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RESEARCH SPOTLIGHT

Highlighting exciting new research from AGU journals

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Chlorine radicals measured in Eyjafjallajökull volcanic plume

When the Icelandic volcano Eyjafjallajökull erupted in spring 2010, it disrupted commercial air travel, stranding passengers across Europe and beyond. In response to the lack of information on the volcanic ash load and dispersion, scientific instruments were deployed on a number of special flights to observe the composition and chemistry of the volcanic plume and included three deployments aboard a Lufthansa aircraft of the Civil Aircraft for the Regular Investigation of the Atmosphere Based on an Instrument Container (CARIBIC) observational instrument package. *Baker et al.* report on the first observation-based estimates of chlorine radical concentrations in the volcanic plume. Previous studies had suggested that chlorine radicals could exist in volcanic plumes. This study, the first to identify chlorine radical chemistry and quantify chlorine radicals in a volcanic plume, will help researchers to more fully understand volcanic chemistry, particularly halogen chemistry, and its effects on the atmosphere. (*Geophysical Research Letters*, doi:10.1029/2011GL047571, 2011) —EB

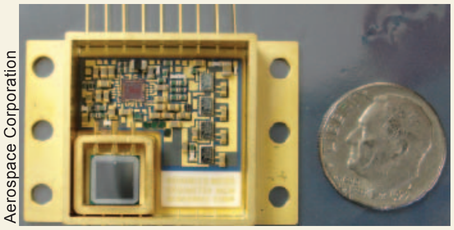
NASA/MODIS/Jeff Schmaltz

Ash from Eyjafjallajökull volcano was found to contain chlorine radicals, according to a new study.

Miniature detector measures deep space radiation

The 1972 journey of Apollo 17 marked not only the last time a human walked on the Moon but also the most recent manned venture beyond the outer reaches of the Earth's atmosphere. With preparations being made for humans to once again explore deep space, important steps are under way to quantify the hazards of leaving low-Earth orbit. One significant risk for long-distance missions is the increased exposure to ionizing radiation—energetic particles that can strip electrons off of otherwise neutral materials, affecting human health and the functioning of spacecraft equipment. The deep space probes that are being sent to measure the risks from ionizing radiation and other hazards can be costly, so maximizing the scientific value of each launch is important.

With this goal in mind, *Mazur et al.* designed and developed a miniature dosimeter that was sent into lunar orbit aboard NASA's Lunar Reconnaissance Orbiter (LRO) in 2009. Weighing only 20 grams, the detector is able to measure fluctuations in ionizing radiation as low as 1 microrad (equivalent to 1.0×10^{-8} joules of energy deposited into 1 kilogram) while requiring minimal power and computer processing. The postage stamp–sized detector tracked radiation dosages for the first year of LRO's mission, with the results being confirmed by other onboard and near-Earth detectors.



Aerospace Corporation

A new microdosimeter, with its minimal space and power requirements, makes detailed measurements of ionizing radiation with its 5-square-millimeter silicon detector.

The authors found that ionizing radiation levels were 30% lower in lunar orbit than when the spacecraft was in transit, with a total dosage roughly 22 times the annual background rate on Earth. They suggest that their detector, with its small footprint and low power demand, could be a staple for future deep space missions. (*Space Weather,* doi:10.1029/2010SW000641, 2011) —CS

Ozone depletion leading force for Southern Ocean change

Previous studies have suggested that key aspects of the Southern Ocean are affected by elevated atmospheric carbon dioxide levels. Increasing greenhouse gas (GHG) concentrations, which strengthen surface winds over much of the Southern Ocean, may increase flow rates in the Antarctic Circumpolar Current (ACC), induce a temperature disparity between the northern and central Southern Ocean, and affect the strength of the meridional ocean circulation (MOC). But GHGs are not the only set of compounds arising from human activity that can trigger these changes. Stratospheric ozone depletion due to such ozone-depleting substances (ODSs) as chlorofluorocarbons, whose production and use were heavily regulated by the 1987 Montreal Protocol, results in similar changes.

Using an atmosphere-ocean coupled general circulation model that allows for detailed calculations of stratospheric chemistry, *Sigmond et al.* simulated past and future changes for the Southern Ocean due to both GHGs and ODSs. Their model calculations suggest that ODSs, which peaked in concentration in 1995, will be the dominant driver of changes in ACC until the second quarter of the 21st century, at which point the monotonically increasing GHG levels will take over. Further, they found that the peak impact of ODSs on ACC will occur a few decades after their peak concentration. The authors suggest that future research needs to take into account the effects of ozone depletion—something not ordinarily done in investigations of Southern Ocean behavior. (*Geophysical Research Letters,* doi:10.1029/2011GL047120, 2011) —CS

—Ernie Balcerak and Colin Schultz, Staff Writers