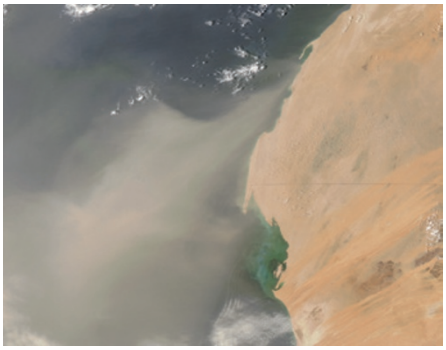
Dust and rain

J. Clim. http://doi.org/hrb (2012)



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Multidecadal variations in sea surface temperature in the North Atlantic Ocean, known as the Atlantic Multidecadal Oscillation, are associated with extreme events such as droughts, floods and hurricanes. Interactions between rainfall, dust and sea surface temperatures help to sustain the Atlantic Multidecadal Oscillation, according to an analysis of meteorological data.

Chunzai Wang of the NOAA Atlantic Oceanographic and Meteorological Laboratory, Miami, and colleagues used meteorological and dust data from the past 60 years to examine the relationship between North Atlantic sea surface temperatures, aerosols and rainfall over the Sahel. They identify a link between the warm phase of the Atlantic Multidecadal Oscillation and high rainfall in the Sahel. Increased rainfall, in turn, is accompanied by a reduction in atmospheric aerosol levels over the semi-arid regions of Africa, and a concomitant decline in the transport of dust offshore.

A reduction in dust levels over the tropical North Atlantic could warm the surface ocean, and set in motion a positive feedback between the Atlantic Multidecadal Oscillation and rainfall in the Sahel. *AA*

Cretaceous circulation

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

Unlike today, during the Cretaceous period, deepwater is thought to have formed from relatively local sources. An analysis of the geochemistry of marine sediments in the North Atlantic Ocean indicates that deepwater formation shifted to the poles, beginning about 80 million years ago towards the end of the Cretaceous.

Stuart Robinson of University College London and Derek Vance of the University of Bristol reconstructed Cretaceous deepwater circulation using neodymium isotopes — a tracer of water mass sources — preserved in Cretaceous fish teeth. They found a synchronous shift in neodymium values in the North and South Atlantic and proto-Indian oceans beginning around 80 million years ago.

The authors favour a scenario in which cooling at the poles initiated deepwater formation in the Southern Ocean, with that water flowing northwards into the Atlantic and Indian oceans. However, they caution that a unique interpretation is not yet possible given the scarcity of data from this time period. *AN*

Emissions blend

Biogeosciences **9,** 689–702 (2012)

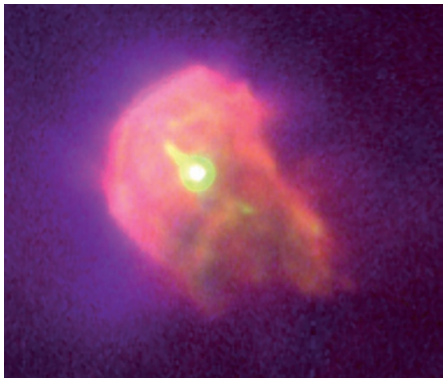
Coniferous forests release large quantities of volatile organic compounds, which stimulate the formation of new particles in the atmosphere. According to field-based measurements, the mix of chemicals released varies between trees, even in a relatively homogeneous stand.

Jaana Bäck of the University of Helsinki and colleagues sampled tree branches and air from a Scots Pine forest in Finland to determine the diversity of the volatile organic compounds emitted. The chemical composition of the compounds released varied significantly between individual trees. A cluster analysis revealed three main emissions groupings, which the researchers term chemotypes, dominated by different compounds. Levels of the compound carene dominated differences between the chemotypes. Stand history and forest thinning seemed to influence the cocktail of compounds released.

Measurements of volatiles emitted from single trees — often used to parameterize atmospheric chemistry models — may be misleading, the team argues. *AA*

Chondrules in the wind

Earth Planet. Sci. Lett. **327–328,** 61–67 (2012)



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Chondrules — spherical particles formed of molten material — are ubiquitous components of most primitive meteorites, but their origins in the early solar nebula are contested. Calculations show that the environments created by magnetic winds accelerating from protostellar disks meet many of the requirements for chondrule formation.

Raquel Salmeron and Trevor Ireland of the Australian National University estimated the acceleration that would occur in winds extending from a protostellar disk at one Earth–Sun length away from the protostar. They found that if the precursor materials of chondrules were lifted by the wind, they would be heated to the point of melting. The resulting chondrules would grow until heavy enough to drop back to the disk, where they would cool rapidly and accrete with cold matrix material to form the primitive meteorites.

This scenario can explain how the earliest materials in the solar system reached the temperatures required for melting, even though the early solar nebula was cold. It also explains the fairly uniform size of chondrules and provides a means for them to mix and accrete with unheated material. *TG*

Poorly mixed mantle

Science **335,** 1065–1069 (2012)

The mantle of the hot, early Earth is thought to have been thoroughly homogenized by vigorous convection. Isotopic data from rock samples collected in Russian Fennoscandia, however, indicate that Earth's young mantle was quite poorly mixed.

Mathieu Touboul at the University of Maryland and colleagues carried out high-precision measurements of tungsten (W) isotopes in 2.8-billion-year-old lava samples that were derived from the Earth's mantle. If the mantle was well homogenized, the isotope ^{182}W should be evenly distributed. However, the ancient lava samples contain anomalously high ^{182}W contents compared with modern mantle-derived rocks. The differing isotopic values imply that a primordial reservoir with anomalously high ^{182}W content existed within the Earth until at least 2.8 billion years ago.

These mantle reservoirs may have survived even the putative Moon-forming collision of the proto-Earth with a Mars-sized object, which is thought to have turned the Earth into a magma ocean. *AW*

Written by Anna Armstrong, Tamara Goldin, Alicia Newton and Amy Whitchurch.