An analysis of high-impact, low-predictive skill severe weather events in the northeast U.S.

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A Thesis

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An objective evaluation of Storm Prediction Center slight risk convective outlooks, as well as a method to identify high-impact severe weather events with poor-predictive skill are presented in this study. The objectives are to assess severe weather forecast skill over the northeast U.S. relative to the continental U.S., build a climatology of high-impact, low-predictive skill events between 1980–2013, and investigate the dynamic and thermodynamic differences between severe weather events with low-predictive skill and high-predictive skill over the northeast U.S. Severe storm reports of hail, wind, and tornadoes are used to calculate skill scores including probability of detection (POD), false alarm ratio (FAR) and threat scores (TS) for each convective outlook. Low predictive skill events are binned into low POD (type 1) and high FAR (type 2) categories to assess temporal variability of low-predictive skill events.
Type 1 events were found to occur in every year of the dataset with an average of 6 events per year. Type 2 events occur less frequently and are more common in the earlier half of the study period.

An event-centered composite analysis is performed on the low-predictive skill database using the National Centers for Environmental Prediction Climate Forecast System Reanalysis 0.5° gridded dataset to analyze the dynamic and thermodynamic conditions prior to high-impact severe weather events with varying predictive skill. Deep-layer vertical shear between 1000–500 hPa is found to be a significant discriminator in slight risk forecast skill where high-impact events with less than 31-kt shear have lower threat scores than high-

impact events with higher shear values. Case study analysis of type 1 events suggests the environment over which severe weather occurs is characterized by high downdraft convective available potential energy, steep low-level lapse rates, and high lifting condensation level heights that contribute to an elevated risk of severe wind.