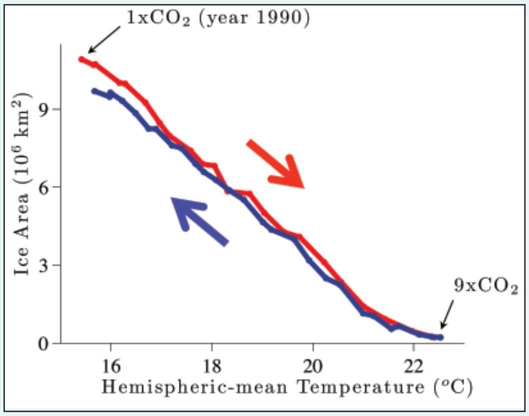
RESEARCH SPOTLIGHT

Highlighting exciting new research from AGU journals

Study suggests Arctic sea ice loss not irreversible

The Arctic has been losing sea ice as Earth's climate warms, and some studies have suggested that the Arctic could reach a tipping point, beyond which ice would not recover even if global temperatures cooled down again. However, a new study by *Armour et al.* that uses a state-of-the-art atmosphere-ocean global climate model found no evidence of such irreversibility. In their simulations, the researchers increased atmospheric carbon dioxide levels until Arctic sea ice disappeared year-round and then watched what happened as global temperatures were then decreased. They found that sea ice steadily recovered as global temperatures dropped. An implication of this result is that future sea ice loss will occur only as long as global temperatures continue to rise.



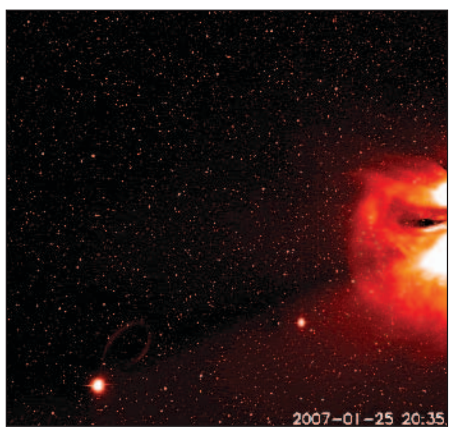
Northern Hemisphere sea ice area and hemispheric-mean temperature, both plotted as 10-year means, when CO_2 is increased (red) and then decreased (blue) in a state-of-the-art climate model. The simulations show no evidence of irreversible sea ice loss.

(*Geophysical Research Letters,* doi:10.1029/2011GL048739, 2011) —EB

Predicting space climate change

Galactic cosmic rays and solar energetic particles can be hazardous to humans in space, damage spacecraft and satellites, pose threats to aircraft electronics, and expose aircrew and passengers to radiation. A new study shows that these threats are likely to increase in coming years as the Sun approaches the end of the period of high solar activity known as "grand solar maximum," which has persisted through the past several decades. High solar activity can help protect the Earth by repelling incoming galactic cosmic rays.

Understanding the past record can help scientists predict future conditions. *Barnard et al.* analyzed a 9300-year record of galactic cosmic ray and solar activity based on cosmogenic isotopes in ice cores as well as on neutron monitor data. They used this to predict future variations in galactic cosmic ray flux, near-Earth interplanetary magnetic field, sunspot number, and probability of large solar energetic particle events. The researchers found that the risk of space weather radiation events will likely increase noticeably over the next century compared with recent decades and that lower solar activity will lead to increased galactic cosmic ray levels. (*Geophysical Research Letters*, doi:10.1029/2011GL048489, 2011) —EB



SECCHI-HI instrument team

A coronal mass ejection imaged by the Solar Terrestrial Relations Observatory (STEREO) A spacecraft about to pass by Mercury and Venus. Barnard et al. *show that although such events are likely to become rarer in the future, those that do occur could generate much greater fluxes of hazardous energetic particles.*

How ocean ridges affect large-scale ocean circulation

Driving the flow of heat and nutrients around the ocean is the meridional overturning circulation, a large-scale current system that in the Atlantic Ocean carries warm surface waters northward and cold, dense water to the south along the bottom of the ocean. An important leg of this journey is the conversion of light warm water into North Atlantic Deep Water (NADW), which occurs along the coasts of Greenland and Labrador, Canada. The temperature and density profile of the ocean is important for climate and ecological systems, so understanding any physical features that may impinge on the properties of NADW, such as ocean ridges, is particularly important.

Using experiments in a laboratory water tank, *Stewart et al.* identified how a ridge could affect the circulation patterns in a model ocean. The authors imposed temperature and heat flux gradients on the surface of the ocean analogue and tracked how differences in ridge size, shape, and location affected the temperature and density stratification. They found that when the ridge is sufficiently shallow, such that the depth of the water between the top of the ridge and the surface of the ocean is less than twice as deep as the ocean thermocline—a near-surface band of the ocean in which water temperature decreases rapidly with depth—the ridge can significantly affect downstream properties. The authors found that when the deep water is forced up and over a shallow ridge, it tends to mix with