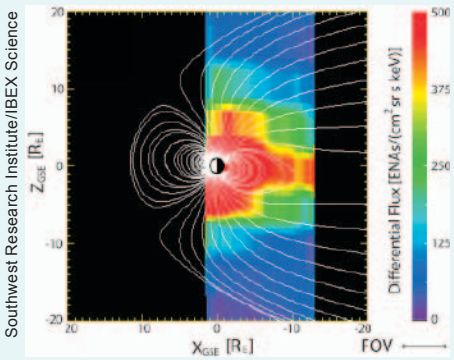
RESEARCH SPOTLIGHT

Highlighting exciting new research from AGU journals

First images of Earth's plasma sheet

New images from the Interstellar Boundary Explorer (IBEX) mission capture for the first time part of Earth's magnetosphere. The new observations, described by *McComas et al.*, provide the first images of the extended terrestrial plasma sheet, the sheet separating the north and south lobes of the magnetosphere. The plasma sheet cannot be seen in images in visible light; the IBEX images were created using detections of energetic neutral atoms. One of the images captured what appears to be a magnetic disconnection event, in which magnetic field lines tear and part of the plasma sheet pinches off from the rest. These types of disconnections release energy and can cause charged particles to be accelerated toward Earth, potentially disrupting satellites. This is the first time that a plasma sheet disconnection event may have been directly seen. (*Journal of Geophysical Research-Space Physics*, doi:10.1029/2010JA016138, 2011)



The white lines show a model of where magnetic field lines are expected in Earth's magnetic atmosphere. The bright red colors show the densest part of the plasma sheet as imaged by IBEX.

What can opals tell us about past climate?

New insight into the mechanisms that caused Earth's glacial periods to abruptly end could come from opal accumulations in sediment cores. Previous studies have shown that the most recent glacial period ended when the Southern Hemisphere's westerly winds intensified and shifted southward; this change in the winds led to increased upwelling that stirred up carbon dioxide in the Southern Ocean, leading to a rise in atmospheric carbon dioxide and warming through the greenhouse effect. The upwelled water from the Southern Ocean also would have traveled to the equatorial zones, where the added nutrient-rich water would have enabled increased production of opal shells by diatoms. These opal shells would accumulate in the sediment.

To search for evidence that a change in Southern Hemisphere westerly winds also occurred during several earlier glacial terminations, *Hayes et al.* measured opal accumulations in sediment cores from the eastern and central equatorial Pacific Ocean. The core from the eastern equatorial Pacific covered the past three glacial terminations; the central Pacific core covered the past five deglaciations.

The results were mixed. The researchers found evidence of increased opal accumulation during some, but not all, of the glacial terminations. There was also evidence of increased opal accumulations at times not associated with glacial terminations. The researchers suggest that a combination of opal fluxes and other measurements could provide a better signature of the mechanism of deglaciation. They also suggest that it is possible that different glacial terminations occurred through different processes. (*Paleoceanography*, doi:10.1029/2010PA002008, 2011)

Antarctic and Greenland ice sheet melting accelerating

The Antarctic and Greenland ice sheets are melting at an accelerating pace, a new study shows. *Rignot et al.* present a record of the mass balance of these polar ice sheets using two methods. One method measures ice sheet mass using gravity data from the Gravity Recovery and Climate Experiment (GRACE) satellite; the other method calculates ice lost at the ice sheet perimeter using atmospheric climate model data and measurements of ice thickness and ice motion, measured with airborne radio echo sounding and interferometric synthetic aperture radar (InSAR) data, respectively, from several satellites. The authors reconciled the two methods and found good agreement.

The researchers found that in 2006, these ice sheets were losing mass at a combined rate of about 475 gigatons per year, which is equivalent to about 1.3 millimeters per year of sea level rise. Furthermore, the rate of ice loss is accelerating, with a combined total acceleration of about 36 gigatons per year per year. They note that this rate of acceleration is 3 times greater than the acceleration of ice mass loss for mountain glaciers and ice caps. If the trend continues, the "ice sheets will be the dominant contributor to sea level rise in the 21st century," the authors report. (*Geophysical Research Letters,* doi:10.1029/2011GL046583, 2011)


NASA/GRACE team/DLR/Ben Holt Sr.

Melt from the Antarctic ice sheet, pictured here, could become a significant source of 21st century sea level rise.

—Ernie Tretkoff, Staff Writer