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Searching for Lightning's Signature on Venus



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Cloud-to-cloud lightning on Earth. Could such flashes be detected on Venus?

Venus—Earth's closest sibling—is a hellish planet with surface temperatures that regularly reach 460°C and an atmosphere that bears down with nearly 100 times the pressure at Earth's surface. Sulfuric acid haze laces its carbon dioxide atmosphere. But whether to add lightning into the mix of inhospitable ingredients remains controversial.

The debate began in December 1978 when the Soviet Venera 11 and 12 probes descended into Venus's atmosphere and detected a large number of electromagnetic pulses that could have been produced by remote lightning. That same month, the Pioneer Venus Orbiter detected “whistlers,” electromagnetic pulses created by lightning strikes that echo their name. But the findings were questioned when flybys by the Galileo and Cassini probes failed to detect lightning's distinctive radio static in the 1990s. The evidence took another zigzag in 2007 when the Venus Express Orbiter once again appeared to detect whistlers.

Still, most scientists claim that only detectable emissions of lightning from the nightside of Venus would be unambiguous proof of the electromagnetic discharge. So Pérez-Invernón *et al.* built a model that could predict any lightning signatures and analyze whether they might

be detectable by the various probes currently keeping a watchful eye on the planet. Modeling the lightning on Venus, however, is no easy feat. Venus's atmosphere lacks the vigorous vertical convection that leads to lightning on Earth. It also lacks the water clouds. Instead, lightning—if it exists at all—likely jumps between the sulfuric acid clouds in an atmospheric band that ranges from 40 to 65 kilometers in height.

The authors suggest that one way to detect lightning on Venus is to look far above the lightning itself and observe enhanced glows at around 100-kilometer altitude. On Earth these enhancements can also be spotted from orbit. In fact, they were first spotted by the space shuttle *Discovery* in October 1990 when the astronauts saw a sequence of sudden brightenings in coincidence with the lightning flashes. The team's new model shows that the Lightning and Airglow Camera (LAC) on board the Japanese Venus Climate Orbiter could spot something similar if lightning on Venus is energetic enough.

Future lightning detections not only will end a 40-year-old controversy but also will shed light on the chemistry of Venus's toxic atmosphere and give researchers clues to storm activity on the planet. (*Journal of Geophysical Research: Space Physics*, doi:10.1002/2016JA022886, 2016) —Shannon Hall, Freelance Writer