An 8 Year Lightning Climatology of North Carolina

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Introduction
Cloud-to-ground (CG) lightning is one of the leading causes of weather-related fatalities in the United States, second only to flooding (Curran et al. 2005). Data from the publication "Storm Data" (NOAA/National Weather Service 2011) ranks North Carolina sixth in the United States for the number of lightning fatalities between 1995 and 2010 and fifth during this study period of 2003-2010. Lightning climatologies have shown a broad maximum of CG flash density over the southeastern United States (Ovillie and Huffines 2001; Ovillie et al. 2011), but these studies have not closely examined the lightning distribution over North Carolina. This climatology explores the influences of the season, time of day, various geophysical features, and mesoscale processes on the spatial and temporal distribution of CG lightning across the state. This project provides a context and initial dataset to support Lightning climatological related projects.

Methodology
An eight year data set (2003-2010) of National Lightning Detection Network (NLND) CG lightning data was constructed from local archives of AWIPS data. The data was quality controlled to remove positive flashes less than 15 kA. The point data, constructed with latitudinal and longitudinal pairs, were then ingested into ArcGIS software where the “Point Density” tool was used to create a 5 km² analysis. Statistical point data for eight selected cities were derived using a 25 km² grid box centered at the associated airport location (AVL, CLT, ECG, EWN, FAY, GSO, ILM and RDU).

Background
North Carolina’s convective weather is heavily influenced by a unique and diverse set of geophysical features, including the southern Appalachian Mountains, the Atlantic Ocean, the Gulf Stream, the rolling terrain of the Piedmont, the gently sloping Coastal Plain, the sand based soil of the Sandhills region, the complex land-sea interfaces, as well as wide variations in soil types and land uses.

Annual Flash Density Maps
- Higher flash densities in the winter along the southeastern coast likely result from enhanced low level instability resulting from a modification of the low level air mass from the Gulf Stream
- Lower flash densities in northeastern NC compared to the rest of eastern NC likely result from cooler near shore waters
- Given the predominance of lightning in the summer, the summer flash density map displays a very similar pattern to the annual flash density map and highlights the location of sea breeze interactions and the Piedmont trough
- The average percent of positive flashes for the eight locations during winter was 20.0%, spring 6.0%, summer 2.4%, and fall 5.8%

Monthly Flash Density
- July has the most flashes out of any month for all eight sites closely examined
- The percent of flashes during July at the eight sites ranged from 44% to 29% and the average was 36.0%
- A dramatic decline in flashes from August to September reflects the climatologically drier fall
- The minimum month varied among November, December, January, and February

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