EnKF Assimilation of Pseudo-GLM Lightning Data and Relationships Between Flash Rates and Microphysics

Meteorological Applications of Lightning Data

<u>Blake Allen</u> (blake.allen@ou.edu, School of Meteorology, Univ. of Oklahoma, Norman, OK, U.S.A.) and Edward Mansell

Total lightning observations that will soon be available from the GOES-R Geostationary Lightning Mapper (GLM) have the potential to be useful in the initialization of convection in numerical weather models, particularly in areas where other types of data that provide information on convective coverage and intensity (e.g., radar observations) are of poor quality or unavailable. Previous studies have shown promise in using total lightning data for this purpose, but have been limited mainly to nudging-type schemes to help initialize and maintain convection in mesoscale or synoptic scale model domains. To further explore how much the assimilation of total lightning data can aid in modulating convective strength and in producing detailed storm characteristics, this study used the Ensemble Kalman Filter (EnKF) to assimilate pseudo-GLM observations into a storm scale model for two real-data cases. The two cases come from opposite ends of the thunderstorm intensity spectrum and include the tornadic Moore, OK May 8, 2003 supercell and a non-severe multicell storm that occurred on June 6, 2000.

For each case, pseudo-GLM observations were created from ground-based lightning mapping array data by generating flash extent densities with a resolution approximately equal to the resolution of the GLM at its nadir. These pseudo-observations were then assimilated to produce analyses of each storm, and tests were done to examine the effectiveness of using various different relationships between microphysical variables and total flash rates as EnKF observation operators and the advantages and drawbacks of two methods of triggering convection in the initially horizontally homogeneous model domain.

Results from these experiments will be presented and compared to observations of each storm as well as to data from EnKF analyses of each storm produced using the more established techniques of assimilating radar radial velocity data or both radar radial velocity and reflectivity data.

In addition to the data assimilation results, comparisons between the graupel-ice 'flux product' and the more detailed simulated non-inductive charging rate will be presented, and possible differences in the utility of flash rate correlations with measures related to non-inductive charging on the whole storm scale versus smaller scales (e.g., GLM-pixel scale) will be considered.