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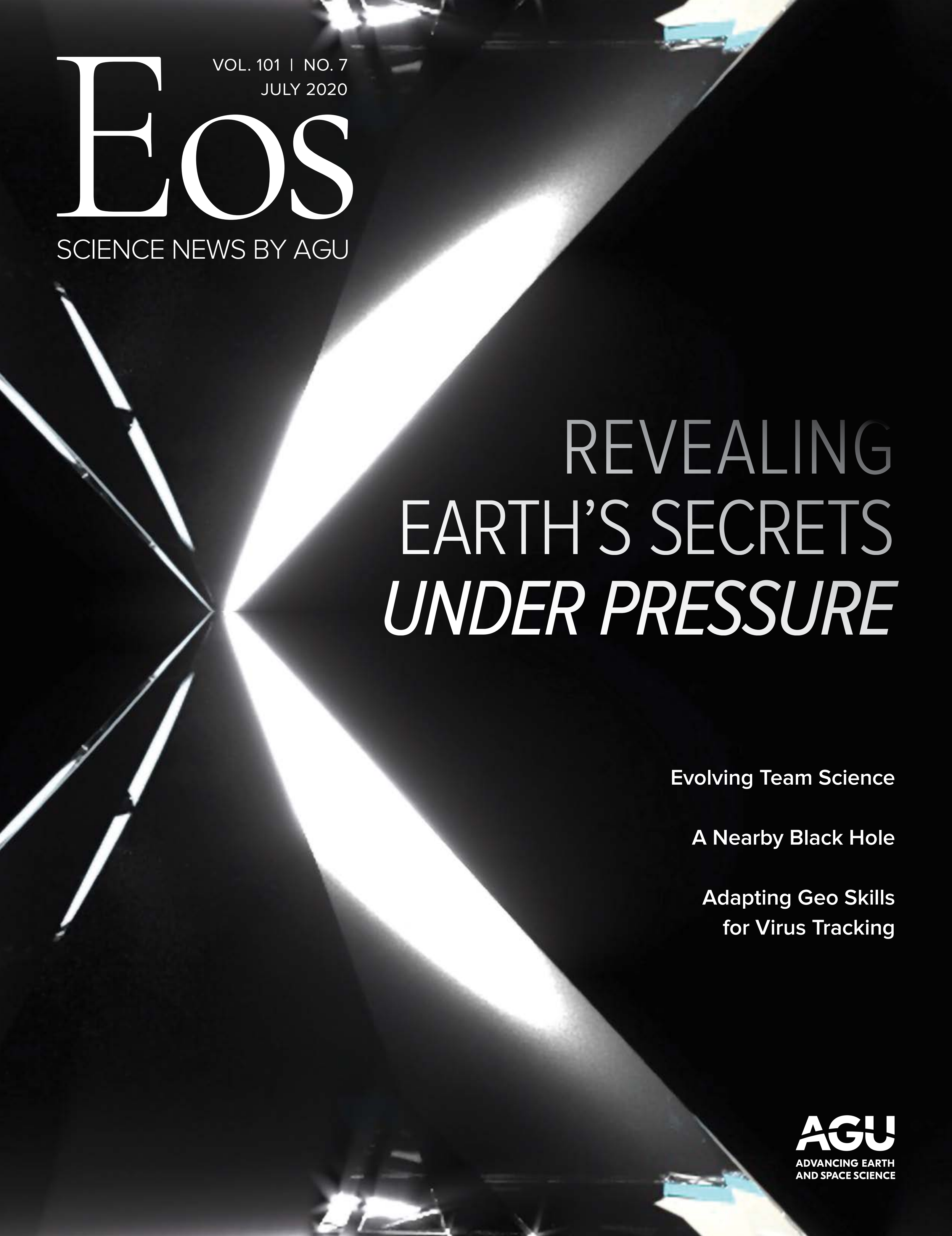

REVEALING EARTH'S SECRETS *UNDER PRESSURE*

Evolving Team Science

A Nearby Black Hole

Adapting Geo Skills for Virus Tracking

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ADVANCING EARTH AND SPACE SCIENCE

Arctic Plankton Populations Vary by Season

As temperatures rise, sea ice melts, and the ocean's chemistry undergoes significant changes in pH and salinity, predicting the downstream ecological effects of these changes is challenging, particularly in areas like the Arctic, where change is occurring quickly. Scientists often turn to planktonic species to glean insights into ecosystem health. These keystone species constitute the basis of the food web in the region and are especially sensitive to changes in the water.

In a new study, *Ofstad et al.* collected plankton samples in the spring and summer of 2016 from the Barents Sea, located north of Scandinavia and western Russia. The researchers focused on the Bjørnøyrenna crater area, which contains several methane seeps that release gas into the water, to survey how concentrations and species diversity of planktonic foraminifera (forams), as well as of the planktonic sea snail *Limacina helicina,* vary over time and in the presence of methane.

The results showed a clear seasonal signal, with populations of both living planktonic forams and *Limacina helicina* growing by an order or more of magnitude and increasing in size as spring progressed to summer. In summer, the foram community is more diverse, with the added presence of subtropical species.

To understand how methane in the water column might affect the forams—through their consumption of carbon from methanotrophic bacteria, for example—the scientists looked at isotopic ratios of carbon and oxygen in the organisms' rigid calcium carbonate shells. However, they found no evidence that the elevated methane levels in the water had a direct impact on the animals. That's not to say that the seeping methane has no effect at all: The researchers hypothesize that it could enhance primary production in the water column indirectly by, for example, carrying nutrients toward the ocean surface or increasing carbon dioxide levels in the water. Such fertilizing could have an effect on a regional scale, potentially drawing in increased numbers of other organisms—a topic that the team concludes should be studied in the future. (*Journal of Geophysical Research: Biogeosciences,* https://doi.org/10.1029/2019JG005387, 2020) **—David Shultz,** *Science Writer*

Researchers surveyed populations of the planktonic sea snail Limacina helicina *and planktonic foraminifera in part of the Barents Sea to assess how concentrations and species diversity of the organisms varied over time and whether they are affected by nearby methane seeps. Credit: Katsunori Kimoto*

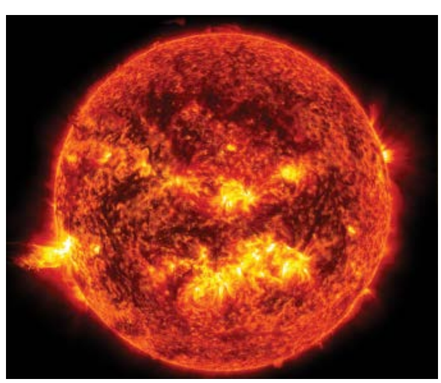
How Accurate Are Our Measurements of the Sun's Energy?

At first glance, the Sun's burning heat seems to be unvarying. To explain the differences we experience, we tend to point to cloud cover, humidity, or the dynamics of our atmosphere. However, as the Sun progresses through its 11-year cycle of activity and quiet, as well as its 27-day rotation, the radiation it bestows on Earth changes.

An instrument called the Spectral Irradiance Monitor (SIM) aboard the Solar Radiation and Climate Experiment (SORCE) satellite monitors how much solar energy bathes Earth across a range of wavelengths from the ultraviolet to the near infrared. Knowing the distribution of solar energy across this spectrum can help scientists track where on Earth this energy is absorbed, a key factor in climate change estimates. However, exposure to harsh solar radiation at shorter wavelengths causes the satellite's instruments to degrade, meaning researchers must adjust for the aging equipment to keep recording accurate measurements.

In pursuit of this accuracy, *Mauceri et al.* compared three methods of correcting SORCE SIM measurements: SIM version 25, Multiple Same-Irradiance-Level, and SIM constrained version 2 (SIMc V2). They then compared the results of these corrective methods with four independent measurements of solar energy and with two solar energy models.

The researchers found that solar energy measurements from the three correction methods matched most closely for—and were therefore most accurate for—visible light wavelengths. They also observed some surprising variation in near-infrared wavelengths, where instrument degradation is small and thus a high level of agreement between the three methods was expected. The discrepancy may be a result of artifacts from corrections made for shorter wavelengths.



During the 11-year solar activity cycle, the radiation emitted by the Sun (seen here in June 2013) varies depending on wavelength. Credit: NASA Goddard Space Flight Center

The team found the greatest variation among measurements at high-energy ultraviolet wavelengths, which also cause the most damage to the instruments. Earth is more sensitive to variations in the amount of ultraviolet radiation it receives than to variations of other wavelengths. To ensure accurate climate models, future correction methods must thus maintain accurate short-wavelength observations. Of the three correction methods for SORCE SIM data, the researchers recommend SIMc V2 for most applications, but they noted that continued research and development are still needed. (Earth and Space Science, https://doi.org/10.1029/2019EA001002, 2020) **—Elizabeth Thompson,** *Science Writer*