Dynamical Analysis of Extreme Precipitation Events in the Northeast

Extreme precipitation events in the Northeast are identified and the dynamical processes that lead to these extreme events are investigated. The time period 1979-2008 is used, in order to make use of a consistent set of precipitation and atmospheric datasets, such as the USHCN and Unified Precipitation datasets, as well as the MERRA and CFSR reanalysis datasets. Station-based precipitation is used to create sets of extreme daily events using both a station-based and regional-wide peaks-over-threshold approach. Statistical analysis of the events reveals a separation in the characteristics of coastal and inland station extremes. Extreme events are distinguished by temporal characteristics such as precipitation duration (single or multi-day events), total rainfall, rainfall days, and rainfall rate, as well as spatial scales of influence, such as single-station events or regional, multiple-station events. Within the two regions, various atmospheric forcing mechanisms, including tropical storms, synoptic storms, and frontal processes are linked to these event types, in order to better identify the dynamics that drive extreme precipitation events. Storm tracks are used to identify potential synoptic and tropical storm forcing. The dynamical analyses include investigation of flow fields, frontal mechanisms associated with synoptic storms and shortwaves, baroclinicity, moisture availability and atmospheric buoyancy.