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**Title:** Insurance Loss Return Periods with Extreme Event Intensity Thresholds across U.S. Climate Regions: 1950-2010

**Running Head:**

**Abstract:**

To improve the utility of NOAA storm event information, NOAA's NCDC is examining trends in storm frequency, intensity and direct economic losses for each of the nine U.S. climate regions from 1950-2010 using the following data sources: hurricanes (NHC), winter storms (NESIS/RESIS), tornadoes (SPC; SWDI), hail (SPC; SWDI), high winds (SPC), and U.S. insurance loss datasets (Munich Re, USDA-RMA, PCS, FEMA). Contrasting both geophysical and economic return periods provides annual exceedance probability curves to inform a broad audience (e.g., emergency managers, urban planners, policy makers) with loss potential of natural hazards in context with historical records.

This research also utilizes socioeconomic data from the Bureau of Economic Analysis (BEA), and U.S. Census data (e.g., gridded population/density, mean housing value, per capita income, production wealth) to normalize for increases in population, inflation, and wealth. Normalizing for each of these societal factors has become a standard methodology used by a number of researchers (e.g., Schmidt et al., 2009; Pielke Jr. et al., 2008, Collins and Lowe, 2001) who have shown that increasing and shifting population (particularly along the coasts) and overall increase in wealth (i.e., property) at risk strongly drive the increase in economic losses seen over the last several decades.

After normalizing for increasing population, wealth and inflation over the 1950-2010 study period our preliminary regression analyses show statistically significant increases (at the 1% level) in economic losses caused by severe thunderstorms (e.g., tornado, hail and high wind combined) in the Central, Southern, East North Central and Southeast climate regions. No significantly decreasing trends in economic losses caused by severe thunderstorms were found in any of the regions, which may result from increased insurance coverage and observations over the last several decades. In addition, winter storm event losses are also significantly increasing (1% level) for the Northeast and Central regions and significantly decreasing (5% level) for the Pacific and Northwest. Hurricanes, however, show no statistically significant increases in economic losses (at < 10% level) for any of the climate regions after removing the effects of increasing population, wealth and inflation. In contrast, if only inflation is removed but the natural increases in wealth and population remain then a statistically significant increase in hurricane damage is seen for the South and Southeast climate regions. But this analysis does not take into account improvements in building codes or forecasting skill over time.

However, there have been fewer studies that examine how geophysical and economic risk curves vary over time for different U.S. climate regions or at even smaller spatial scales (e.g., states, counties) where the data is most robust. This is the focus of our current research in developing hazard ‘risk climatologies’ to contrast current and past extreme events with historically normalized economic loss and risk climatologies for varying spatial and time horizons.

### **Acronyms:**

FEMA: Federal Emergency Management Administration  
NESIS: Northeast Snowfall Impact Scale  
NHC: (NOAA) National Hurricane Center  
NIDIS: National Integrated Drought Information System  
PCS: Property Claim Services  
RESIS: Regional Snowfall Impact Scale  
SPC: (NOAA) Storm Prediction Center  
SWDI: (NOAA) Severe Weather Data Inventory  
USDA-RMA: U.S. Department of Agriculture – Risk Management Agency  
USDM: U.S. Drought Monitor

### **References:**

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