# Ocean–climate links revealed

**An analysis of thousands of datasets to test the link between climate change and changes in biological and physical systems around the world has concluded that man-made global warming is a more significant influence than natural climatic variation, deforestation and land-use changes on natural phenomena such as animal breeding cycles, plant flowering, coastal erosion and ice-melting.**

In the international study, reported in *Nature*,[1] NASA's Dr Cynthia Rosenzweig and scientists from 10 other institutions – including Professor David Karoly of the University of Melbourne – analysed data from papers published back to 1970 on changes to 829 physical systems and around 28 800 plant and animal systems. In 90 per cent of cases, observed changes were consistent with predictions based on climate change modelling.

'This level of concordance is really quite remarkable, all the more so when we consider that there has been only around 0.75°C of temperature change so far, yet the expectation for this century at the current rate of emissions is four to nine times that amount,' commented Professor Barry Brook, Director of the Research Institute for Climate Change and Sustainability at the University of Adelaide.

**There is strong evidence that many bird migration and breeding cycles are out of sync due to global warming.** Terrance Emerson/iStockphoto

However, Professor Brook also pointed to shortcomings in the study. 'In biological systems, for instance, there are 22 studies from Australia and a staggering 28 000 from Europe (there are also relatively few from Asia, Africa and South America). Clearly Australia needs to foster a broad-based system of biophysical monitoring.'

1 Rosenzweig C *et al.* (2008) Attributing physical and biological impacts to anthropogenic climate change. *Nature* **453**, 353–357.

# 'Tipping point' may come earlier

**Professor Tim Flannery recently issued a warning about the 'extremely urgent' need for action to stem greenhouse gas emissions. He says climate change is happening so quickly, the world needs to prepare to take 'radical emergency measures' within five years – such as pumping sulphur into the stratosphere to initiate global dimming.**

'It's the last barrier to a climate collapse,' says Dr Flannery. 'Regardless of what happens to future emissions, there is already far too much greenhouse gas in the atmosphere so cutting emissions is not enough. We have two to three decades before we reach a global tipping point.'

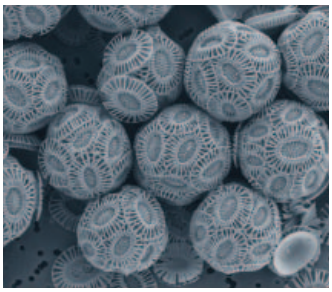
Dr Flannery's comments followed the release of a draft paper co-authored by NASA's Dr James Hansen,[1] which challenged current assumptions about the global temperature response to atmospheric $CO_2$. The paper – 'Target $CO_2$: Where should humanity aim?'– claims the current level of 385 ppm (parts per million) atmospheric $CO_2$ is more than sufficient for catastrophic climate change to occur within a few decades, unless levels can be reduced to 300–350 ppm within decades.

1 http://arxiv.org/abs/0804.1126

# Beyond $CO_2$ and methane

**Research from the UK's University of East Anglia has highlighted the need for more understanding about the impact of the lesser known atmospheric gases.**

Professor David Richardson has issued a warning about the growing impact of nitrous oxide ($N_2O$) or laughing gas. While it makes up just 9 per cent of total greenhouse gas emissions, it has 300 times the global warming potential of $CO_2$ and can survive in the atmosphere for 150 years. Nitrous oxide emissions from waste-treatment plants, landfill and fertiliser pollution have increased as bacteria in oxygen-depleted environments switch from oxygen to nitrates to respire, releasing nitrous oxide.



**Marine bacteria metabolise large volumes of the climate-changing gas dimethyl sulphide from compounds in coccolithophorids (above) and other marine algae.** Jeremy Young/The Natural History Museum, London

Richardson's colleague, Dr Andrew Curson, has found that marine microbes are making dimethyl sulphide (DMS) – another greenhouse gas – at the rate of more than 200 million tonnes a year. DMS triggers the formation of clouds, which have a cooling effect. The microbes generate DMS by metabolising a sulphur compound made by seaweeds and marine plankton. 'If we want to understand climate change better, we have lots to do,' said Dr Curson.