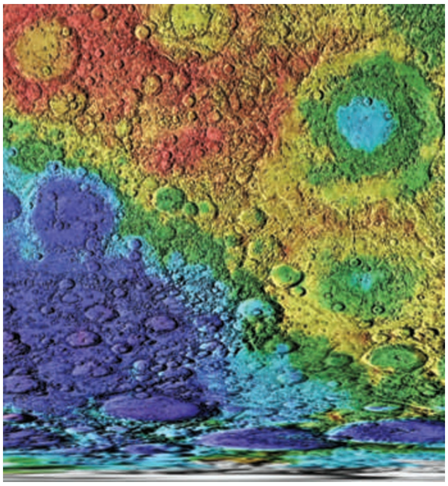
Impacts on ice

Icarus doi:10.1016/j.icarus.2009.12.012 (2010)



USGS

Water ice found on the Moon could have been delivered by impacting comets, according to a numerical model of lunar-impact events.

Simulations by Lissa Ong, of the University of Arizona, and colleagues show that the proportion of a comet's mass that becomes trapped on the Moon by its gravity depends on the speed of the impacting body. Water delivered to the Moon is thought to migrate to the lunar poles, although much of it will be lost to space weathering before reaching high latitudes. Accounting for this loss, the researchers calculate that between 0.13 and 4.3 billion metric tons of the water brought to the Moon by comets could have remained stable at the poles, for about one billion years.

These estimates largely agree with measurements of polar water ice from the Lunar Prospector mission, indicating that comets were the primary source of water to the Moon.

Wetland storms

Geophys. Res. Lett. doi:10.1029/2009GL041652 (2010)

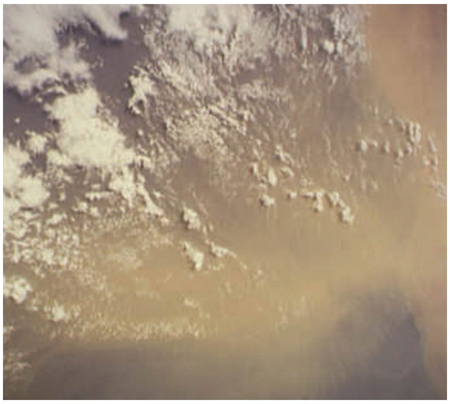
Wetlands have the potential to alter climate by releasing water and heat into the atmosphere. Two decades of climate data show that the seasonal flooding of wetlands in the Sahel increases the prevalence of regional storms.

Christopher Taylor, of the Centre for Ecology and Hydrology, Wallingford, UK, examined the effects of the seasonal formation of wetlands on the prevalence of convective storms in the area of the Niger Inland Delta. He used satellite data from 1983 to 2005 to quantify both wetland extent and cloud cover. During the wet season, rainfall in the upper catchment area of the Niger River induces flooding in the downstream delta, forming extensive wetland areas. When the wetlands are present, cloud cover increases, and the initiation of storms is 54% higher than in the dry season. Storm numbers also double in regions to the west of the wetlands.

Taylor suggests that the development of hydroelectric dams in the upper reaches of the Niger River would inhibit wetland formation, potentially reducing the incidence of convective storms, and thus rainfall, in the region.

Dusty displacement

Geophys. Res. Lett. doi:10.1029/2009GL041774 (2010)



NASA-JSC

The intertropical convergence zone is the band of precipitation that forms where the Northern and Southern Hemisphere trade winds meet. Satellite measurements show that dust storms from Africa can temporarily alter the location of the rainfall band over West Africa and the eastern North Atlantic Ocean.

Eric Wilcox and colleagues at the NASA Goddard Space Flight Center, Maryland reconstructed dust concentrations, precipitation, temperature and wind strength in the North Atlantic Ocean from nine years of satellite measurements. During the dustiest days, the location of the intertropical convergence zone was shifted north, by one to four degrees of latitude. The dust also enhanced precipitation in the northern reaches of the zone, while blocking sunlight and cooling the sea surface below.

The team attributes the effects primarily to the air mass that carries the dust off the continent. They propose that the dusty air warms the lower atmosphere in the region and alters atmospheric circulation, particularly at the northern boundary of the intertropical convergence zone.

Depressing plumes

Earth Planet. Sci. Lett. **291,** 207–214 (2010)

It is thought that before the eruption of massive volumes of lava, known as flood basalts, plumes of hot material rise from the mantle and raise the surface of the Earth. However, scattered observations have also shown surface subsidence. Numerical simulations suggest that this subsidence can be explained by the deflection of a mineralogical boundary deep in the mantle.

Wei Leng and Shijie Zhong at the University of Colorado used geophysical models to simulate the ascent of a hot plume through the mantle as it passes through a well-known shift in mineralogy located about 660 km below the Earth's surface. The simulations show that as the plume reaches the transition, it ponds temporarily beneath this boundary. The excess heat of the plume causes the boundary in the surrounding region to be deflected, which could result in subsidence at the surface.

The simulated initial subsidence occurs tens of millions of years before any surface uplift associated with the initial eruptions, a time span comparable to field observations.

Ocean-floor asymmetry

Geology **38,** 59–62 (2010)

The discovery of magnetic anomalies mirrored in lava flows on both sides of mid-ocean ridges led to the suggestion that surfaces of ocean basins are symmetric. Seismic imaging has revealed that the layers beneath actually show subtle asymmetry.

Giuliano Panza, of the University of Trieste, Italy and colleagues used seismic-wave velocities to create a three-dimensional representation of the upper 300 km of the Earth. Looking at cross sections of mid-ocean ridges in the East Pacific, mid-Atlantic and Indian oceans, they described the structure of the ocean basins and the underlying mantle. Along the western limbs of the ridges, they reported thicker lithosphere and substantially higher seismic velocities, compared with the eastern limbs of the same ridges.

Ocean-basin asymmetry could result from the westward drift of the ocean ridges — and the rigid upper layer of the Earth on which they sit — relative to the underlying mantle. This movement was previously hinted at by studies of subduction zone asymmetry.