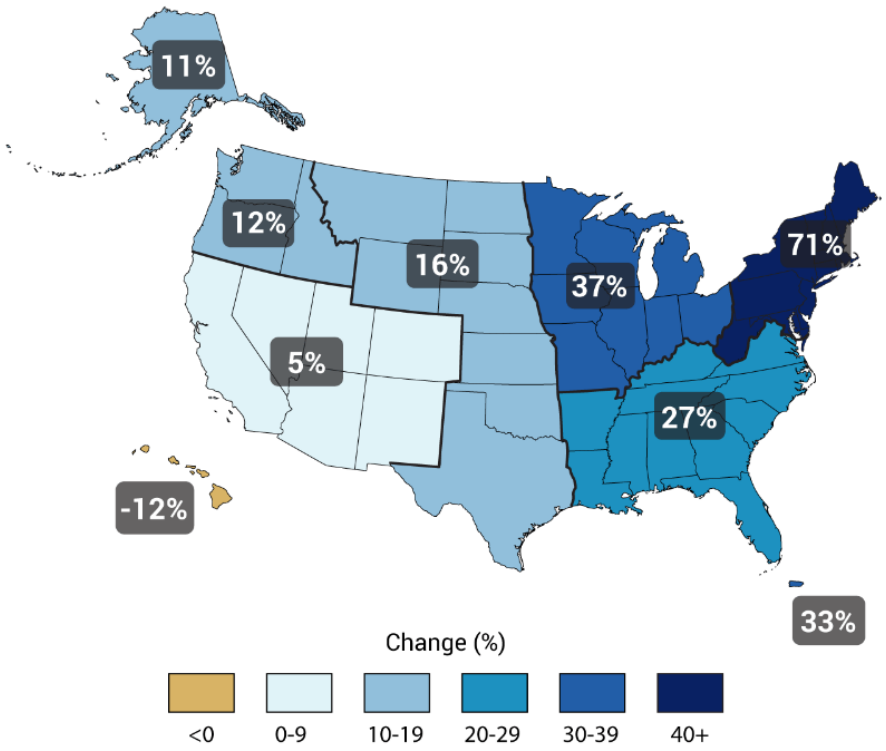
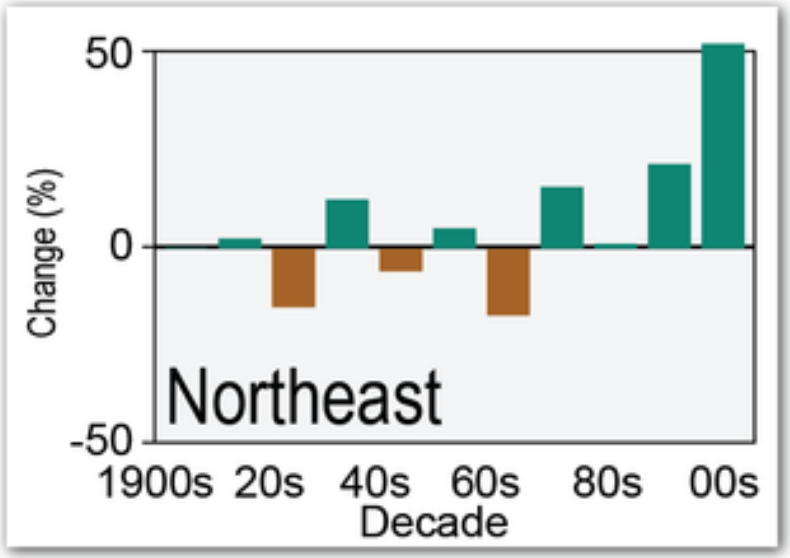
Assessing Precipitation Changes and Mechanisms Over the Northeastern United States

- Explore the temporal and spatial attributes of precipitation change in the Northeastern United States since 1901
- Investigate the climatological mechanism driving the changes in extreme precipitation over seasons and space
- Disentangle the effects of anthropogenic forcing and natural variability on the occurrence of extreme precipitation events

Northeast extreme events increased dramatically from 1958–2012.



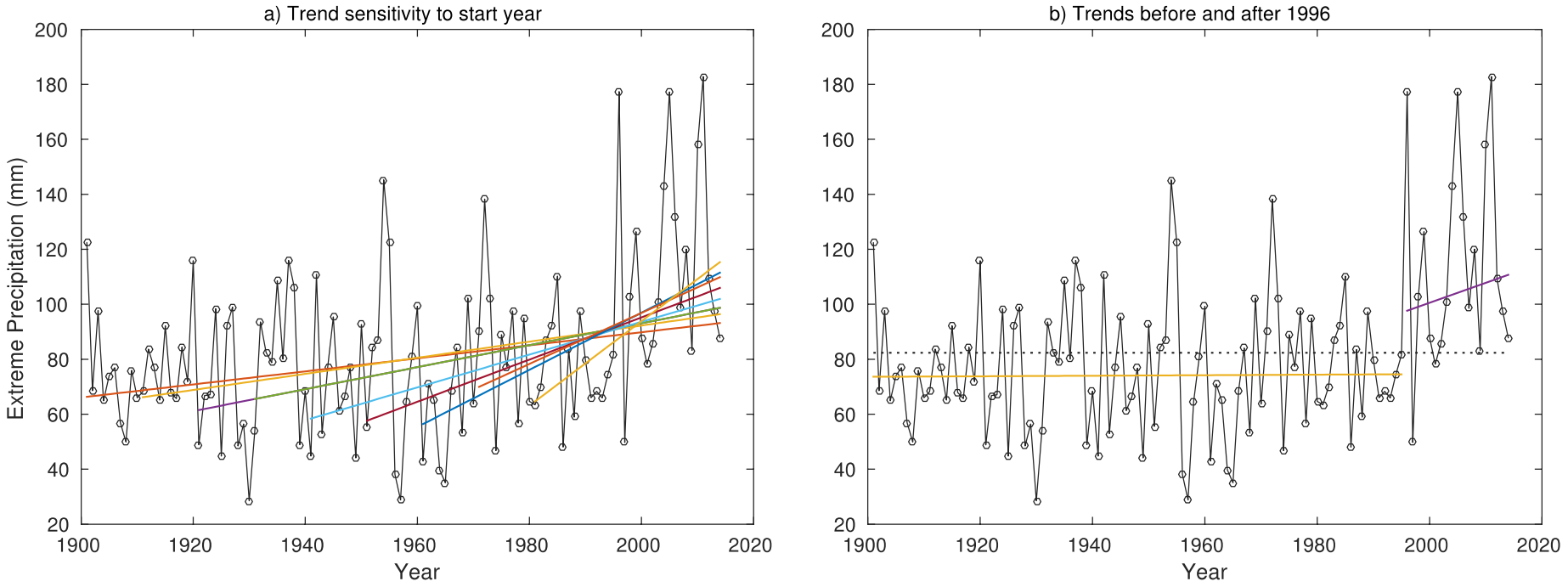


Walsh et al. (2014)

Methodology

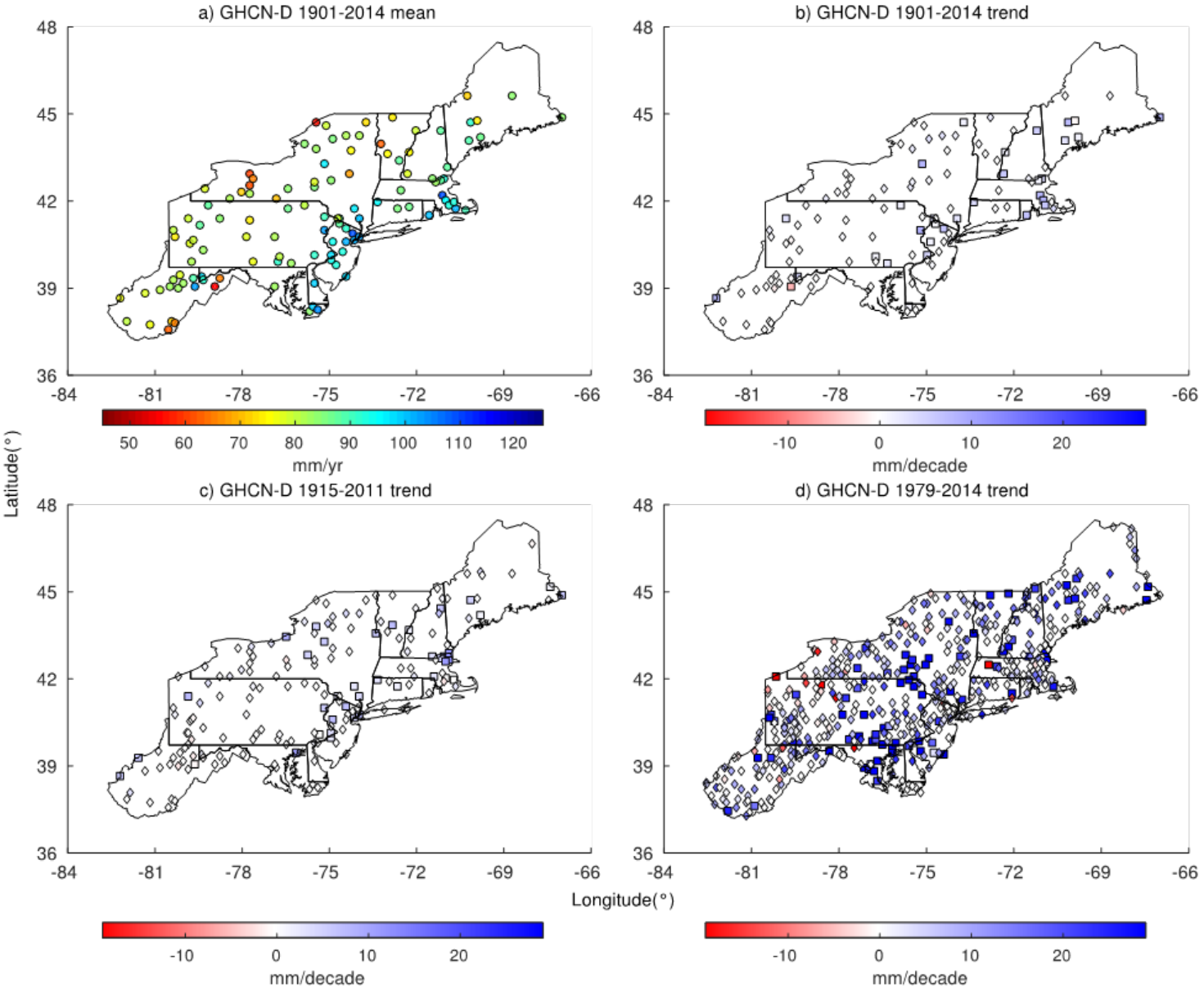
- Quantify the temporal and spatial attributes of precipitation change with multiple datasets and assess their consistencies *(Completed)*
  - Station observations: Global Historical Climatology Network Daily (GHCN-D)
  - Gridded data: Gridded observational weather dataset (LI2013; Livneh et al. 2013)
  - Reanalysis data: North American Regional Reanalysis (NARR)
- ERA Interim reanalysis was chosen to investigate the mechanisms (e.g., geopotential, wind pattern, and moisture flux) driving this change. *(Ongoing)*
- Use climate models to disentangle the effects of anthropogenic forcing and natural variability on extreme precipitation change *(Ongoing)*

Extreme precipitation experienced an abrupt increase after 1996.



Time series of spatially averaged Northeast GHCN-D annual extreme precipitation from 1901–2014 with (a) nine trendlines for time periods starting in 1901, 1911, 1921, 1931, 1941, 1951, 1961, 1971, and 1981, and ending in 2014; and (b) dashed line denoting 1901–2014 average annual extreme precipitation and trendlines before and after the changepoint year of 1996. Extreme precipitation is defined as the largest 1% of all daily precipitation events.

Huang et al. 2017



GHCN-D annual extreme precipitation (a) means 1901–2014, (b) trends 1901–2014, (c) trends 1915–2011, and (d) trends 1979–2014. In (b)–(d), square points represent significant trends, diamond points represent insignificant trends, and white points represent undetectable trends or trends with zero slope.

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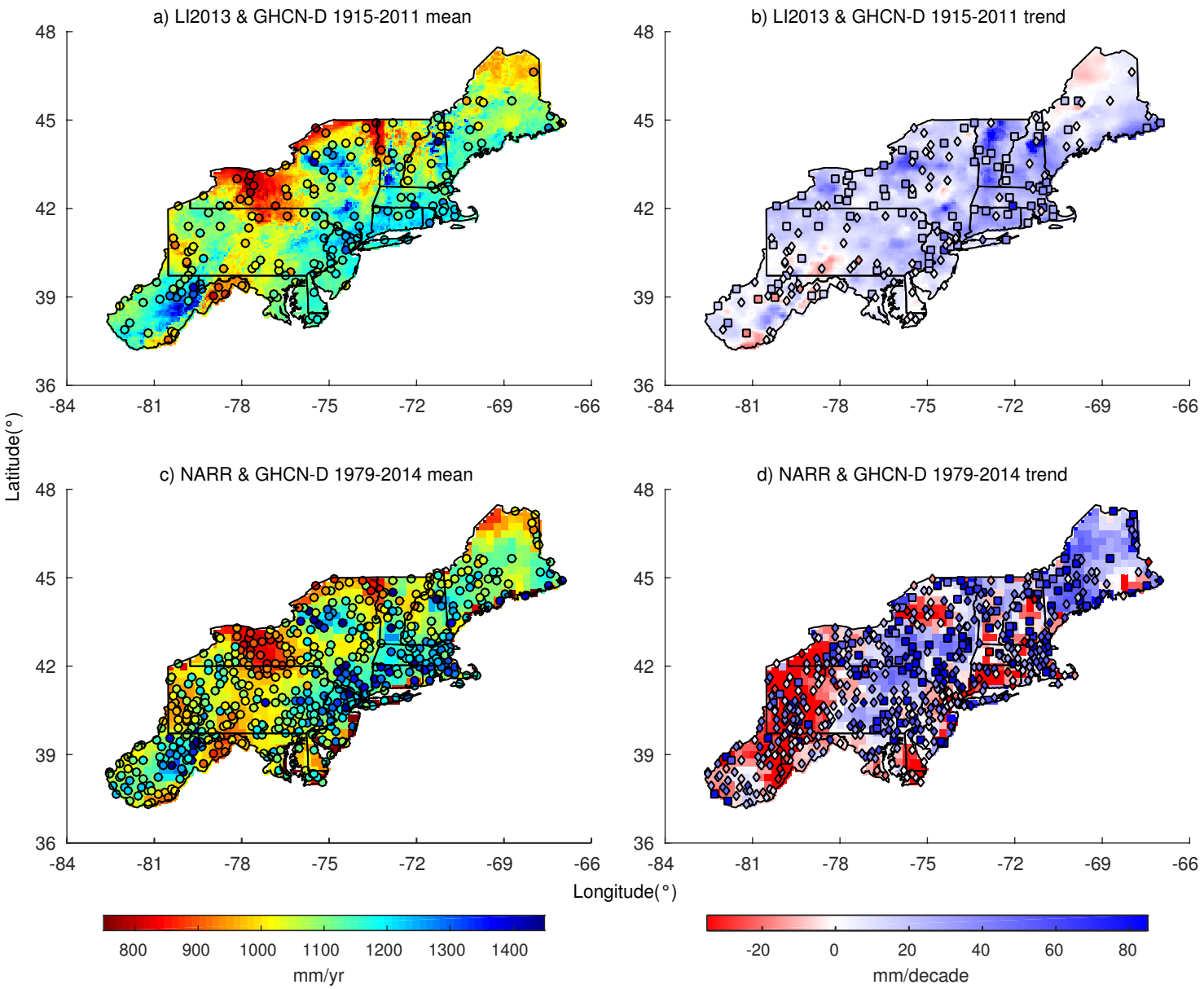

LI2013 (shading) and GHCN-D (points) annual total precipitation (a) means and (b) trends 1915–2011. NARR (shading) and GHCN-D (points) annual total precipitation (c) means and (d) trends 1979–2014. In (b) and (d), square points represent significant trends while diamond points represent insignificant trends.

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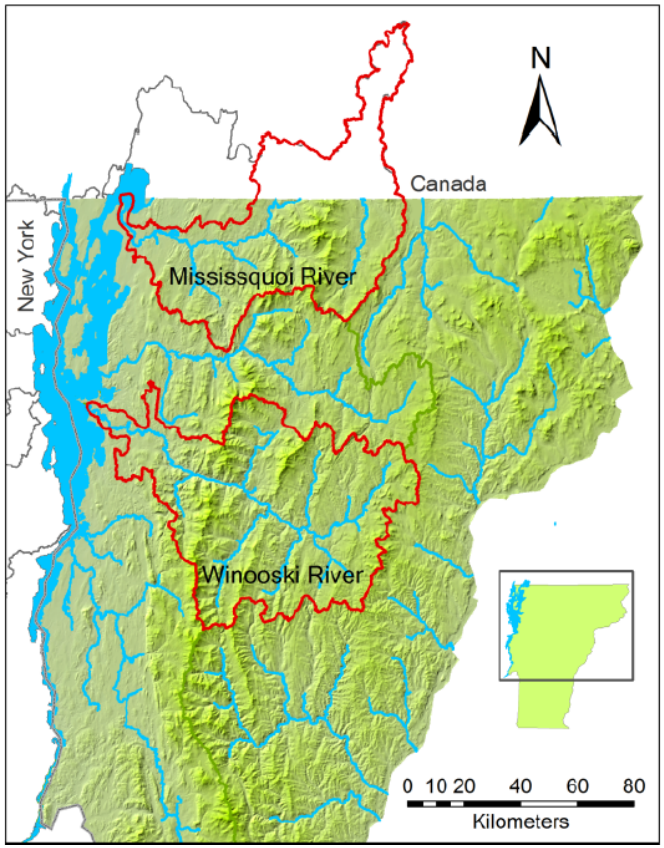
Project Funding

NSF Awards EPS-1101317 and OIA 1556770

Basin **R**esilience to **E**xtreme **E**vents (BREE) Research

The research aims to identify strategies for resilience in the Lake Champlain Basin. A new Integrated Assessment Model (IAM) will be developed to bring together soil and water sensor inputs and models to test management scenarios for resilience to extreme events.



Vermont EPSCoR