OCEANOGRAPHY

Ocean carbon

Glob. Biogeochem. Cycles http://doi.org/m6n (2013)

Ocean uptake of CO_2 slows the rate of increase in atmospheric CO_2 concentrations. How this carbon sink will respond to climate change remains unknown, but understanding the changes that have occurred over recent decades will help to improve future projections.

Amanda Fay and Galen McKinley of the University of Wisconsin-Madison, USA, investigate trends in observed surface ocean CO_2 concentration over various timescales between 1981 and 2010. The global ocean was divided into 16 biomes. Over the full 30-year period, they find that CO_2 concentrations in the surface ocean have generally increased at a rate consistent with, or slightly lower than, that of the atmosphere.

On shorter timescales, climate variability forces ocean concentrations to increase more sharply than atmospheric CO_2 in some regions, and more slowly in others. For example in the Southern Ocean, the positive Southern Annular Mode has weakened and the carbon sink strengthened since the early 2000s. Of more concern is the impact of North Atlantic surface warming. This reduces CO_2 solubility and thus decreases the magnitude of the sink, constituting a potential negative feedback that reinforces increasing atmospheric CO_2 concentrations. *BW*

ECOLOGICAL IMPACTS

Adapting at pace

Ecol. Lett. http://doi.org/m6k (2013)

Species adapt to changing environmental conditions. Nevertheless, a significant concern remains as to whether such adaptations can occur fast enough to avert the worst ecological impacts of climate change. Ignacio Quintero from Yale University and John J. Wiens from the University of Arizona, USA, investigate this question by studying evolutionary relationships (phylogenies) among the main vertebrate animal groups. They estimate rates of adaptive change based on differences in climatic variables between closely related species and estimated times of evolutionary splitting. They then compare these adaptive change estimates with predicted rates of climate change to 2100.

The results show a striking mismatch between past rates of evolution and projected twenty-first-century climate change. To keep pace with future rates of climate change, unprecedented niche evolution rates (more than 10,000 times faster than those typically observed) would be required. *AB*

ATMOSPHERIC SCIENCE

Monsoon arrives early

Geophys. Res. Lett. http://doi.org/m6p (2013)

Changes in the South Asian monsoon can severely impact vulnerable regions and affect a large number of people. May–June precipitation in central and northern India has increased for the period 1950–1999, resulting in the onset of the monsoon occurring 10–20 days earlier.

Massimo Bollasina, from Princeton University, USA, and colleagues used a climate model with fully interactive aerosols and chemistry to investigate the interaction of increased aerosol emissions with the monsoon for the period 1860–2005.

They find that strong aerosol forcing over the Bay of Bengal and Indochina in the spring increases atmospheric stability and cools the sea surface temperature, preventing a northward shift of precipitation. This leads to thermodynamical changes, such as increased surface temperature, in northwest India. These changes result in monsoon precipitation arriving into the region in June. The aerosol–precipitation–circulation interactions reported here can help to explain the early arrival of the monsoon. *BW*

RENEWABLE ENERGY

Uneven benefits

Proc. Natl Acad. Sci. USA http://doi.org/m29 (2013)

Wind and solar power can reduce emissions of CO_2 and air pollutants by replacing energy from fossil fuels, and bring climate, health and environmental benefits. The windiest or sunniest sites yield the best energy performance, but not necessarily the highest emissions reduction, as this depends on the conventional generators displaced.

Kyle Siler-Evans of the Carnegie Mellon University, USA, and colleagues analysed wind turbines at more than 33,000 locations and solar panels at more than 900 sites across the USA and found a significant regional variation in emissions reduction. The monetary value of the combined health, environmental and climate benefits falls between US\$10 MWh^{-1} and US\$100 MWh^{-1} depending on the location, and the sites with the highest energy output do not provide the greatest social benefits in many cases. The researchers find that the cost of the Production Tax Credit — a federal subsidy for wind energy— is more than outwieghed by the social benefits from wind farms, but the same investment could achieve greater benefits if differentiated by region. *MC*

SCIENCE AND SOCIETY

Usable science

Glob. Environ. Change http://doi.org/m6m (2013)

Cataloguing the potential risks that are posed to society by climate change has resulted in a perceived need for action and hence a requirement for 'usable science'. This is now widely promoted in environmental change research programmes. However, little work has been undertaken to evaluate the success of such research in real world decision contexts.

To address this James Ford from McGill University, Canada, and co-workers developed a conceptual model and assessment framework to evaluate the usability of climate change research in decision-making. The approach was applied to research conducted as part of the International Polar Year in Canada. Twenty-three projects had the explicit goal of informing decision-making. However, this was not generally reflected in research design, with fewer than half using input from decision-makers to set research objectives. Moreover decision context was not widely considered, and knowledge users were not usually engaged in the assessment of data quality. The authors conclude that key attributes necessary for determining success in linking science to decision-making (that is, pertinence, quality and timeliness) were frequently not captured. *AB*

Written by Alastair Brown, Monica Contestabile and Bronwyn Wake.