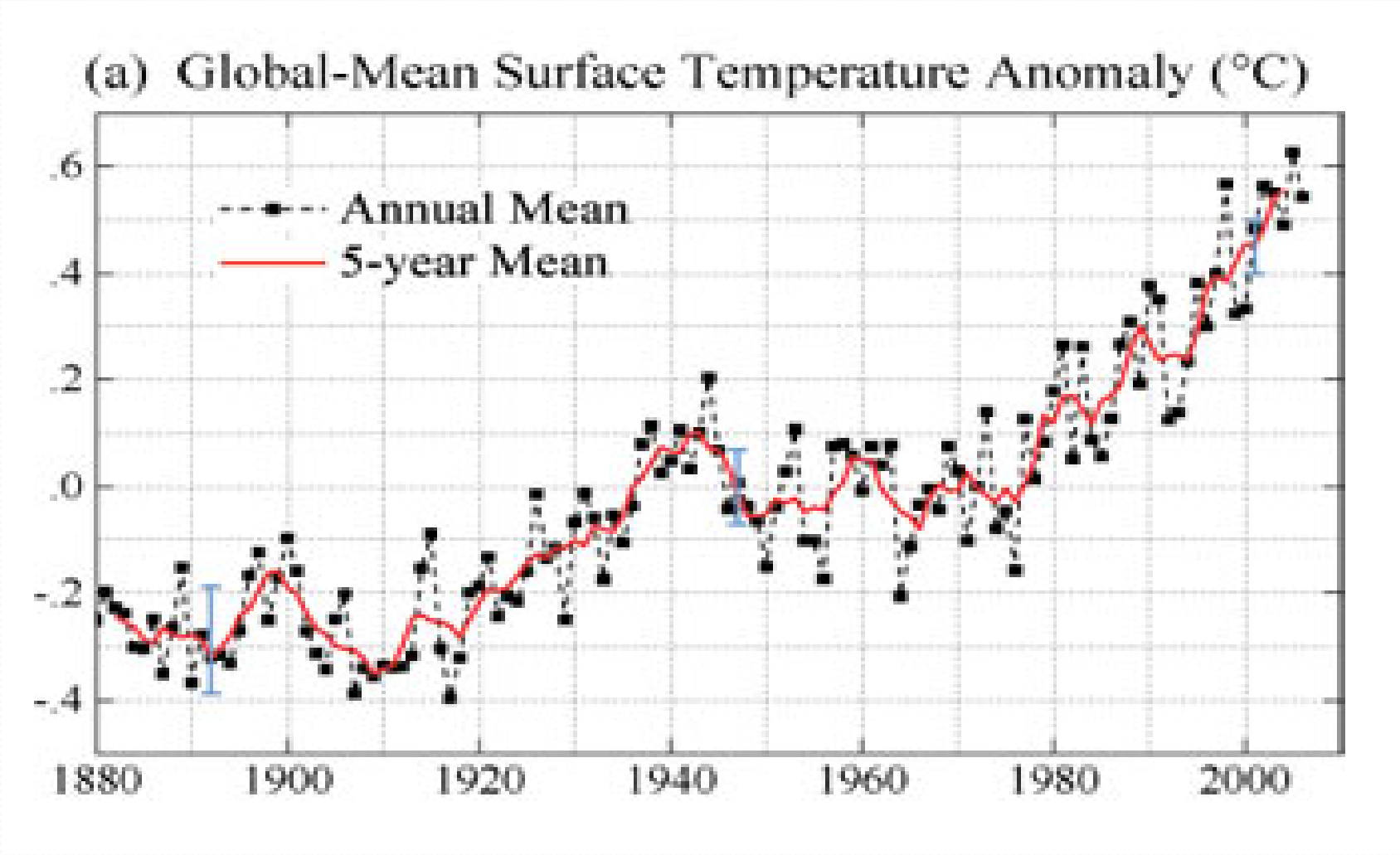
Teaching approaches

Probability and risk

Promotes discussion about science and society:

- how risk statistics are derived
- how the risks associated with the issues are presented to the public
- why scientists are unable to state categorically the risks associated with certain issues
- how we decide whether or not to carry out risky activities – do we always calculate the risk first?

Probability and risk



Teaching approaches

Cross curricular projects

Promotes discussion about science and society:

Geography
Citizenship
Mathematics
Science
PSHE

How might this operate in your school?

References

Busch, K.C. and Osborne, J. (2014). Effective strategies for talking about climate change in the classroom. *School Science Review*, 96, 354, 25-32.

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Thank you