ECOLOGY

Mind the tree-ring gap

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According to research, tree-ring records have a blind spot for cooling after large volcanic eruptions.

Most tree-ring records come from the poleward or high-altitude edges of forests, where the trees are most sensitive to changing temperatures. Michael Mann, of Pennsylvania State University, and colleagues note that if temperatures drop suddenly, leading to a growing season of less than a few weeks, these trees might grow so slowly that the rings would be too small to see. This could lead to the coldest years being skipped over in the climate record. At the same time, the aerosols released by volcanoes cause more sunlight to be scattered and hence create more favourable growing conditions. This can make the record look warmer than it really was. Models taking these effects into account better replicate the tree-ring data, the researchers show.

Together these effects seem to explain why tree-ring records tend to never show more than 1 °C of cooling, when models predict cooling of 2 °C or more after gigantic eruptions such as the one that occurred in AD 1258–1259. *NJ*

TECHNOLOGY

Driving energy innovation

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Research has recently emphasized the importance of new energy technologies to achieve environmental sustainability and energy security, especially in light of possible future oil shocks. However, little is known about the international variation in the form and quality of energy technology innovation.

Andrew Cheon and Johannes Urpelainen of Columbia University, New York proposed that increases in international oil prices induce different energy technology innovation responses across sectors depending on how good sectors are at innovating. The ability to innovate in a specific industry depends on the political influence of private businesses that expect to benefit from energy technology innovation because such influence enables public investment. The researchers test this integrated political–economic account by using data on public research and development expenditures and patents in the domain of renewable energy technology for industrialized countries from 1989 to 2007.

They found strong support for the interactive hypothesis: only sectors with a history of successful innovation in renewable energy will have a powerful political–economic response to changes in international oil prices. *MC*

OCEANOGRAPHY

Ocean acidification costs

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Ocean acidification is increasingly recognized as a major global problem. However, economic assessments of its effects are missing. Unlike other marine organisms, molluscs — with a worldwide commercial value of around $US15 billion — show solid scientific evidence of the biological impact of acidification, which can help such economic evaluations to be made.

Daiju Narita, of the Kiel Institute for the World Economy, Germany, and colleagues estimated global and regional economic costs of mollusc-production losses due to ocean acidification. They found that the global costs could be over $US100 billion if the demand for molluscs increases as a result of income growth combined with a business-as-usual emissions trend towards the year 2100. The impacts on the globally dominant Chinese production of molluscs and the expected increase in the demand for molluscs in developing countries, including China, largely explain the cost levels.

As the ocean acidifies faster than the atmosphere warms, the acidification effects on molluscs would raise the social cost of carbon — the benefit to society of avoiding the damage of an additional unit of carbon emitted — more strongly than the

BIOGEOCHEMISTRY AND OCEANOGRAPHY

Aloha!

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Primary production at the North Pacific subtropical gyre, located about 150 kilometres north of Honolulu, Hawaii, rises to thrice its winter rate during a narrow four-week period in late summer, according to the results of a 13-year sediment trap experiment at the aptly named, Station ALOHA (A Long-term Oligotrophic Habitat Assessment).

Although it is known that about 90% of marine photosynthetic carbon fixation occurs in open ocean gyres, this finding represents a previously unexpected peak in carbon sequestration at the site. The peak is caused by high summer-light levels driving the growth of diatoms, which, rather than becoming limited by the upwelling of nutrients, form a symbiotic relationship with nitrogen-fixing cyanobacteria that also bloom in response to long summer days.

David Karl, at the University of Hawaii, Honolulu, and his colleagues report that the presence of these two organisms explains why greater proportions of carbon and nitrogen, relative to phosphorus, flow to depths of up to four kilometres in the gyre around August than in wintertime. They also suggest a follow-up investigation into the possibility of a genetically controlled cascade of metabolic processes in these organisms, triggered by changes in photoperiod. *AP*