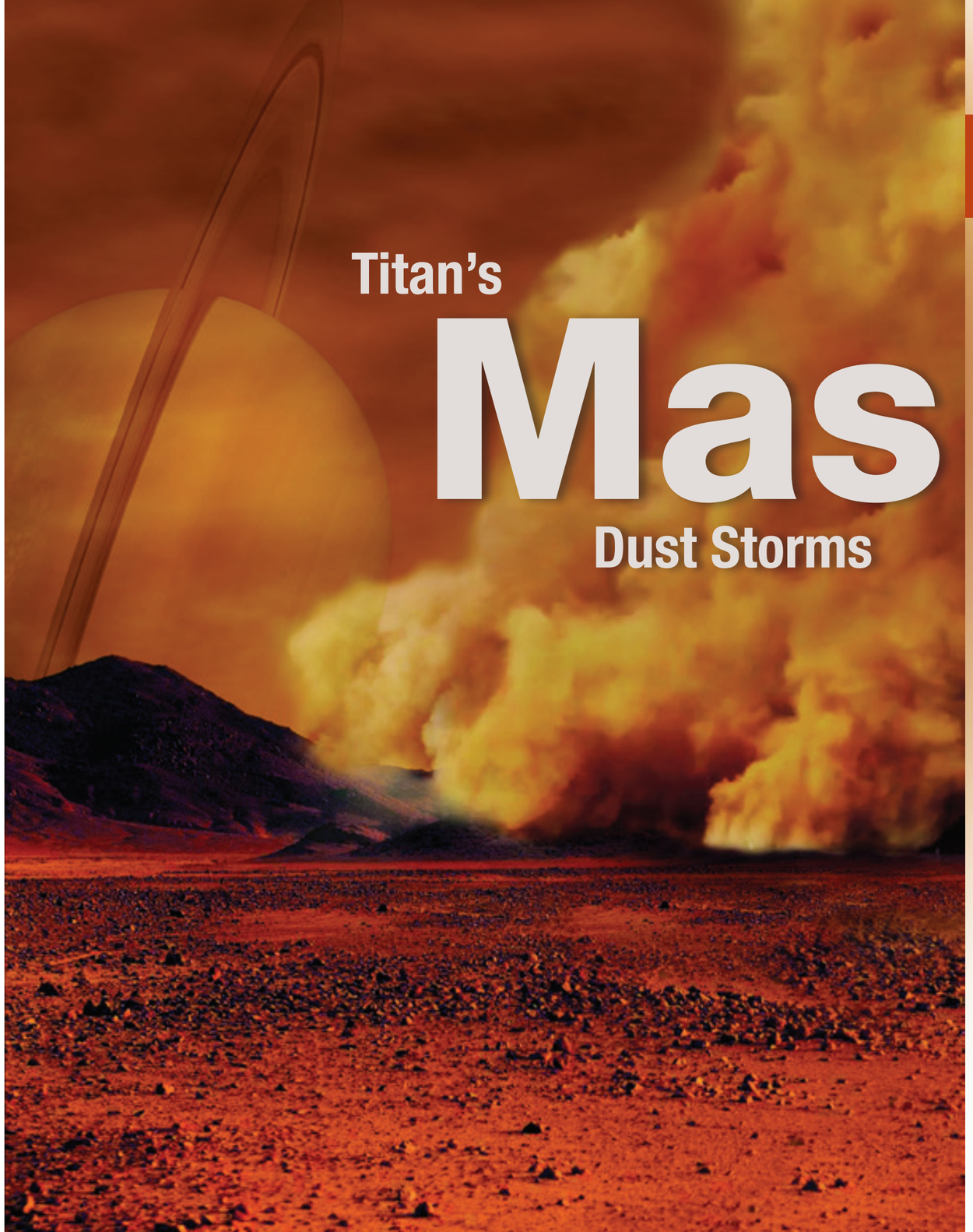

Titan's Massive Dust Storms

Data from NASA's Cassini spacecraft revealed in the fall of 2018 what appear to be giant dust storms in equatorial regions of Saturn's moon Titan. The discovery makes Titan the third solar system body, in addition to Earth and Mars, where dust storms have been observed.

"Titan is a very active moon," says Sébastien Rodriguez, an astronomer at the Université Paris Diderot in France and one of the lead researchers in this discovery. "We already know about its geology and exotic hydrocarbon cycle. Now we can add another analogy with Earth and Mars: the active dust cycle, in which organic dust can be raised from large dune fields around Titan's equator."

Titan is an intriguing world, in ways quite similar to Earth. In fact, it is the only moon in the solar system with a substantial atmosphere and the only celestial body other than our planet where stable bodies of surface liquid are known to still exist.

There is one big difference, though: on Earth such rivers, lakes, and seas are filled with water, while on Titan it is primarily methane and ethane that flow through these liquid reservoirs. In this unique cycle, the hydrocarbon molecules evaporate, condense into clouds, and rain back onto the ground.

The weather on Titan varies from season to season as well, just as it does on Earth. In particular, around the equinox (the time when the sun crosses Titan's equator) massive clouds can form in tropical regions and cause powerful methane storms. Cassini observed such storms during several of its Titan flybys.

When Rodriguez and his team first spotted three unusual equatorial brightenings in infrared images taken by Cassini around the moon's 2009 northern equinox, they thought they might be the same kind of methane clouds; however, an investigation revealed they were something completely different.

"From what we know about cloud formation on Titan, we can say that such methane clouds in this area and in this time of the year are not physically possible," says Rodriguez. The researchers were also able to rule out frozen methane rain or icy lavas. Modeling showed that the features must be atmospheric but still close to the surface and most likely forming a very thin layer of tiny solid organic particles. Since they were located right over the dune fields around Titan's equator, the only remaining explanation was that the spots were actually clouds of dust raised from the dunes.

Organic dust is formed when organic molecules, arising from the interaction of sunlight with methane, grow large enough to fall to the surface. "The near-surface wind speeds required to raise such an amount of dust as we see in these dust storms would have to be very strong," says Rodriguez. The existence of such strong winds generating massive dust storms implies that the underlying sand can be set in motion, too, and that the giant dunes covering Titan's equatorial regions are still active and continually changing.

Rodriguez notes that the winds could be transporting the dust raised from the dunes across large distances, contributing to the global cycle of organic dust on Titan and causing similar effects to those that can be observed on Earth and Mars.

The results were obtained with Cassini's Visual and Infrared Mapping Spectrometer. The Cassini-Huygens mission is a cooperative project of NASA, ESA (European Space Agency), and the Italian Space Agency. The Jet Propulsion Laboratory is managed for NASA by Caltech; JPL manages the Cassini-Huygens mission for NASA's Science Mission Directorate in Washington. JPL designed, developed, and assembled the Cassini orbiter. The radar instrument was built by JPL and the Italian Space Agency, working with team members from the U.S. and several European countries. The Cassini spacecraft deliberately plunged into Saturn on September 15, 2017, ending its nearly 20-year mission.

For more information about Cassini, visit **nasa.gov/cassini** and **saturn.jpl.nasa.gov**