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RESEARCH SPOTLIGHT

Highlighting exciting new research from AGU journals

Gullies on Mars indicate presence of liquid water

Present-day conditions on Mars were thought to prevent water from existing as a liquid on the planet's surface, but recent studies have pointed to the existence of liquid water. Now observations of gully activity on Mars provide further indications of the presense of transient liquid water.

Reiss et al. studied images of the Russell crater dune field on Mars taken by the High Resolution Imaging Science Experiment (HiRISE) from November 2006 to May 2009. They observed that the length of a 2-meter-wide gully channel had increased by about 50 meters in 1 year and about 120 meters in 2 years. On the basis of the morphology of the channel and other factors, the researchers believe that these changes in the length of the gully are best explained by erosional processes triggered by the melting of small amounts of water ice. This adds to the growing body of evidence that transient liquid water can exist on Mars. (*Geophysical Research Letters*, doi:10.1029/2009GL042192, 2010)

NASA/JPL/University of Arizona

Gullies on the dunes of Russell Crater.

Modeling groundwater age in large aquifer systems

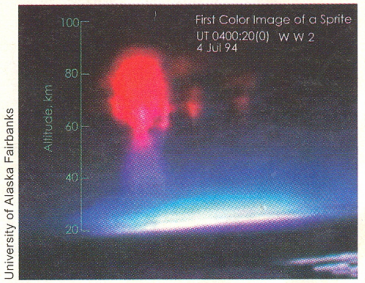
Groundwater age, the amount of time groundwater has been in an aquifer, is important because the length of time water spends in an aquifer can influence many geologic processes. However, determining groundwater age—which can be as short as a few days or as long as thousands of years—can be complicated because groundwater basins are large and complex and groundwater age distribution is affected by mixing and transport of different parcels of water.

Hydraulic conductivity (the ease with which water can move through the ground) and porosity (the fraction of pore space available for water to flow) have been observed to vary with depth, but these factors generally have not been taken into account in groundwater age models. *Jiang et al.* conducted a numerical simulation to study the age distribution of groundwater in complicated flow systems. The researchers show that the age of groundwater in the basin is influenced by depth-dependent hydraulic conductivity and porosity. Their model indicates that groundwater age distribution is more heterogeneous than had been thought. The study should help scientists interpret complex age distributions of groundwater in large aquifer systems. (*Geophysical Research Letters*, doi:10.1029/2010GL042387, 2010)

Explaining strange features of sprite lightning

A sprite is an electrical discharge similar to lightning, but it occurs in the upper atmosphere (at altitudes of 50–90 kilometers), above large thunderstorms. These large flashes of light, which are triggered in almost all cases by a rare lightning form in which positive charge is held at the top of clouds rather than the ground, can span tens of kilometers of altitude.

Sprites were first photographed in 1989. High-speed videos in recent years show that they always start in the ionosphere (sometimes out of a wide saucer-shaped halo) and first shoot downward in the form of long ionized filaments called streamers; sometimes they shoot up again later. The downward streamers are bright at their growing tips, and the channel is first dark and becomes bright again after some distance. While observations continue, many features of sprites remain unexplained.



University of Alaska Fairbanks

First color image of a sprite.

To shed light on some of the characteristics of sprites, *Luque and Ebert* developed simulations that, unlike previous models, included variations in air density along the length of sprite streamers. The results help scientists to better understand some previously unexplained observations associated with sprites, such as light emission from the streamer trail, the emergence of negatively charged upward propagating streamers, the increase in light emissions from the streamer head with air density, and changes in streamer speed. (*Geophysical Research Letters*, doi:10.1029/2009GL041982, 2010)

—ERNIE TRETKOFF, Staff Writer