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A Preliminary Observation of Operational Products from the Geostationary Lightning Mapper

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Overview/Introduction

- Operational forecasters have many challenges, one being the forecasting of severe weather and tornadoes. Ground-based networks have been used to identify lightning jumps. The GLM sensor is new; therefore, any research focused on it would be very beneficial.
- Because ground-based systems have found a jump, GLM is expected to have a jump, too. The difference is that GLM works differently and senses differently than the ground-based systems.
- The materials used include: Advanced Weather Interactive Processing System (AWIPS), the Weather Event Simulator (WES), and Storm Data via the National Centers for Environmental Information.

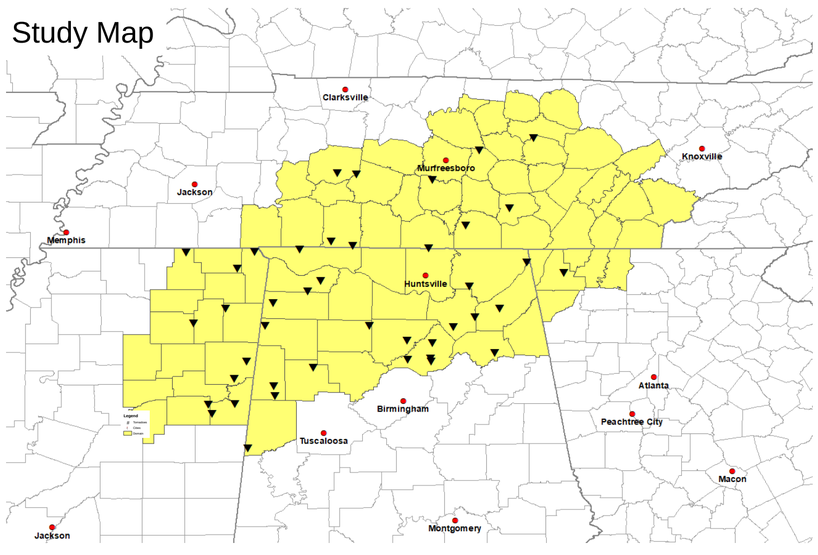

Figure 1: Area of interest with tornadoes indicated by triangles.

How was the data retrieved?
Each storm was tracked approximately 30 minutes before and after the tornado, as well as during the tornado itself. GLM, NLDN, and ENTLN data were gathered every minute. (NLDN and ENTLN data were not available for every case due to data archiving considerations.)

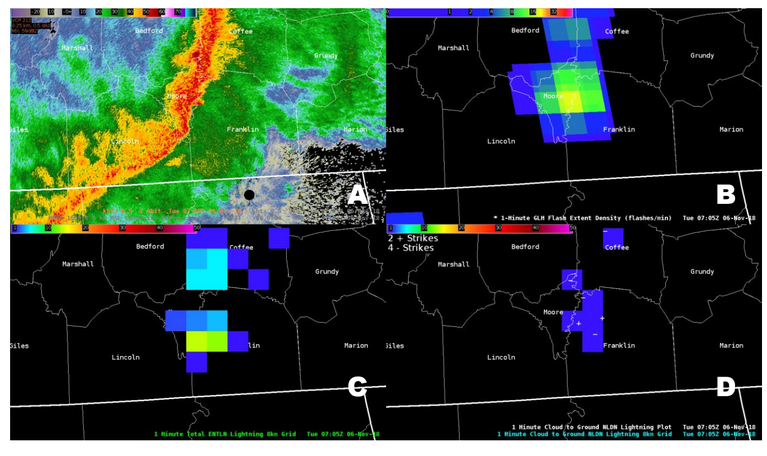

Figure 2: AWIPS view of the November 6, 2018 Franklin-Coffee-Grundy tornado used for the study. Depicting radar reflectivity (A), GLM (B), Earth Network Total Lightning Network (ENTLN) (C), and National Lightning Detection Network (NLDN) (D).

Why 37 cases, but 41 tornadoes?
3 tornadoes were combined because they were so close in time and location that there was not a clear distinction between them. The other tornado was removed because its lightning could not be separated from neighboring storms.

Methodology

- Find a region for research: Huntsville area of interest with parts of Georgia, Mississippi, and Tennessee.
- Master list of tornadoes was created using information from June 2018-June 2019 because of access to GLM data.

Results

- GLM: 36/37 cases had a jump, including sigma levels of 1-2 and also 2 or above.
- ENTLN: 20/20 cases had a jump, including sigma levels of 1-2 and also 2 or above.
- NLDN: Doesn't view lightning the same as the others, and so it was only used as supplemental information.

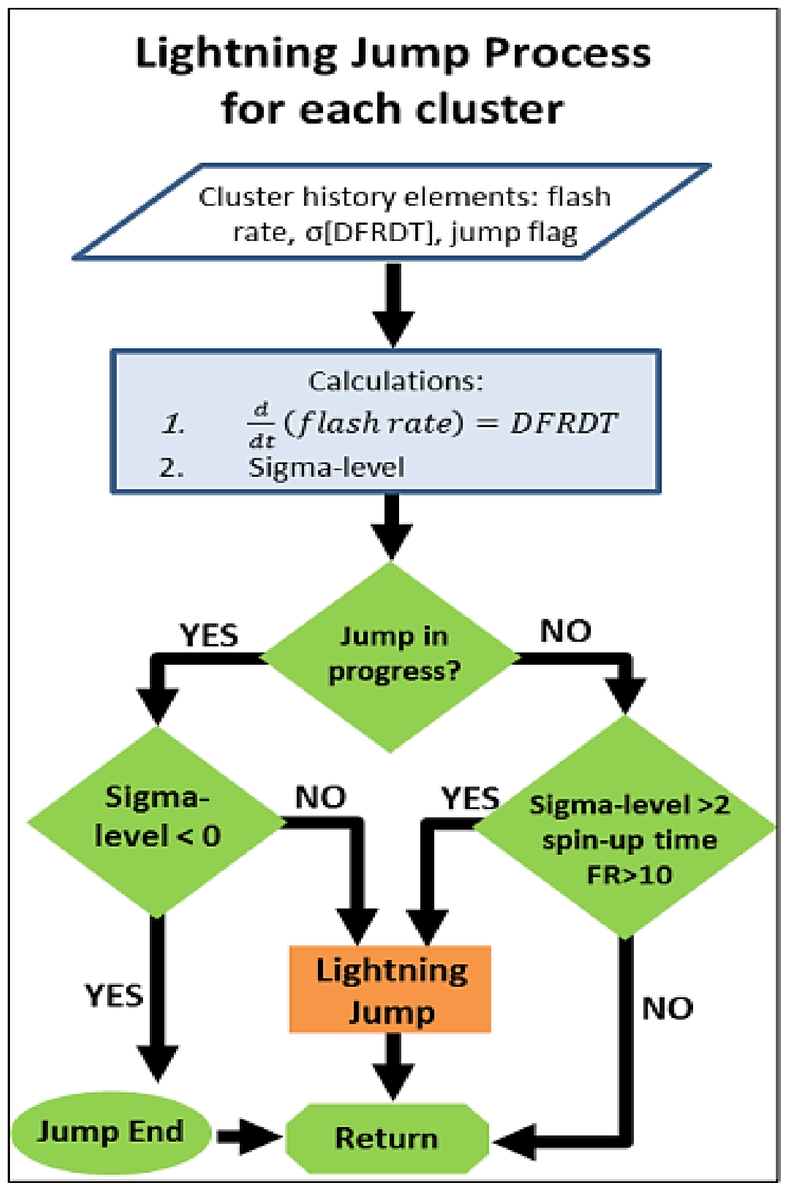

Figure 3: A lightning jump process map describing the algorithm used for the project from Schultz et al. 2016.

Table 1: Comparison between the GLM and ENTLN results

	GLM	ENTLN
# of cases	37	20
# of cases with a σ level between 1 and 2	35	18
# of cases with a σ level ≥ 2	19	11
Average lead time with a σ level between 1 and 2	14 minutes	15 minutes
Average lead time with a σ level ≥ 2	11 minutes	11 minutes

Impact/Conclusions

- Based on these GLM cases studied, a correlation can be identified and it can be compared with ENTLN data.
- GLM detects the lightning jumps an average of 14 minutes before tornado touchdown for small (sigma levels of 1 to 2) jumps and 11 minutes for large (sigma levels of 2 or more) jumps.
- These data will help forecasters because they can use GLM data to assess updraft intensification of potentially tornadic storms.
- Educating the weather community about GLM and its use will help the products spread and allow more people to understand and use this valuable knowledge.

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