Storm Tracking and Lightning Cell Clustering using Geostationary Lightning Mapping Data for Data Assimilation and Forecast Applications

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Kristin M. Calhoun[1,2], Donald R. MacGorman[2], Benjamin S. Herzog[1,3]

[1]Cooperative Institute for Mesoscale Meteorological Studies (CIMMS),
120 David L. Boren Blvd, Norman, OK
[2]National Severe Storms Laboratory (NSSL), Norman, OK
[3]School of Meteorology, University of Oklahoma, Norman, OK

There are multiple thresholds of lightning rates and lightning density that may be used to define storm clusters for use by forecasters and in numerical forecast models. The gridded location and duration of flashes may be easier assimilated than the total flash rate of a storm, but it is currently unknown whether a product such as maximum flash extent density will show the same trends as the total storm flash rate or even how these products vary across different storm modes. In order to determine these relationships, gridded lightning data is associated with a storm cell or cluster and tracked over time using algorithms within the Warning Decision Support System-Integrated Information (WDSS-II) system. Parameters in these algorithms have been tuned specifically to track storm clusters containing lightning using gridded Reflectivity at -10 C. However, in the absence of radar data, storm cells and clusters may be identified and tracked using lightning data alone.

Current work utilizes VHF lightning data from Lightning Mapping Array (LMA) systems in various locales which is sorted into flashes and gridded at both 1-km and the expected Geostationary Lightning Mapping (GLM) resolution. Year 2 of the project will focus on comparing the tracked lightning flash rates and maximum flash density of each storm with the high-resolution verification data available from the Severe Hazard Analysis and Verification Experiment (SHAVE) as well as *Storm Data* and radar-derived parameters such as multi-radar Vertically-Integrated Liquid (VIL) and the Maximum Expected Size of Hail (MESH). These data will be analyzed to determine what criteria for lightning data are most indicative of convective development and severe weather potential across a multitude of storm types including supercell storms, short-lived storms, ordinary or multi-cell storms and convective lines. Our results may then be used to develop lightning data assimilation schemes in convection-permitting forecast models. In addition to the data assimilation aspect, this data may also be used to inform forecasters of expected flash rates and densities of various storm modes and severity.