ATMOSPHERIC SCIENCE

Low-level clouds

Geophys. Res. Lett. http://doi.org/hwk (2012)

Sea ice is a vital component of the Arctic climate system, with recent losses thought to affect the properties of clouds in the region. Observations indicate that low-lying clouds are less frequent in ice-free areas of the Arctic Ocean during autumn.

Kazutoshi Sato of the Japan Agency for Marine-Earth Science and Technology and colleagues analysed the height of the autumnal cloud base in ice-covered and ice-free regions of the Chukchi and Beaufort Seas of the Arctic Ocean, using radiosonde and ceilometer data collected between 1998 and 2010. Low-lying clouds with a base below 500 m were 30% less frequent in ice-free regions, compared with ice-covered areas. In contrast, clouds characterized by a base height exceeding 500 m were about 20% more frequent in ice-free areas. Conditions in the boundary layer between the ocean and the atmosphere also varied with sea-ice coverage: ice-free areas were characterized by a larger thermal contrast between the air and sea, and greater warmth in the lower troposphere.

The team suggests that it is these boundary layer conditions, and associated heat fluxes, that determine cloud-base height over the Arctic Ocean. *AA*

PALAEOCEANOGRAPHY

North to south

Paleoceanography http://doi.org/hwm (2012)

Atmospheric carbon dioxide concentrations during the last glacial period were about 100 ppmv lower than interglacial values. Numerical simulations indicate that the entrainment of North Atlantic waters into deep waters formed in the Southern Ocean could explain some of this change.

Eun Young Kwon of the University of California, Los Angeles, Mathis Hain of Princeton University and colleagues used ocean circulation models to assess the potential effects of changes in the location where water masses are last in contact with the surface mixed layer, a process known as ventilation. Today, much of the Atlantic sea floor is bathed by North Atlantic deep water, whereas during the glacial period, most of the deep water flowed from the south. However, if the glacial deep water was both sourced and ventilated from the Southern Ocean, like it is today, it actually raised atmospheric CO_2 concentrations. Instead, the simulations showed that the geochemical signature of the glacial bottom waters is consistent with a water mass that, although entering the basin from the south, contained a substantial proportion of water that was last ventilated in the North Atlantic.

This scenario can reconcile an increased storage of carbon in the deep ocean with an expansion of southern water masses. *AN*

TECTONICS

Slippery fractures

Earth Planet. Sci. Lett. **331–332,** 164–176 (2012)

At subduction zones, sea water and fluids released from the down-going oceanic plate can help lubricate the interface with the overriding plate, lowering friction and potentially reducing the occurrence of earthquakes. Seismic data show that a large fracture in the plate subducting beneath south-central Chile may release excessive amounts of lubricating sea water, and could help to reduce the magnitude of earthquakes there.

Yvonne Dzierma at the University of Kiel, Germany, and colleagues identified a region of rocks altered by the expulsion of fluids from a subducting slab beneath south-central Chile from seismic mapping. The purported zone of alteration correlates with a large fracture — the Valdivia Fracture Zone — in the subducting plate. This fracture zone, which stretches from the subducting slab to the surface, could collect and store large amounts of sea water from the Pacific Ocean while at the surface, and then release the fluids as it is pulled under the South American continent.

The researchers suggest that fluids from large fracture zones may reduce the seismic hazard associated with subduction, at least locally. *AW*

PLANETARY SCIENCE

Smoothed by dust

Icarus http://doi.org/hwn (2012)

Atlas is a tiny satellite of Saturn — just 39 km at its equator — with a surprisingly smooth and featureless surface. Physical modelling of charged particles indicates that the surface of Atlas is continually resurfaced by the movement of levitating dust.

Using close-up images of Atlas from the Cassini spacecraft, Naoyuki Hirata and Hideaki Miyamoto at the University of Tokyo showed that the surface of the satellite is smooth, mostly devoid of craters, and coated by fine particles. The lack of craters is particularly surprising because the A-ring, in which Atlas orbits, contains abundant debris that is expected to collide with the satellite frequently. This implies that a crater-erasing process has been active on the surface. An electrostatic analysis shows that fine dust particles, like those found on Atlas's surface, can become electrostatically unstable and subject to levitation.

The researchers propose that dust levitation allows the fine particles to migrate across Atlas's surface, coating any underlying topography. Although this process has previously been considered minor on other airless bodies, such as the Moon and asteroids, dust levitation could be a substantial mechanism of resurfacing across the dusty inner Saturnian system. *TG*

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