Synoptic and Mesoscale Aspects of Ice Storms in the Northeastern United States

Christopher M. Castellano¹, Lance F. Bosart², Daniel Keyser³, John Quinlan², and Kevin Lipton²

¹Department of Atmospheric and Environmental Sciences, University at Albany, State University of New York, Albany, NY
²NOAA/NWS/WFO Albany, NY

*Corresponding author email: castellano@albany.edu

**Abbreviations:** CWA, Climatic WATCH Area; CFS, Climate Forecast System; N=137, number of ice storms; NWP, Numerical Weather Prediction; QG, gravity,

**Motivation:**
- Ice storms endanger human life and safety, undermine public infrastructure, and disrupt local and regional economies.
- Ice storms are historically prevalent and destructive.
- Ice storms present a major operational forecasting challenge.

**Objectives:**
- Establish a cold-season climatology (Oct 1993–Apr 2010) of ice storms in the northeastern U.S.
- Identify environments conducive to ice storms and dynamical mechanisms responsible for freezing rain events.
- Provide forecasters with greater situational awareness of the synoptic and mesoscale dynamical mechanisms responsible for freezing rain events.
- Partitioned ice storms by synoptic weather patterns.
- Utilized radiosonde data from the University of Wyoming and calculated backward trajectories from the Gulf of Mexico.

**Data and Methodology**

**Ice Storm Climatology**
- Catalogued ice storms impacting 14 NWS CWAs (Fig. 1) using NCEP Storm Data:
  1. Any event listed as an "ice Storm".
  2. Any event with significant ice accretion (>0.25 in).
  3. Any event with damage attributed to ice accretion.

**Composite Analysis**
- Identified 35 ice storms impacting the ALCY CWA
- Generated synoptic composite maps (2.5° NCEP– NCAR reanalysis data) and composite cross sections (0.5° Climate Forecast System Reanalysis [CFSR] data) centered on Albany, NY (KALB), for the two most common synoptic patterns
- Performed analyses at the synoptic time nearest the midpoint of each event

**Case Study:**
- Used 0.5° CFSR data to create maps illustrating the synoptic evolution and dynamical forcing during the 11–12 Dec 2008 ice storm
- Utilized radiosonde data from the University of Wyoming and calculated backward trajectories from the NOAA HYPLAT model to examine the local thermodynamic environment in the ice storm region

**Summary:**
- Ice storms are coincident with an upstream trough, an amplifying downstream ridge, and confluent upper-level flow over eastern North America.
- Ice storms occur in association with quasi-geographic (QG) ascent and frontal dynamical forcing beneath an equatorward jet entrance region.
- Ice storms present a major operational forecasting challenge.

**Summary:**
- Ice storms are endured by complex topography and proximity to large bodies of water.
- 81.8% of ice storms were local, regional, or subsynoptic, while only 18.2% were synoptic.
- Ice storms were primarily associated with Type G (N=65), Type BC (N=30), or Type EF (N=25) synoptic weather patterns.

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