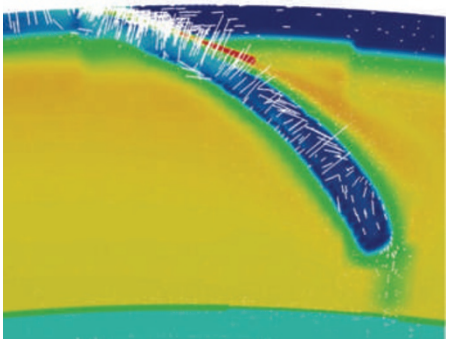
Model of plate motion

Science **329,** 1033–1038 (2010)



The pull of dense oceanic crust as it plunges into the mantle at subduction zones affects the speed of tectonic plate motion at the Earth's surface. Numerical modelling shows that this effect is a consequence of the strength of both the subducted slab and deep lower mantle.

Michael Gurnis at the California Institute of Technology and colleagues present a sophisticated numerical model of the Earth that incorporates realistic plate geometries and material properties such as rock strength. The simulation shows that if the narrow, subducting oceanic slabs are strong, they can act to guide stresses in the plate. As a strong slab descends into the mantle it will pull the surface remainder of the plate along with it, resulting in rapid plate motion. However, if the strong subducting slab embeds into a strong and therefore resistant lower mantle, plate motion will slow down.

The researchers conclude that the complex balance between the strength of the subducting oceanic plate and the strength of the underlying lower mantle affects plate tectonic motion.

Cloudy Mars

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Observations from the Mars Climate Sounder suggest that the water ice clouds that form over the martian tropics during the northern hemisphere summer are higher and thinner than previously thought.

Nicholas Heavens of the California Institute of Technology and colleagues used data retrieved from the Mars Reconnaissance Orbiter to assess the evolution of tropical clouds throughout the summer in the northern hemisphere of Mars. They found that high, thin clouds formed over the tropics early in the summer. The latitudinal extent and altitude of the clouds then increased throughout the season, reaching a maximum just before the autumn equinox. This is in contrast to the development of clouds predicted by many model simulations.

The researchers suggest that the radiative forcing associated with the height of the clouds may drive a strong and deep meridional overturning circulation in the atmosphere that has yet to be captured in simulations of the martian climate system.

Volcano amplification

Geology **38,** 771–774 (2010)

Earthquakes have been shown to be associated with volcanic eruptions. Satellite-based monitoring of volcanic activity worldwide indicates that this response depends on the orientation of the fault rupture as well as the size of the earthquake and its distance from the volcano.

Dario Delle Donne at the Università di Firenze, Italy, and colleagues compared the global heat flux from volcanoes to catalogues of seismic activity between 2000 and 2006. Regionally, 37% of volcanoes exhibited increased activity in response to an earthquake. At the global scale, seismic activity is also correlated with volcanic eruptions. The largest increase in global volcanic heat flux occurred after the 26 December 2004 Sumatra–Andaman earthquake, Indonesia. After this earthquake, volcanic activity increased by 300%. Heightened volcanic activity persisted for months.

Seismic waves alone, however, are unlikely to be sufficient to generate an eruption. Instead, earthquakes could amplify activity in volcanoes that are already in a state of unrest.

Diatom dynamics

Deep-Sea Res. II
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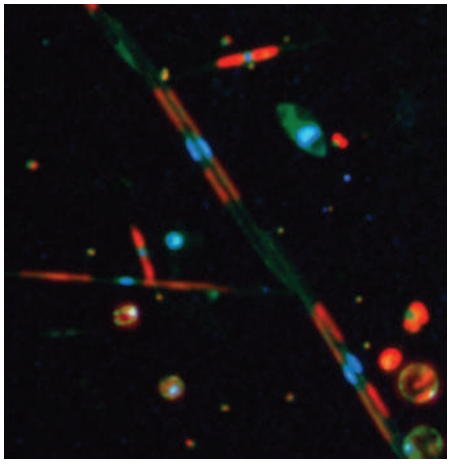

ANDREW TAYLOR

Despite high levels of nutrients such as nitrate and phosphate, the level of primary production in the eastern equatorial Pacific Ocean is relatively low. Microcosm experiments suggest that iron and silicon co-limit phytoplankton in the region.

Mark Brzezinski of the University of California, Santa Barbara, and colleagues examined the impact of silicon and iron additions on the growth of diatoms — one of the most common types of phytoplankton — in the surface waters of the eastern equatorial Pacific. The addition of silicon increased the total amount of silica produced by the organisms, and doubled the silica content of small, abundant diatoms. The addition of iron, however, stimulated the production of organic matter and led to the growth of larger, initially rare, diatom species. The increased growth following the addition of iron also led to the drawdown of nutrients such as nitrate.

The researchers suggest that in the eastern equatorial Pacific, silicon regulates diatom silicification, and thus cell wall formation, whereas iron regulates diatom production, community composition and growth.

Snow and warming

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According to a numerical simulation, reductions in terrestrial snow cover over the twenty-first century could contribute significantly to the warming of the Northern Hemisphere. Snow can alter surface temperatures and atmospheric circulation because it is highly reflective to solar radiation and insulates the ground below.

Michael Alexander of the Earth System Research Laboratory, Colorado, and colleagues simulated the impact of projected reductions in terrestrial snow cover on climate at the end of this century using a coupled climate model. Both the absorption of solar radiation at the surface, and the flux of heat to the overlying atmosphere, increased in response to a reduction in snow cover. The resultant rise in surface air temperatures was small at a local level — less than 3 °C — but was manifest at a continental scale. The warming associated with the decline in snow cover contributed significantly to warming in Eurasia and North America, particularly during spring and autumn.

The loss of snow also elicited remote atmospheric responses in the simulations, which varied by location and season.