

Research and Analysis Program

National Aeronautics and
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New Earth Discoveries 2019

The Earth Science Division's Research & Analysis Program combines observations from space, airborne and ground-based systems with modeling and data analysis to teach us new things about the Earth every day.

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Climate change spells trouble for species that depend on snow cover for warmth

Although typically associated with warming, climate change is predicted to make winters much colder for certain niche species. The subnivium—the interface between snowpack and the ground—is an important seasonal refuge for diverse species when extreme winter temperatures make the surface uninhabitable. New NASA research shows climate change is expected to drastically shorten the subnivium's duration from 126 days to 110 days in the mid-latitudes. This shortened period will force vulnerable species back out into the harsher surface environment before they're ready.

Ocean surface salinity measurements help improve rainfall predictions on land

The ocean, which makes up 97% of all water on Earth, is the ultimate source of all precipitation on land. A new NASA study explores this connection further, using data from the Soil Moisture Active-Passive (SMAP) satellite to examine the connection between sea surface salinity and rainfall in the southwestern United States. The study found that abnormally salty (more evaporation) or fresh (more precipitation) patches of the ocean can be used to predict rainfall on land one season ahead. Therefore, incorporating salinity data into models can improve forecasts necessary for managing water resources.

Observed slowdown in CFC-11 decline suggests global emissions have increased

Trichlorofluoromethane (CFC-11) is a potent greenhouse gas, which countries agreed to begin phasing out in 2010. However, recent observations from NASA, NOAA, Korea, and Japan have shown a notable slowdown in the decline of CFC-11 over eastern Asia. Models point to emissions from eastern mainland China, which were more than 3 gigagrams per year higher from 2014 to 2017 than they were from 2008 to 2012. This increase accounts for 40% to 60% of the global rise in CFC-11 emissions.

Taking a volcano's temperature from space

NASA scientists have developed a first-of-its-kind ASTER Volcanic Thermal Output Database to identify and collect data on volcanic thermal output over large areas. Of the 330 potentially active volcanoes catalogued, 88 were found to have some type of volcanic thermal feature, including 16 that had never before been detected from space. The database will provide new insight into volcanic activity, including a data-driven approach to improving space-based volcanic monitoring.

Declining spring snow cover in the Northern Hemisphere

Persistent changes to regional snowpack in a changing climate can have disruptive societal and economic impacts, including on water supply, agriculture, and flooding. A new study using NASA data found that the Northern Hemisphere has been experiencing declines in spring snow cover since the mid-1980s as a response to recent warming. Current limitations within existing satellite systems inhibit our ability to accurately monitor snow cover trends in mountainous regions, making the severity of these trends unclear.

Cold water currently slowing the fastest-thinning Greenland glacier

Measurements taken during two different NASA campaigns show the Jakobshavn Glacier, which has been Greenland's fastest-flowing and fastest-thinning glacier for the past 20 years, is now flowing more slowly, thickening, and advancing toward the ocean instead of retreating farther inland. Researchers concluded the slowdown occurred due to cooler ocean currents since 2016. Water temperatures near the glacier are now colder than they have been since the mid-1980s.

Winter carbon emissions shift permafrost region from a sink to a source

NASA data show the circumpolar boreal-Arctic region is a significant net source of carbon. CO₂ emissions from microbial decomposition in the winter are currently outpacing the uptake of CO₂ of plants in the summer. The results also indicate that enhanced loss of soil-based CO₂ due to future winter warming will increasingly exceed carbon uptake during the growing season. These significant winter emissions are currently not included in Earth system models nor in IPCC assessments, which could have a large impact on global climate predictions.

When zooplankton migrate, they take carbon with them

Zooplankton that live below 200m depth make a daily migration up to the upper layers of the ocean at night, and back down to the mesopelagic zone (200-1000m depth) during the day. The effect of this vertical migration on carbon transport is still largely unquantified. NASA observations during the NAAMES campaign informed new models that show how vertical migration is a significant contributor of carbon export out of upper part of the ocean – about 16% of total global export, and even more in the subtropics.