

Researchers measure a record-setting megaflash

Weather-tracking advances reveal astonishing extremes of lightning

By Joe Rojas-Burke, ASU News
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It was a single lightning flash that streaked across the Great Plains for 515 miles, from eastern Texas nearly all the way to Kansas City, setting a new world record.

“We call it megaflash lightning, and we're just now figuring out the mechanics of how and why it occurs,” said [Randy Cervený](#), an Arizona State University President’s Professor in the [School of Geographical Sciences and Urban Planning](#).

Cervený and colleagues used space-based instruments to measure the megaflash, which took place during a major thunderstorm in October 2017.

Its astonishing horizontal reach surpasses by 38 miles the previous record of 477 miles recorded during an April 2020 storm in the southern U.S. The new record-setter went unnoticed until a re-examination of satellite observations from the 2017 storm.

“It is likely that even greater extremes still exist, and that we will be able to observe them as additional high-quality lightning measurements accumulate over time,” said Cervený, who serves as [rapporteur of weather and climate extremes](#) for the World Meteorological Organization, the weather agency of the United Nations.

For years, lightning detection and measurement relied on ground-based networks of antennas that detect the radio signals emitted by lightning and then estimate location and travel speed based on the time it takes signals to reach other antenna stations in the network.

Satellite-borne lightning detectors in orbit since 2017 have made it possible to continuously detect lightning and measure it accurately at continental-scale distances.

“Our weather satellites carry very exacting lightning detection equipment that we can use document to the millisecond when a lightning flash starts and how far it travels,” Cervený said.

Parked in geostationary orbit, the National Oceanic and Atmospheric Administration's GOES-16 satellite detects around 1 million lightning flashes per day. It is the first of four NOAA satellites equipped with geostationary lightning mappers, joined by similar satellites launched by Europe and China.

"Adding continuous measurements from geostationary orbit was a major advance," said Michael Peterson at the Georgia Tech Research Institute. "We are now at a point where most of the global megaflash hot spots are covered by a geostationary satellite, and data processing techniques have improved to properly represent flashes in the vast quantity of observational data at all scales."

Peterson is first author of a [report](#) in the Bulletin of the American Meteorological Society documenting the new lightning record.

Most lightning flashes are limited to less than 10 miles in reach. When a lightning bolt reaches beyond 60 miles (100 kilometers, to be exact), it's considered a megaflash. Less than 1% of thunderstorms produce megaflash lightning, according to satellite observations [analyzed by Peterson](#). They arise from storms that are long-lived, typically brewing for 14 hours or more, and massive in size, covering an area comparable in square miles to the state of New Jersey. The average megaflash shoots off five to seven ground-striking branches from its horizontal path across the sky.

While megaflashes that extend hundreds of miles are rare, it's not at all unusual for lightning to strike 10 or 15 miles from its storm-cloud origin, Cervený said. And that adds to the danger. Cervený said people don't realize how far lightning can reach from its parent thunderstorm.

Lightning kills 20 to 30 people each year in the U.S. and injures hundreds more. Most lightning strike injuries occur before and after the thunderstorm has peaked, not at the height of the storm.

"That's why you should wait at least a half an hour after a thunderstorm passes before you go out and resume normal activities," Cervený said. "The storm that produces a lightning strike doesn't have to be over the top of you."

Extreme lightning

Longest duration for a single lightning flash: 17.102 seconds, on June 18, 2020, during a thunderstorm over Uruguay and northern Argentina.

Deadliest direct strike: 21 people killed by a single flash of lightning as they huddled for safety in a hut in Zimbabwe in 1975.

Deadliest indirect strike: 469 people killed in Dronka, Egypt, when lightning struck a set of oil tanks, causing burning oil to flood the town in 1994.

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Main image

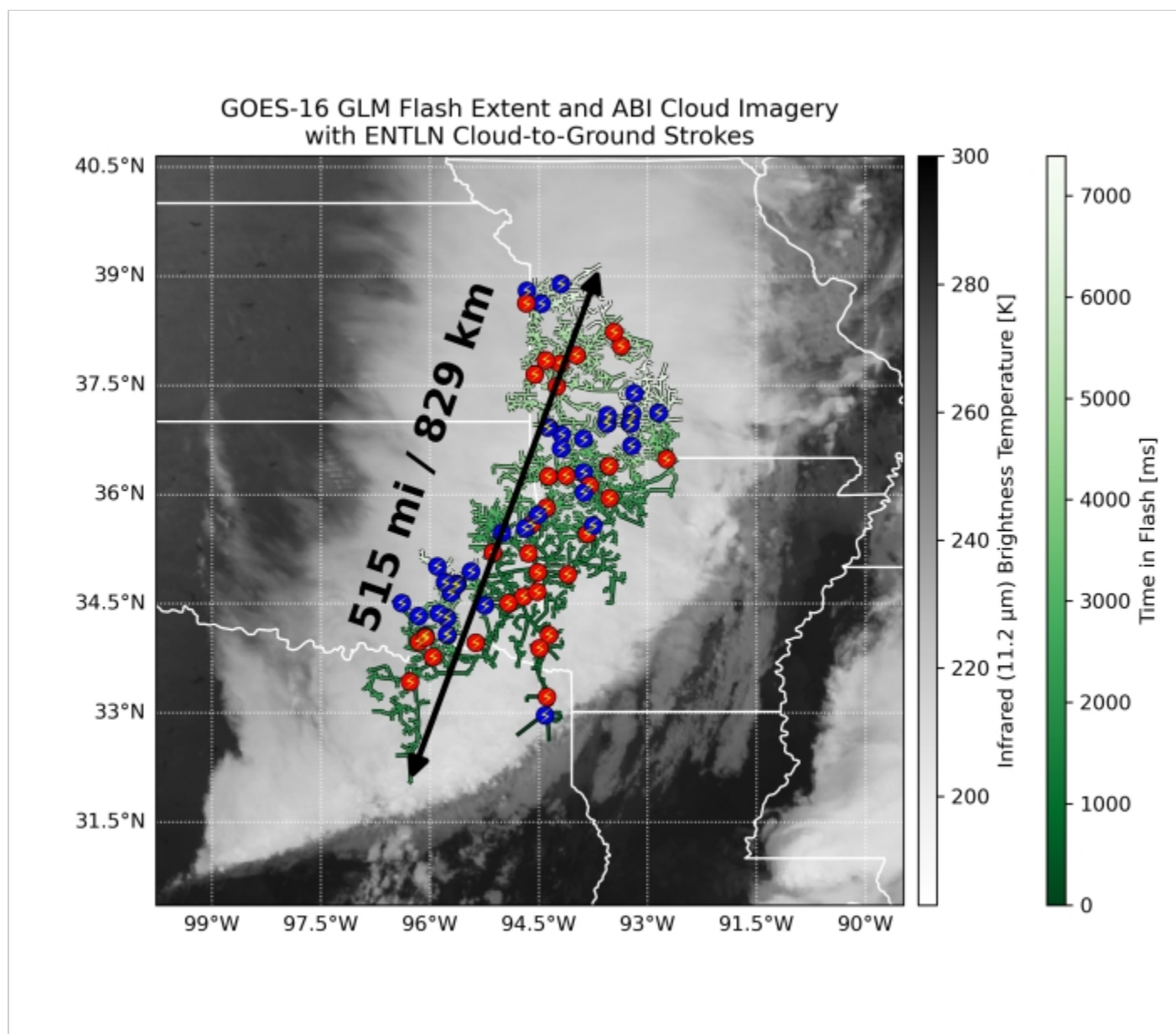


iStock photo of lightning during a summer storm.

Text image(s)



ASU President's Professor Randy Cervený is an expert in record-setting weather. ASU photo



This graph uses satellite data to show the reach of a megaflash from a storm that crossed the Great Plains in 2017.