

Long-Term Quantification of Extreme Precipitation in Relation with Tropical and Extra-tropical Cyclonic Activity over the Carolinas

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The precipitation climatology of the Southeastern United States and the Carolinas region in particular spans a very broad spectrum of precipitation regimes. A warm season that is characterized by isolated thunderstorms, squall line mesoscale convective systems, and tropical cyclones, and a winter season characterized by frontal rain from extra-tropical cyclones, ice, and snowfall. Each of these types of precipitation system impacts regional hydrology in very different ways, and are associated with a large variety of natural hazards.

In this work, we use long-term surface observations from the Global Historical Climatology Network (GHCN-Daily) combined with tropical cyclones (TCs) and extra-tropical cyclones (ETCs) track information to quantify the precipitation contribution of each of these storm systems to annual and seasonal precipitation over the Carolinas. For the period 1950–present, we analyze the contribution of warm season TCs and cold season ETCs both in term of precipitation totals and precipitation extremes (1-year and 5-year return period events) for over 100 surface stations. For the most recent concurrent period (2000s and onward), in-situ observations from GHCN-D are completed with higher resolution observations derived from radar (Stage IV, NMQ/Q2) and satellites (TMPA 3B42, CMORPH, PERSIANN) platforms. In addition to providing statistics at the station level, a detailed map of the Carolinas with an historical analysis of over 60 years of TC strikes and ETC activity that will include return periods of storms as a function of their type and intensity.