teachers guide

Cyclones 4: Modelling climate

Components

	NAME	DESCRIPTION	AUDIENCE
	Modelling climate teachers guide	The guide shows how to build students' understanding of how models are used to predict climatic events.	teachers
Start	*Predicting climate* interactive learning object	Students make choices, based on key factors from the SRES models, to see what their ideal future looks like.	students
	Modelling the future fact sheet	Students use this fact sheet, together with the learning object, *Predicting climate*, to extend their understanding of the SRES models.	students
	The heat is on! fact sheet	This fact sheet looks at predicted predicted temperature increases for Perth, and describes impacts of increasing temperature, predicted by all future climate scenarios.	students
	Dangerous days ahead fact sheet	This fact sheet contains an interview with Professor Shane Maloney, a thermal physiologist at The University of Western Australia, using worst case predictions to examine impacts of temperature rises on humans. Projections are made for Western Australian lifestyle in 2070.	students

Purpose

To extend students' understanding of how climate projections are made, based on a number of interdependent variables.
To introduce the concept of acclimatisation and why it is important for the future.

Outcomes

Students understand that:

- research about the broad effects of climate change is an important pursuit undertaken by contemporary scientists;
- climate models have limitations because human choices about social and economic organisation can affect the climate change outcome; and
- scientists have a range of views about climate change, but that a broad consensus about the future encompasses most of those views.

Students:

- explain why research into effects, on humans, of climate change is important for planning for the future;
- make informed decisions about climate change and its broader effects; and
- describe temperature projections for Western Australia and how they will impact their lives.

Activity summary

ACTIVITY	POSSIBLE STRATEGY
Students use the learning object, *Predicting climate*, to investigate how assumptions about societal factors affect climate projections from models. Students should first complete the questionnaire according to their values, then what they think is most, or least, likely.	students, individually or in pairs
Students read the fact sheet, *Modelling the future*, and discuss their findings. Questions suggested in this guide may be used to stimulate discussion.	whole class
Students read the fact sheets, *The heat is on!* and *Dangerous days ahead*, and discuss how this kind of research can be used to prepare for future climatic conditions.	whole class

Using the learning object, *Predicting climate*

The learning object, *Predicting climate*, uses storylines from the Special Report on Emissions Scenarios (SRES) developed by the International Panel on Climate Change (IPCC). Each SRES model has specific characteristics that have been used to develop a student questionnaire.

By making selections, students will arrive at a SRES model that most closely fits their values. Characteristics of the SRES models are interdependent, so in making some selections, students will automatically also choose others.

After arriving at a SRES model encourage students to repeat the questionnaire, this time answering differently. For example, which do they think is the most likely scenario?

Discussion questions

DISCUSSION QUESTIONS	SUGGESTED RESPONSES
Why is there such a reliance on fossil fuels in models where regional development is a focus?	Scientists believe regional models will result in different rates of technology development for renewable technologies. Some countries will advance quickly to mainly using renewable energy, however others will remain heavily dependent on non-renewable energy (such as coal) as a more affordable option.
Why is population size such an important factor in climate change?	To provide water and food, plus service the basic needs of humans, requires energy. Currently most of this energy is supplied by the burning of fossil fuels. As population expands more resources are required, which consumes more energy. Thus energy dependency, plus the land clearing and degradation associated with food production, makes population size one of the key factors associated with climate change.
Were you surprised by your results? Why should a green set of choices produce a high temperature rise?	A local focus with emphasis on renewable energy sources may benefit an individual country. However, if the new technology is not shared, and there is a high cost to run it, then less-developed countries will rely on non-renewable energy sources and older technology. Overall, this produces a greater global temperature rise.
Why are some choices in the learning object, such as globalisation and population decline, inseparable?	Globalisation can produce benefits for participating countries such as improved wealth (for some). With improved wealth may come better health care and access to education. When these occur birth rates decline.

More information

For more information about the SRES storylines, visit http://www.grida.no/publications/other/ipcc_sr/

Maloney, S. K., Forbes, C. (2011) What effect will a few degrees of climate change have on human heat balance? Implications for human activity. *International Journal of Biometerology*, *55*: 147-160

Fuller, A., Dawon, T., Helmuth, B., Hetem, R. S., Mitchell, D., Maloney S. K., (2010) Physiological mechanisms in coping with climate change. *Physiological and Biochemical Zoology, 83*(5): 713-720

Hansen, J., Mki. Sato, R. Ruedy, K. Lo, D.W. Lea, and M. Medina-Elizade, 2006: Global temperature change. *Proc. Natl. Acad. Sci., 103*, 14288-14293, doi:10.1073/pnas.0606291103

CSIRO (2007). Climate Change in Australia 2007 – Technical report, supplementary material: Temperature. http://www.climatechangeinaustralia.gov.au/technical_report.php

Technical requirements

The teachers guide and fact sheets require Adobe Reader (version 5 or later), which is a free download from www.adobe.com.

The learning object requires Adobe Flash Player version 8 or later (this is a free download from www.adobe.com). It can be placed on a web or file-server and run either locally or remotely in a web browser.

Image credits

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fact sheet, *The heat is on!*

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fact sheet, *Dangerous days ahead*

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SPICE resources and copyright

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Associated SPICE resources

Cyclones 4: Modelling climate may be used in conjunction with related SPICE resources to address the broader topic of how scientists use data to make predictions.

DESCRIPTION	LEARNING PURPOSE
Cyclones (overview) This learning pathway shows how a number of SPICE resources can be combined to teach the topic of cyclones. The topic is used as a context to investigate modelling of present and future climate.	
Cyclones 1: Looking at cyclones A presentation that shows effects of some recent cyclones sets the scene for a teacher-led class discussion about origins and conditions for cyclone formation.	**Engage**
Cyclones 2: Exploring tropical cyclones The resource explores patterns of cyclone formation associated with sea surface temperature and latitude.	**Explore**
Cyclones 3: Predicting tropical cyclones Data on sea surface temperatures are analysed to predict future cyclone activity.	**Explain**
Cyclones 4: Modelling climate Students investigate how the world may change if various climate change scenarios, suggested by CSIRO research, are followed.	**Elaborate**