Rare ‘superbolt’ flashes found to be 1,000 times brighter than normal lightning

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LOS ALAMOS, N.M., Nov. 12, 2020—Two new studies about the brightest lightning events on Earth—called “superbolts”—found that they are distinct from normal lightning flashes and can be more than 1,000 times brighter. The new findings could help scientists better understand these mysterious strokes and inform safety efforts, such as public advisories and engineering guidance. The two studies analyzed lightning events seen from orbiting satellites and give a better picture of how these energetic lightning flashes originate.

“One lightning stroke even exceeded 3 terawatts of power—thousands of times stronger than ordinary lightning detected from space,” said Michael Peterson, a remote-sensing scientist at Los Alamos National Laboratory and lead author on the studies, which were published today in the American Geophysical Union’s *Journal of Geophysical Research: Atmospheres*. “Understanding these extreme events is important because it tells us what lightning is capable of.”

The research addresses an ongoing debate among scientists about how these energetic lightning flashes originate. The new studies propose that superbolts typically result from rare positively charged cloud-to-ground events, rather than the more common negatively charged cloud-to-ground events characteristic of most lightning.

Superbolts, first reported in 1977 based on optical brightness measurements made by the Vela satellite, were initially described as lightning flashes 100 times brighter than typical lightning. Since then, however, scientists have debated whether these observations represent phenomena distinct from ordinary lightning. The viewing angle of a satellite, for example, could affect the observed brightness of a lightning event.

“When you see a lightning flash from space, it will look a lot dimmer than if you were to see it from ground level because the clouds block some of the light,” Peterson said.

The new studies complement the 1977 report. One study used data captured by the Geostationary Lightning Mapper, a detector on a satellite that remains centered over the Americas, from January 2018 through January 2020. The authors added up signals detected on the cameralike sensor to calculate the total brightness for lightning flashes.

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Links to papers (available for free download until Dec. 15):

Geostationary Lightning Mapper (GLM) Observations of the Brightest Lightning in the Americas, Michael Peterson, Erin Lay: Los Alamos National Laboratory, Los Alamos, New Mexico, United States.

Revisiting the Detection of Optical Lightning Superbolts, Michael Peterson, Matt W. Kirkland: Los Alamos National Laboratory, Los Alamos, New Mexico, United States.