**Linking Lightning Activity to Intensity Changes in Tropical Cyclones: A Case Study of Hurricane Earl (2010)**

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Many recent studies have attempted to establish a relationship between lightning activity and tropical cyclone intensity change. One such study concluded large inner core (< 100 km) lightning bursts are indicative of a weakening storm. Another suggested downshear convection moving into the inner core could lead to intensification and downshear reformation of the low level center. Given these contradictory results, no coherent relationship has been established between lightning and intensity change in tropical cyclones.

The World Wide Lightning Location Network (WWLLN) recorded a remarkable number of strikes associated with Hurricane Earl in 2010. Lightning peaked within 500 km of the center of Earl during a period of rapid intensification (RI) from 00 UTC August 29 through 00 UTC August 31 as Earl became a major hurricane. This period of RI was preceded by a burst of inner core lightning upshear of the center. The NASA Genesis and Rapid Intensification Processes (GRIP) mission collected many additional observations during Earl's RI. The unusually large amount of lightning, a period of RI and extensive in situ observations make Earl an ideal case study to further investigate any possible relationship between lightning flash rate and intensity change.

Moderate northeasterly vertical wind shear in the 850-200 hPa layer existed over Earl as a result of strong outflow from Hurricane Danielle at the beginning of RI. The shear gradually relaxed and transitioned to weak northwesterly shear. More than 70% of the lightning strikes within a 500 km radius occurred downshear, with a preference towards downshear right in the outer rainband region. This agrees with previous studies, but the inner core lightning distributions do not: a majority of the inner core strikes occurred upshear. Also contrary to previous studies, most of the lightning occurred left of the northwesterly storm motion.

Previous studies have suggested an inner core convective burst, such as the one observed in Hurricane Earl, indicates the end of RI rather than the beginning. In addition to linking the lightning activity to intensity changes, the thermodynamics and kinematics that allowed the upshear, inner core convection to rapidly intensify Earl will be explored using both in situ observations and model analyses.