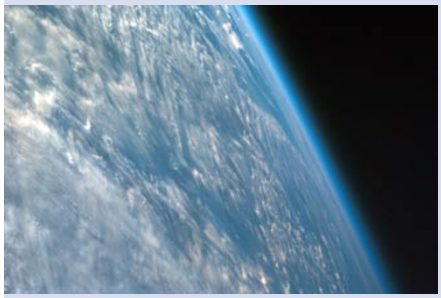
ATMOSPHERIC SCIENCE

Water vapour warming



NASA

Science doi:10.1126/science.1182488 (2010)

A loss of water vapour in the Earth's upper atmosphere may have slowed the rate of global warming over the past decade, suggests new research. Although the decade 2000–2009 was the warmest on record, average global temperatures levelled off during this period despite a continued rise in greenhouse gas emissions.

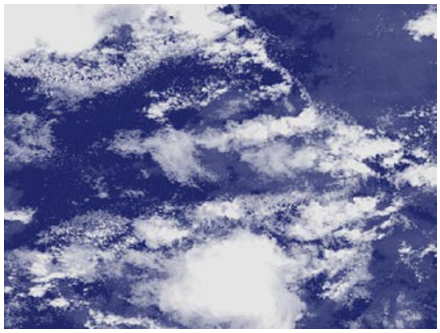
Now a team led by Susan Solomon of the US National Oceanic and Atmospheric Administration in Boulder, Colorado, reports that water vapour concentrations in the stratosphere fell by 10 per cent from 2000, offsetting — by 25 per cent — the warming that would otherwise have occurred since then. The team used an atmospheric model and a range of recent observations of stratospheric water vapour to reach their conclusion. Using more limited data, they also found that water vapour in the stratosphere probably increased between 1980 and 2000, a period of rapid warming. The increase in water vapour between 1990 and 2000 may have amplified the rapid warming of that period by as much as 30 per cent, they say.

The study confirms earlier work showing that water vapour has an important role in warming. It also partly explains the drop in warming over the past decade.

Olive Heffernan

CLIMATE PREDICTION

Clarity on clouds



MARAT KHAIROUTDINOV, STONY BROOK UNIVERSITY

Geophys. Res. Lett. **37,** L01702 (2010)

Clouds are one of the largest sources of uncertainty in climate models. That's because global climate models cannot explicitly capture cloud formation. Instead they use a series of equations to describe the average conditions under which clouds form and decay, a technique called parameterization.

Now a team of researchers led by Cristiana Stan of the Center for Ocean-Land-Atmosphere Studies in Calverton, Maryland, has simulated the Earth's climate using a model that explicitly represents cloud processes. Stan and colleagues analysed simulations from a standard coupled climate model. They then replaced the cloud parameterization in their model with an embedded two-dimensional cloud process–resolving model and ran the simulation again. They found that when clouds were explicitly represented in the model, the climate simulation improved in several respects, including more accurate depiction of seasonal precipitation patterns and of several important climatic phenomena, such as the Madden–Julian Oscillation, the Asian monsoon and the El Niño/Southern Oscillation.

The study suggests that clouds should be explicitly represented in climate models for more accurate simulations of the climate.

Olive Heffernan

BIODIVERSITY AND ECOLOGY

Flourishing forests

© ISTOCKPHOTO

Proc. Natl Acad. Sci. USA
doi:10.1073/pnas.0912376107 (2010)

A recent growth spurt among forests in the Northern Hemisphere may be the result of climate change, suggests new research. Until now, regrowth as a part of natural ecosystem recovery after disturbances such as logging or clearing has obscured the influence of climate change on recent boosts in forest biomass.

Sean McMahon of the Smithsonian Environmental Research Center, Edgewater, Maryland, and colleagues analysed changes in biomass over the past 22 years in 55 temperate deciduous forest plots in the United States where the history of disturbances was known, together with 100 years of local climate data. They found that in 78 per cent of the forest plots, increases in forest biomass over the past two decades have outpaced increases predicted from natural recovery by an average of 4.15 tonnes per hectare per year. The increase in growth was independent of stand age and year of sampling, found the authors, who attribute the growth spurt to a combination of increasing temperatures, longer growing seasons and higher concentrations of atmospheric carbon dioxide.

Continuous monitoring of forests worldwide will be necessary to decipher exactly which of these factors is the most influential, say the authors.

Anna Armstrong

PALEOCLIMATE

Sea level spike

BOGDAN P. ONAC

Science **327,** 860–863 (2010)

Conventional wisdom holds that as ice sheets grew over Europe and North America during the last glacial period — about 120,000 to 20,000 years ago — sea level fell in bumpy fits and starts, eventually dropping to about 130 metres below today's levels. Scientists now report that 81,000 years ago, sea levels

reached about 1 metre higher than today, owing to ice sheets rapidly melting between periods of growth.

To reconstruct sea level throughout the last glacial period, a team led by Jeffrey Dorale of the University of Iowa and Bogdan Onac of the University of South Florida looked to the caves that dot the southern coast of the Spanish island of Mallorca. The deposition of crusty layers of carbonate minerals in these caves records past sea levels. When the team dated these deposits, they found a period of high seas about 84,000 to 80,000 years ago that punctuated the trend in sea level decline.

If the rapid rise in sea level is confirmed by other records, it will suggest that the 100,000-year climate cycle thought to underlie recent ice ages may not fully explain the waxing and waning of ice sheets.

Alicia Newton

BIODIVERSITY AND ECOLOGY

Out of step

© ISTOCKPHOTO / DIRK FREDER

Glob. Change Biol.
doi:10.1111/j.1365-2486.2010.02165.x (2010)
Recent changes in the seasonal timing of biological events such as flowering and migration have been linked to warmer temperatures. Now a study shows that such seasonal shifts are becoming increasingly common in the UK and could wreak havoc across ecosystems as they disturb the delicate balance of nature.

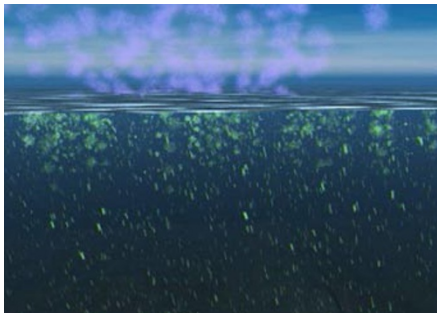
A team led by Stephen Thackeray of the Centre for Ecology and Hydrology in Lancaster, UK, looked at more than 25,500 records of the timing of biological events for 726 marine, terrestrial and freshwater species over a 30-year period from 1976 to 2005. During this period, all three of these environments experienced a warming trend of about 0.04–0.05 °C per year. Thackeray and colleagues found that over the 30 years under study, the timing of 84 per cent of spring and summer events moved forward. The shift was more rapid than suggested by previous studies, averaging almost 0.4 days per year.

Many organisms time their reproduction and migrations to coincide with maximum food availability. If warming is the cause of these seasonal shifts, the new study suggests that 'trophic mismatching', in which the arrival and reproduction of predators no longer synchronizes with access to food, could be more common in future.

Olive Heffernan

OCEAN SCIENCE

Souring seas



NASA

Nature Geosci. doi:10.1038/ngeo755 (2010)
Marine plankton survived a period of intense ocean warming and acidification some 55 million years ago. But their future descendants might not be so lucky, suggests a new study.

Using an Earth-system model called GENIE-1, Andy Ridgwell and Daniela Schmidt of Bristol University in the UK compared possible future levels of ocean acidity to those experienced during the Palaeocene-Eocene Thermal Maximum (PETM), a period of warming during which a massive amount of carbon was released into the atmosphere. Ridgwell and Schmidt ran their model assuming a 'business as usual' greenhouse gas emissions scenario until 2100 and a linear decline in emissions thereafter. This gives a total carbon release of 2.18 trillion tonnes, similar to the amount thought to have been released during the PETM.

They found that in the future the deep ocean could become undersaturated with carbonate, the mineral form of carbon used by calcareous organisms for building shells and skeletons, to an even worse extent than during the PETM. At the ocean surface, the rate of acidification could exceed that experienced during the PETM, potentially challenging the ability of plankton to adapt.

Olive Heffernan