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# The El Nino-Southern Oscillation and cloud-to-ground lightning along the Gulf Coast of the United States

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Numerous studies have examined the precipitation and temperature variations associated with the El Nino-Southern Oscillation (ENSO) cycle. However, very little is known of the influence of ENSO on lightning. This study seeks to understand that relationship using an eight-year dataset (1995-2002) of cloud-to-ground (CG) lightning flashes over the Gulf Coast of the United States. This region is an appropriate study domain because of its high lightning frequency and its strong teleconnection with the NINO 3.4 region of the equatorial Pacific.

Flash density maps were compared with past lightning climatologies and the one known study linking ENSO with the number of thunderstorm days. Following the qualitative review, Pearson's correlations were computed between concurrent monthly pairings of NINO 3.4 sea surface temperature (SST) and CG lightning flash deviation.

Monthly mean flash density findings were, overall, consistent with previous United States climatologies. The overall mean for this study was, however, less than other studies, perhaps due to a greater number of cool ENSO periods compared with previous lightning climatologies. Winter season lightning flash densities are strongly influenced by the ENSO cycle. This is especially evident for the El Nino winter of 1997-1998 when a marked increase in lighting activity was observed. Overall flash densities decreased during La Nina winters. For January and February areas of high correlation between NINO 3.4 SST anomaly and CG lightning flash deviation were spatially coincident with areas of enhanced flash density. Both the enhanced CG flash regions and high correlation values and patterns are indicative of a southerly shift in the mid-latitude storm track known to occur during warm ENSO events. The sum-

mer months did not have as great a response to SST anomalies as the winter months. August stood out as having a large area of negative correlation perhaps indicating a decrease in convective activity during El Nino summers. These findings have implications for lightning hazard assessment and can be useful for long-term seasonal planning.