Climate prediction

Polished predictions

Science doi:10.1126/science.1139450 (2007)
Global warming will slow over the next few years, before picking up speed, finds a new study. Previous climate model predictions only accounted for the influence of externally driven changes such as solar radiation, atmospheric aerosols and greenhouse-gas emissions, and did not attempt to predict internal variability of the climate system.

Now, Doug Smith and colleagues from the Met Office Hadley Centre, UK have developed a climate model prediction system that incorporates internal variability arising from natural changes such as El Nino, fluctuations in ocean circulation and regional variations in ocean heat content, as well as the variability caused by external factors. Comparing the results of ten-year hindcasts from the new system with those based on previous methodologies, they found that the new system predicted global surface temperature more accurately on interannual to decadal timescales. Over land, the improvements were greatest in North and South America and eastern Australia.

Both systems predict warming over the next decade. In the new system, however, internal climate variability offsets human-driven warming over the next few years, with no net warming before 2008. But at least half of the years after 2009 will be warmer than 1998, the warmest year on record.

Olive Heffernan

Extreme events

Climate catastrophe

J. Geophys. Res. **112,** D13107 (2007)
Smoke generated by even a 'small' nuclear war would provoke deadly and widespread climatic disruption that would cause far greater mortality than the bombs themselves, finds a new study. Sudden and lasting cooling from the smoke blocking the sunlight would devastate agriculture worldwide for years and cause famine on a scale unprecedented in human history.

Alan Robock and colleagues at Rutgers University, New Jersey, ran two simulations, using a new global climate model that reaches up to the top of the mesosphere, approximately 80 km above the Earth's surface. One simulation assumed a war that unleashed some 20,000 weapons, equivalent to current Russian and US arsenals. The second assumed a war using one-third of those weapons.

All-out war would result in a true 'nuclear winter', says Robock. Soot would persist in the atmosphere for over a decade, resulting in average global cooling of as much as –7 °C, and would halve rainfall, leading to global famine. In the 'limited' war, temperature and rainfall reductions would be half as severe, but would last equally as long. The study is the first to use this type of model, including the ocean and atmosphere up to 80 km, to simulate the effects of nuclear warfare on the climate.

Harvey Leifert

Biodiversity and ecology

Snail sayonara

Biol. Lett. doi:10.1098/rsbl.2007.0316 (2007)
The Aldabra banded snail (*Rachistia aldabrae*), last seen alive in 1997, has been driven to extinction by reduced rainfall associated with climate change, according to new research.

Justin Gerlach of the Nature Protection Trust of Seychelles collated data from 16 invertebrate collections, made between 1895 and 2006, to examine changes in the abundance, distribution and demography of the only known population of the snail. Because no live snails were found in surveys after 1997, there were two specific searches for *R. aldabrae* in 2005 and 2006, which only found shells that were at least five years old.

The Aldabra atoll is one of the least disturbed places on Earth. However, regional rainfall has decreased and prolonged dry periods have increased since the late twentieth century. Juvenile snails were more susceptible to desiccation than adults, with all young perishing in prolonged dry spells. The demographic population change from juvenile loss strongly correlates with reduced rainfall and dry periods.

R. aldabrae now has the unfortunate distinction of being one of the few species whose extinction can be attributed directly to climate change, rather than indirect effects such as habitat change. Gerlach believes that further species surveys on the atoll will likely show the impact of reduced rainfall on biodiversity.

Robin Wilkinson

Climate impacts

The future's wet

Science doi:10.1126/science.1140746 (2007)
Global warming may result in even more rain than that currently projected by climate models. Models and observations agree that a warmer planet will have more water in the atmosphere, but exactly how much of this will fall as rain has been hard to pin down.

Frank J. Wentz of Remote Sensing Systems in Santa Rosa, California and co-workers analysed trends in water vapour, surface wind and precipitation from global satellite data between 1987 and 2006. Although climate models indicate that precipitation should have increased by only 1–3% per degree Celsius of surface warming during this period, they found an increase of 7% per degree Celsius — the same rate at which water vapour increased in the atmosphere.

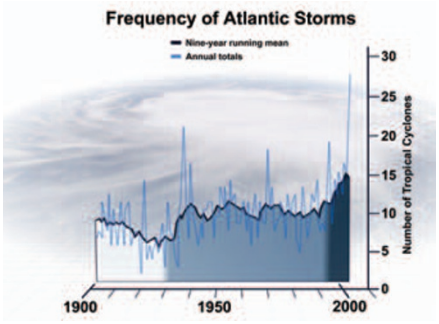
The lower rainfall in the model simulations can be explained by the fact that they projected weaker global surface winds than those observed in the satellite data. Stronger surface winds increase the evaporation of moisture from the Earth's surface and transport it upwards into the atmosphere where it falls as rain. Where this additional rain will fall in the future remains a mystery: will it alleviate drought in arid areas or contribute to flooding in wet regions?

Samia Mantoura

© GETTY

Extreme events

Storm warning



© NCAR

Phil. Trans. Royal. Soc. A
doi:10.1098/rsta.2007.2083 (2007)

The frequency of North Atlantic hurricanes has more than doubled in the past century — a trend primarily driven by climate change — a new study finds. Researchers have identified three distinct climatic periods, or regimes, in the region since 1900. In each successive one, the number of tropical cyclones and hurricanes (extreme cyclones) increased by about 50% compared with the previous period and then stabilized.

Greg Holland of the US National Center for Atmospheric Research and Peter Webster of the Georgia Institute of Technology in the USA analysed North Atlantic Ocean tropical cyclone activity in relation to sea surface temperature from 1855 to 2005. They found two sharp transitions to periods of elevated activity, occurring in 1930 and 1995, which were correlated with increases in sea surface temperature in the eastern North Atlantic. The first period from 1990 to 1930 saw an average of six tropical cyclones per year, whereas the most recent, from 1995 to 2006, saw an average of 15 per year. Regardless of the number of cyclones each year, about half became hurricanes.

Similar, or higher, levels of storms and hurricanes are expected in the future, resulting from continued warming of the Atlantic and the Gulf of Mexico.

Harvey Leifert

Cryosphere

An ice time

Nature doi:10.1038/nature06015 (2007)

Antarctic climate change has lagged behind changes in northern hemisphere summer sunshine over the past 360,000 years, finds a new study. This suggests that CO_2 levels amplify rather than trigger the end of ice ages.

A team led by Kenji Kawamura at Tohoku University in Japan and the Scripps Institution of Oceanography in California dated ice cores using the oxygen-to-nitrogen ratios of trapped air in a new method to establish the order in which changes in CO_2, Antarctic temperature and sunshine occur at the end of an ice age. Although other ice-core dating techniques have been available, this study is the first to extend such an accurate timescale back 360,000 years.

Kawamura's team found that changes in northern high-latitude summer sunshine preceded the dramatic global warming that ended the last four ice ages. The distribution of sunlight on the planet, which has been precisely estimated, is affected by changes in the Earth's 'orbital parameters', such as the tilt of the Earth's axis. Until now, various mechanisms that drive ice ages on a 100,000 year cycle have been proposed, but the timing of events remained unclear. The results will help climate modellers to better understand the relationship between these factors in simulating global warming scenarios.

Samia Mantoura

© GETTY