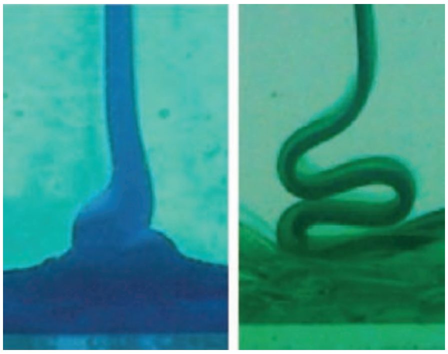
Corrected online: 13 December 2009

Deepest mantle explored

Geochem. Geophys. Geosys. **10,** Q10004 (2009)



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Analogue modelling of the D" layer — defined by anomalously large lateral heterogeneity in seismic profiles near the core–mantle boundary — has suggested two potential new explanations for the characteristic shape of this layer.

Nicolas Loubet and colleagues, of the Institut de Physique du Globe, France, used sugar syrups of different viscosities to simulate the process of relatively cool, viscous oceanic lithosphere being forced into the mantle at subduction zones. They found that, with a sufficiently high viscosity contrast between the descending slab and surrounding mantle, when the viscous fluid hit a surface representing the core–mantle boundary, it folded, creating topography similar to that observed at the D" layer.

However they also note that this folding effect could be caused by the viscous subducted slab passing through a region of rapid viscosity change, such as the discontinuity in the Earth's mantle at a depth of 660 km. The authors infer that piles of folded lithosphere could develop there and subsequently descend to the core–mantle boundary, which would be consistent with the apparent widening of subducted slabs observed at this depth.

Mild Antarctic winters

J. Clim. doi:10.1175/2009JCLI3074.1 (2009)

Laurie Island in the southernmost Atlantic Ocean, 170 km from the Antarctic coastline, is the site of the longest daily climate record in the high southern latitudes. An analysis of this century-long series exposes a clear warming trend from the 1950s that occurs throughout the seasons, suggesting that the Antarctic ozone hole is not the sole cause of the warming.

Susan Solomon of the National Oceanic and Atmospheric Administration, USA, and colleagues analysed the daily data from 1903 to 2008 for temperature trends, looking at seasonal and annual mean temperatures. They found evidence of a 2 °C mean temperature rise, and also report that cold extremes have become increasingly milder since the 1950s, warming by up to 5 °C. Summer temperatures shifted towards warmer values mainly after development of the ozone hole in the 1970s.

Over the period of observation, temperatures above freezing have been observed more and more frequently, with important implications for ice melt.

Arctic aerosols

Glob. Biogeochem. Cycles
doi:10.1029/2009GB003559 (in the press).

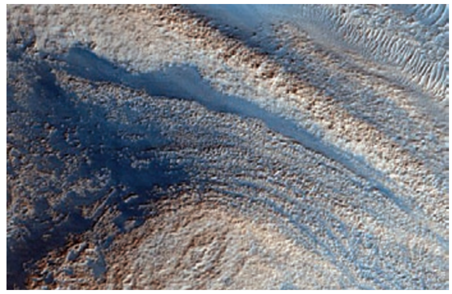
The biological production of carbon-containing aerosols in the ocean could influence cloud formation. Model simulations suggest that ocean warming could stimulate marine aerosol production in the Arctic Ocean.

Akinori Ito and Michio Kawamiya of the Japan Agency for Marine-Earth Science and Technology used an integrated Earth system model to examine the impact of climate change — specifically reductions in sea-ice cover and changes in chlorophyll concentration in the Arctic Ocean — on organic carbon emissions. Reductions in sea-ice cover had little impact on the net flux of carbon-containing aerosols from the global ocean to the atmosphere, which remained close to the non-perturbed value of 7 Tg carbon per year. However, sea-ice and chlorophyll perturbations had a significant impact on the magnitude of emissions in the Arctic Ocean, which were significantly increased.

The researchers suggest that an increase in light availability in the sea-ice-free ocean, and hence an increase in primary productivity, was responsible for the increased Arctic aerosol emissions.

Shaping valleys

Geomorphology
doi:10.1016/j.geomorph.2009.10.018 (2009)



NASA

The regular spacing of glacial valleys on Earth and Mars is controlled by a balance between the thickening of ice in nascent valleys and the stresses and drag that limit the glacier's flow, according to numerical simulations.

Digital elevation models created by Jon Pelletier and colleagues at the University of Arizona confirmed that glacial valleys on Earth had a characteristic spacing of 1–3 km, whereas valleys on Mars occurred every 10–30 km. Using a three-dimensional numerical model, the researchers showed that this spacing arises as a complex interplay between ice viscosity, the threshold for shear stress at the base of the glacier, basal friction, the slope of the valley and gravity.

Compared with glacial valleys on Earth, those on Mars generally have shallower valley slopes relative to the overall mountain relief, and the colder surface temperatures increase the ice viscosity. These attributes, in combination with lower gravity, were sufficient to generate the observed martian valley spacing in the numerical model.

Cool pool

Geophys. Res. Lett. **36,** L21703 (2009)

Marked by surface temperatures upwards of 28 °C, the Atlantic warm pool develops in the tropical and subtropical western Atlantic Ocean during the summer months. Records from the underlying sediments suggest that sea surface temperatures throughout the Atlantic warm pool dropped by 2–3 °C during the peak of the Little Ice Age.

Julie Richey of the University of South Florida and colleagues used marine sediments to reconstruct sea surface temperatures in the Gulf of Mexico over the past six centuries. They found a temperature minimum at AD 1750, in line with several other records scattered throughout the periphery of the Atlantic warm pool. This led the team to conclude that the warm pool cooled, and later warmed, coherently.

Northern Hemisphere reconstructions indicate that air temperatures over the continents were less than 1 °C cooler during the Little Ice Age. The researchers attribute the stronger cooling observed in the Gulf of Mexico to a prolonged and dramatic reduction in the geographic extent and intensity of the Atlantic warm pool.

Correction

In the Research Highlight 'Deepest mantle explored' (*Nature Geosci*. **2,** 823; 2009), 'continental crust', 'continental slab' and 'folded crust' should have been 'oceanic lithosphere', 'subducted slab' and 'folded lithosphere' respectively. These errors were corrected online in the HTML and PDF versions on 13 December 2009.