

Lightning Jump Algorithm Development for the GOES-R Geostationary Lightning Mapper

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Current work on the lightning jump algorithm to be used in GOES-R Geostationary Lightning Mapper (GLM)'s data stream is multifaceted due to the intricate interplay between the storm tracking, GLM proxy data, and the performance of the lightning jump itself. This work outlines the progress of the last year, where analysis and performance of the lightning jump algorithm with automated storm tracking and GLM proxy data were assessed using over 700 storms from North Alabama. The cases analyzed coincide with previous semi-objective work performed using total lightning mapping array (LMA) measurements in Schultz et al. (2011). Analysis shows that key components of the algorithm (flash rate and sigma thresholds) have the greatest influence on the performance of the algorithm when validating using severe storm reports. Automated objective analysis using the GLM proxy data has shown probability of detection (POD) values around 60% with false alarm rates (FAR) around 73% using similar methodology to Schultz et al. (2011). However, when applying verification methods similar to those employed by the National Weather Service, POD values increase slightly (69%) and FAR values decrease (63%).

The relationship between storm tracking and lightning jump has also been tested in a real-time framework at NSSL. This system includes fully automated tracking by radar alone, real-time LMA and radar observations and the lightning jump. Results indicate that the POD is strong at 65%. However, the FAR is significantly higher than in Schultz et al. (2011) (50-80% depending on various tracking/lightning jump parameters) when using storm reports for verification. Given known issues with Storm Data, the performance of the real-time jump algorithm is also being tested with high density radar and surface observations from the NSSL Severe Hazards Analysis & Verification Experiment (SHAVE).

The conceptual model of how a lightning jump relates to storm physics and dynamics has been explored to optimize its integration into future operational applications. Current work using polarimetric and multi-Doppler analysis at the time of a lightning jump reveals that significant increases in updraft volume are seen leading up to the lightning jump. Similarly, maximum updraft speed increases or remains steady leading up to and through the lightning jump. These observations also correspond to increases on average of 2.7 dB in the mean reflectivity profile between -10C and -40C during the 10 minutes leading up to the jump, followed by a decrease of -2.2 dB during the 10 minutes immediately after the jump. Specifically applied to supercells, recent results show that the lightning jump coincides or precedes the development of the initial mesocyclone and in many cases, subsequent development of low-level circulations. These trends are true for tornadic and non-tornadic supercells, showing that inferred rapid strengthening of the updraft by radar can be supported by a lightning jump or increasing flash rate trend. This confirmation may increase confidence and perhaps provide the ability to 'tip the scales' on a warning for either severe weather or a tornado depending on prior knowledge of the environment.