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## NEWS

# One-Pixel Views Show Earth as an Exoplanet



An image of Earth captured by the DSCOVR satellite. Credit: NASA/DSCOVR

**W**hen Al Gore, then U.S. vice president, originally proposed the Deep Space Climate Observatory (DSCOVR) satellite in 1998, he hoped that its detailed images of the Earth's surface would inspire the public. They have, and now scientists are finding a novel use for these satellite observations that Gore probably never imagined: studying exoplanets. By averaging thousands of high-resolution DSCOVR images down to just one pixel each, a team of scientists was able to determine how the Earth's average color varies over a year. The team also compared the data with models of the Earth to reveal how environmental conditions like clouds and snow modulate the appearance of distant exoplanets. These results were presented in January at the 233rd Meeting of the American Astronomical Society, held in Seattle, Wash.

### Smashing the Data

Aronne Merrelli, an atmospheric scientist at the Space Science and Engineering Center at the University of Wisconsin-Madison, and his colleagues collected over 5,000 images of the sunlit side of the Earth taken in 2016 by the Earth Polychromatic Imaging Camera (EPIC) on board DSCOVR. The researchers repurposed

these EPIC data, which were originally intended to reveal information about the planet's ozone levels, aerosols suspended in the atmosphere, clouds, and vegetation. "We just smash it down to one pixel," said Merrelli of the data spanning the ultraviolet, visible, and infrared. "We're throwing away a lot of information." This single-pixel view of the Earth is similar to the resolution scientists have of distant planets orbiting other stars, said Merrelli. "You can mimic what Earth might look like from very far away."

The researchers—a mix of Earth scientists and astronomers—then examined how the planet's average color varied over seasons. They found that Earth tended to be redder from June through September, probably because of the increase in vegetation in the Northern Hemisphere and a reduction in snow cover.

### The Importance of Clouds

Merrelli and his team also compared the EPIC observations with a model of the Earth's surface with its current configuration of landmasses and oceans and varying amounts of clouds, snow, and sea ice. These simulations allowed the scientists to determine the impact of dynamic environmental conditions on the planet's color. They found that clouds played a large role in dictating the planet's average color.

Drake Deming, an astronomer at the University of Maryland not involved in the research, said, "This type of investigation definitely lays the groundwork for imaging of Earth-like exoplanets."

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