SCIENTIFIC COMMUNITY

## Reframing model priorities

*Bull. Am. Meteorol. Soc.* http://doi.org/rvw (2014)

Earth systems models — physical climate models that incorporate biogeochemistry, such as the carbon cycle — are used for understanding and projecting human impacts on climate. Over the years, models have become more complex as greater understanding allows a more realistic representation of the Earth system and processes. This increase in realism aimed to improve prediction accuracy but it is increasingly clear that it has resulted in increased uncertainty, which has important implications for the usability of results in decision-making.

Model development needs a new approach according to Matthew Smith, of Microsoft's Computational Science Laboratory, Cambridge, UK, and colleagues. The focus should shift from improving real-world representation to understanding the level of complexity required for predictive, actionable science and effective decision-making. The authors suggest a new 'balanced complexity' approach: a formal method enabling the identification of key areas of uncertainty, key earth-system components and the level of complexity required to most effectively address specific questions. Adopting such an approach should greatly improve the ability of models to provide policy-relevant information for more effective decision making. *BW*

CLIMATE MODELLING

## Sensitivity to emissions

*Geophys. Res. Lett.* http://doi.org/rv2 (2014)

Transient climate response to emissions (TCRE) is a metric used to relate surface air temperature increases to cumulative emissions. It is thought to be independent of the rate of $CO_2$ emissions. Using seven different emissions scenarios — ranging from 2 to 25 gigatonnes of carbon per year — to force an Earth Systems Model, John Krasting, of the Geophysical Dynamics Laboratory, NOAA, Princeton, USA, and colleagues calculate TCRE ranges and their robustness to varying emissions levels. Each experiment was integrated for 200 years, or until there was a doubling of atmospheric $CO_2$.

TCRE is reported as 0.76–1.04 °C, with high-end values for the lowest and highest emissions tested indicating the metric is robust to emission level changes. It is smallest for 5–10 gigatonnes of carbon per year, which is in-line with current emission levels. Although the relationship between TCRE and emission rate is a complex function of climate-carbon cycle feedbacks, it is a small source of uncertainty relative to that generated by model differences. *BW*

PSYCHOLOGY

## Green choices motives

*Glob. Environ. Change* http://doi.org/rv3 (2014)

Product choices are mainly driven by the functional benefits of owning and using the products (instrumental advantages). However sustainable products, such as solar panels, often cost more and are less reliable (instrumental shortcomings) than conventional ones, and therefore face higher barriers to adoption.

Ernst H. Noppers of the University of Groningen, The Netherlands, and colleagues hypothesized that instrumental attributes alone are insufficient to explain choice patterns for sustainable innovations. They tested the significance of a range of attributes for the adoption of electric cars and local renewable energy systems. In addition to instrumental attributes, they looked at the environmental outcomes of owning and using the products (environmental attributes) and the outcomes for one's self-identity and social status (symbolic attributes). Participants stated the importance of instrumental and environmental attributes for choosing green products. However, the results showed that positive evaluations of symbolic attributes, especially in the presence of instrumental shortcomings, can raise interest in sustainable innovations with important implications for communication campaigns. *MC*

CLIMATE IMPACTS

## Cultural world heritage at risk

*Environ. Res. Lett.* **9**, 034001 (2014)

ROBERT HARDING WORLD IMAGERY/ALAMY

Many UNESCO cultural world heritage sites are located near the coasts and therefore threatened by warming-induced sea-level rise. To preserve them for the benefit of as many future generations as possible, impacts on cultural sites should be analysed over a very long time period.

With spatially resolved sea-level estimates over the next 2,000 years and high-resolution topography data, Ben Marzeion of the University of Innsbruck, Austria, and Anders Levermann of Potsdam University, Germany, identified the cultural sites that will be affected by sea-level rise under different global mean temperature levels. If the current temperature level is sustained over the period considered, 40 of the 720 UNESCO sites are likely to be affected, whereas a temperature rise of 3 °C would bring the number up to 136. The researchers warn that, given uncertainties in the analysis, the results are more likely to be an underestimation of the impacts of sea-level rise rather than an overestimation. *MC*

ECOLOGICAL IMPACTS

## Fly in the face of adversity

*Glob. Change Biol.* http://doi.org/rvz (2014)

Climatic variables play an important role in determining the distribution of species and there are now many examples of species that have altered their distribution in response to ongoing climatic changes. However, there remains some debate about the mechanism of thermal sensitivity, with different theories implying different approaches to estimating species distributions in response to projected climate change.

Johannes Overgaard of Aarhus University, Denmark, and co-authors investigated the relative skill of two alternative models — based on growth performance or extreme thermal stress tolerance — in explaining current, and potential future, distributions of ten fly species with tropical or widespread distribution in Australia. They found that adult tolerance to extreme thermal events was a good predictor of their current distribution, compared with measures of growth and development, which performed poorly. Application of the thermal tolerance model predicted a similar degree of climate change impact across tropical and widespread taxa. *AB*

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