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An Empirical Assessment of Meteorological Factors Associated with Lightning Episodes in the Carolina Piedmont

Surface and upper air observations are evaluated for their association with cloud-to-ground lightning strikes in the Carolina Piedmont. Duke Energy, the utility company responsible for supplying electricity to a large portion of the Carolina Piedmont, estimates that the majority of their annual outages and nearly all their summertime outages result from lightning strikes. This study includes events between 1995 and 1999 within a 100 square mile region centered on Greensboro, North Carolina. The central goal of this research is to contribute to the search for meteorological variables associated with disruptive lightning episodes. The attempt is made here to identify variables that distinguish between disruptive high energy lightning events and more modest cloud-to-ground events that do not interrupt power distribution.

Temperature, humidity, and wind data at the mandatory levels are examined for association with the frequency and intensity of lightning episodes. Measures of surface temperature, humidity, and winds are assessed for their association with counts of daily and hourly cloud-to-ground strikes, return strokes, and amperage. General multivariate models are used to select factors and covariates associated with robust lightning events. Lightning strike data are acquired from Global Atmospherics, Inc. while surface and upper air data are from the National Weather Service and the National Climatic Data Center. Highly predictive models are elusive, but factors derived from measures of boundary layer humidity and low level instability are the most useful. These data suggest that upper air wind speed, direction, and shear are potentially predictive factors. Funding for this research is sponsored by Duke Energy.