

# Earth system science

Increasing knowledge of the component parts of the Earth system and the ways they interact



ESA

## Water found on a planet outside this solar system

For the first time, scientists have discovered water on a planet outside our own solar system. The team of researchers used NASA's Earth-orbiting Spitzer telescope, to discover the planet named HD 189733b.

The landmark discovery of water in the planet's atmosphere was based on measurements of key wavelengths in the infrared region to pick out the unique signature of water. Painstaking analysis was backed up by highly accurate water absorption parameters devised by Bob Barber and Jonathan Tennyson from University College London and based on work developed under a NERC grant.

The grant, entitled 'Infrared and visible wavelength absorption by water vapour', allowed the researchers to create a definitive database of water absorptions across these parts of the electromagnetic spectrum. This is essential for climate change research

because water vapour is the most powerful greenhouse gas in the Earth's atmosphere. It absorbs both incoming sunlight and heat leaving the Earth's surface.

But researchers from the European Space Agency and NASA had another use for this new database: locating water on a planet 63 light years from our sun.

The planet, a gas giant similar to Jupiter, is unlikely to support life as it is too close to its sun.

■ Water vapour in the atmosphere of a transiting extrasolar planet. *Nature*, 2007.

Artists impression of the planet HD 189733b.  
The planet orbits a star 63 light years from the sun.



NASA/ESA/CSIC/Beoboo/ESA

## Carbon sink begins to buckle

Evidence that carbon sinks have weakened has been found by researchers from the University of East Anglia (UEA), the British Antarctic Survey (BAS) and the Max Planck Institute for Biogeochemistry.

An increase in winds over the Southern Ocean, caused by ozone depletion and greenhouse gases, caused a release of CO<sub>2</sub> stored in the ocean into the atmosphere. This is preventing further absorption of the gas.

Lead author Corinne Le Quéré of UEA and BAS said, 'For the first time, we see climate change affecting a CO<sub>2</sub> sink. Models predict that many such feed backs will occur this century.'

In the North Atlantic, Andrew Watson and Ute Schuster of UEA also found a dramatic decline in the CO<sub>2</sub> sink between the mid 1990s and mid 2000s.

■ Saturation of the Southern Ocean CO<sub>2</sub> sink due to recent climate change. *Science*, 2007.

■ A variable and decreasing sink for atmospheric CO<sub>2</sub> in the North Atlantic. *Journal of Geophysical Research*, 2007.

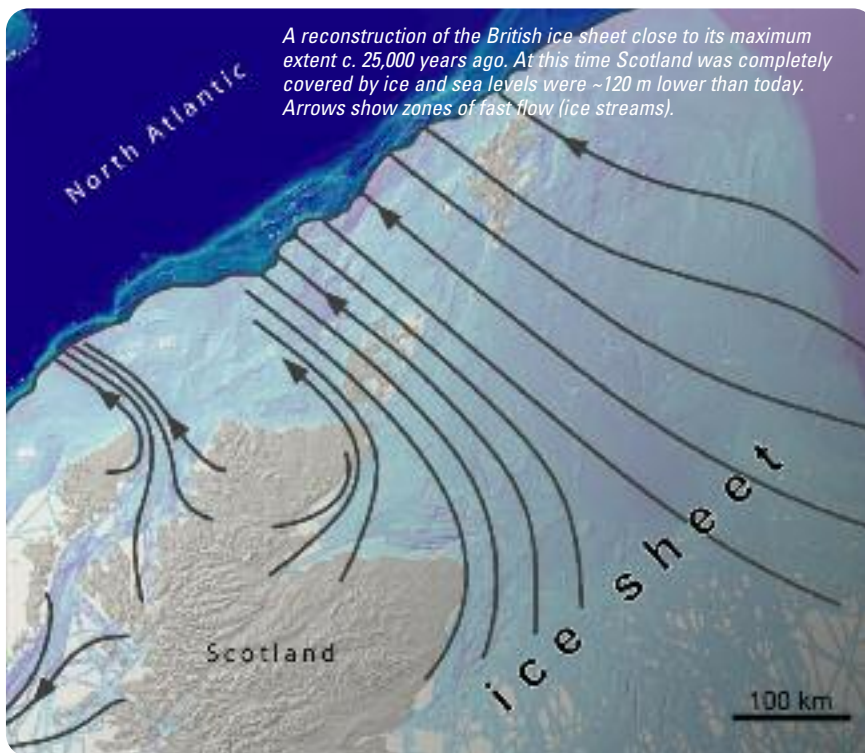
## Sea-level predictions too conservative

Sea levels rose 1.6 metres per century during the last interglacial period 124,000-119,000 years ago, indicating that recent best estimates of sea-level rise in the coming century may be too low.

Lead author, Eelco Rohling of the University of Southampton's School of Ocean and Earth Science, based at the National Oceanography Centre, said, 'Until now, there have been no really convincing data of the full rate of past sea-level rises above the present level.'

Temperatures during the period were up to two degrees warmer than the present and sea levels settled at 4-6 metres above today's average.

■ High rates of sea-level rise during the last interglacial period. *Nature Geoscience*, 2007.



A reconstruction of the British ice sheet close to its maximum extent c. 25,000 years ago. At this time Scotland was completely covered by ice and sea levels were ~120 m lower than today. Arrows show zones of fast flow (ice streams).

## Footprint of a collapsing ice sheet

Using remarkable new seabed imagery, researchers at the British Geological Survey have discovered unambiguous evidence of the collapse of the British and Scandinavian ice sheets around 20,000 years ago, at the end of the last ice age.

The high-resolution echo-sounder dataset is allowing scientists to reconstruct the effects of climate and sea-level change on the last British ice sheet, including why, and at what rate, it collapsed.

■ The northern sector of the last British Ice Sheet: maximum extent and demise. *Earth Science Reviews*, 2008.

## Global hydrogen budget

In the future the global economy may run on hydrogen rather than carbon. But the global hydrogen budget is poorly understood. Now scientists from the National Centre for Atmospheric Science (NCAS) have created detailed models of the present-day hydrogen budget.

'We've compiled up-to-date emissions datasets of atmospheric hydrogen for both human emissions and natural sources,' says NCAS researcher Nicola Warwick.

These datasets provided the information for 3D global model simulations of hydrogen, and for the first time a global simulation of heavy hydrogen (known as deuterium, a stable isotope of hydrogen). These accurate

simulations will improve researchers' ability to estimate the impact of a future hydrogen economy.

## Volcano found beneath ice

A layer of ash across an area larger than Wales is the first evidence of a volcanic eruption beneath Antarctica's most rapidly changing ice sheet, say scientists from the British Antarctic Survey.

The team, led by Hugh Corr, say the volcano on the West Antarctic ice sheet erupted in 325 BC but remains active.

Hugh says, 'We believe this was the biggest eruption in Antarctica during the last 10,000 years. It blew a substantial hole in the ice sheet, and generated a plume of ash and gas that rose around 12 kilometres into the air.'

■ A recent volcanic eruption beneath the West Antarctic ice sheet. *Nature Geoscience*, 2008.

BAS Twin Otter in flight during the aerial survey

