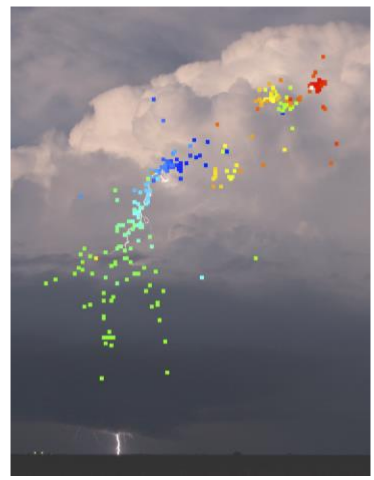
Lightning Measurement and Meteorology
By: Eric Bruning

If you've listened to AM radio during a thunderstorm, you've heard the crackling noise made by a nearby lightning strike. That same radio noise has been used for decades to detect lightning. The scientists and engineers who made the first operational lightning measurements could do so every thousandth of a second — fast enough to detect the big ground strikes that are the gravest immediate danger to people, but no more. But technological development never rests, and now cheap, fast computers make it easy to measure lightning at the speed it happens: all the small signals produced by a lightning channel as it develops every tenth of a millionth of a second. Now we can measure more: the path of the whole lightning channel that's hidden inside the cloud, not just the one spot where it might happen to strike ground.

The new, fast lightning measurements have revealed some surprising and delightful patterns in how lightning channels move inside thunderstorms. The smallest lightning discharges are a few football fields in length. The largest ones are hundreds of times larger, extending for dozens or even hundreds of miles. The small sparks seem to happen where the winds in a thunderstorm were likely the most complex. The long discharges happen in steadier, layered clouds. Measurements are needed to confirm that the complex winds and small flashes go together, drawing on insights from the wind and lightning sciences. But lightning scientists, focused on the physics of the discharge, have only rarely been in close contact with experts in thunderstorms winds.



Modern lightning instruments map out the whole lightning channel and its relationship to winds in thunderstorms.

At the National Wind Institute, we're approaching the problem by bringing together lightning science and wind science. The technical staff and heritage of measurements in the National Wind Institute support state of the art lightning mapping instrumentation and mobile, wind-measuring radars that allow us to chase down the storms with the right lightning behavior. Repurposing of instruments tailored to near-ground wind measurement allowed us to fuse together wind and lightning data to answer new science questions. Our measurements successfully showed that the theory of complex winds (turbulence) can explain why some lighting flashes are small and others are large.

Basic scientific research turns into applied science when research measurements and theoretical models can be tailored to operational needs. We began with years of study of lightning flash size behavior in partnership with Lubbock's local National Weather Service forecast office. When NOAA and NASA launched their new space-based Geostationary Lightning Mapper, we were prepared to translate those methods into training and products that are now used internationally to observe lightning on the scale of the planet.

About the Author

Dr. Eric Bruning is an Associate Professor of Atmospheric Science at Texas Tech University. He has participated in numerous field campaigns focused on ground, balloon, and space-based observations of lightning and storm electricity, and applies those datasets to link electricity and meteorology. He is recognized internationally for data processing and dissemination methods that support the operational and scientific use of lightning and other weather datasets, and has worked with an artist at the intersection of the arts and scientific visualization.