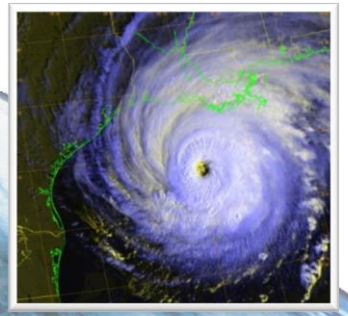
Atmospheric and Environmental Research

Verisk Climate™

Emerging Risk Research Program
Executive Summary of Phase I Results
Diagnosis of Severe Weather Environments in the US



June 23, 2014

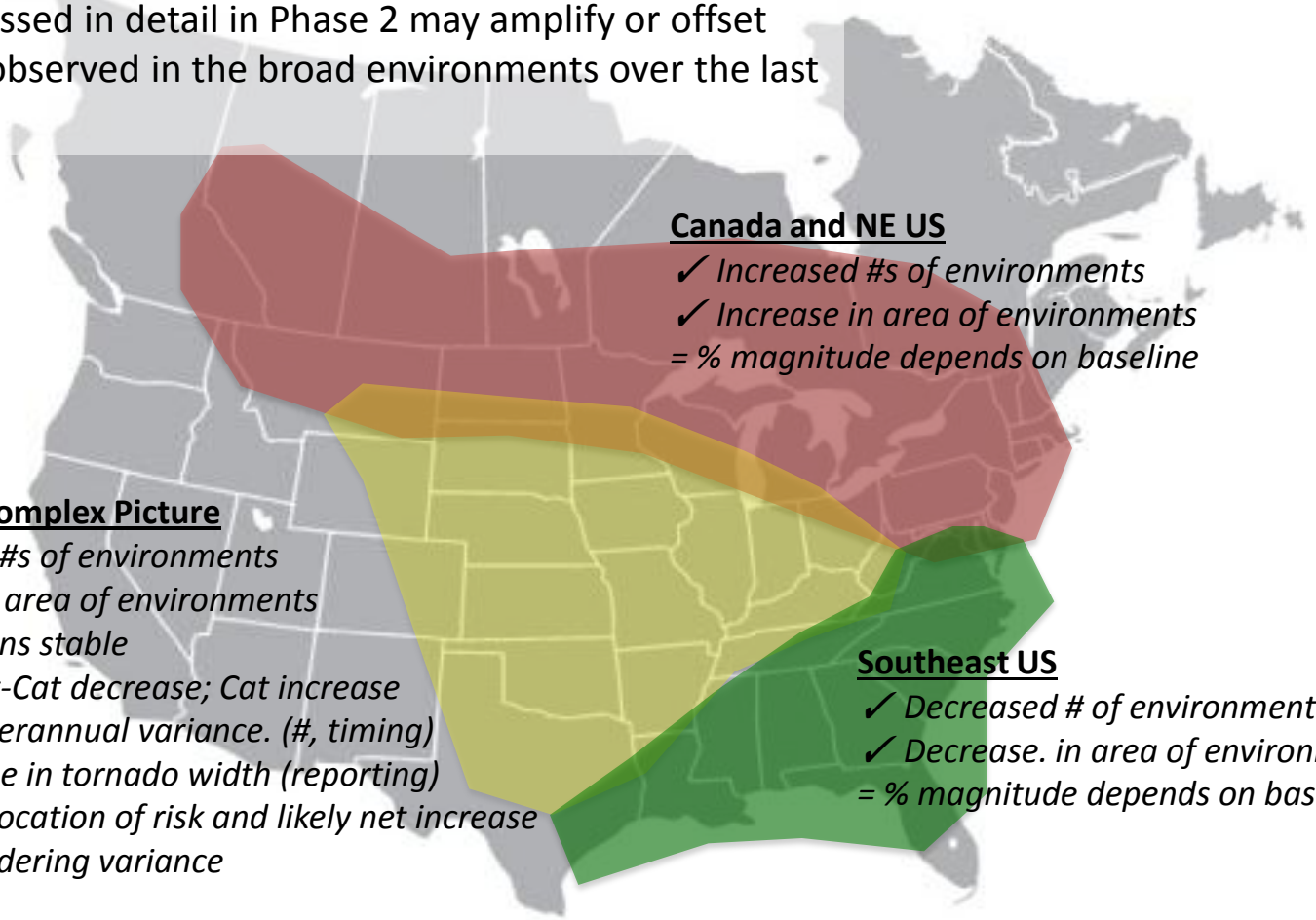
Emerging Risk Research Program

Climate Variation and Severe Convective Hazards

- 2-year effort, 2013-2015, to detect and quantify changes in the occurrence of hail/tornado/wind perils in the US and Canada
- 9 participating US and Canadian insurers
- Phase 1/Year 1 is finished and looked at long-term, large-scale trends in hail/tornado/wind
- Phase 2/Year 2 starts now and will explore differentiation of severe weather risk on small spatial & time scalesd

Summary of Broad Phase 1 Conclusions

Differences in severity (e.g., hail size, path width/length, etc.) that will be assessed in detail in Phase 2 may amplify or offset what has been observed in the broad environments over the last 20 years



Canada and NE US

✓ *Increased #s of environments*

✓ *Increase in area of environments*

= % magnitude depends on baseline

Central US: Complex Picture

✓ *Decreased #s of environments*

✓ *Increase in area of environments*

✓ *Observations stable*

✓ *Implies not-Cat decrease; Cat increase*

✓ *Greater interannual variance. (#, timing)*

✓ *Step change in tornado width (reporting)*

= Implies reallocation of risk and likely net increase when considering variance

Southeast US

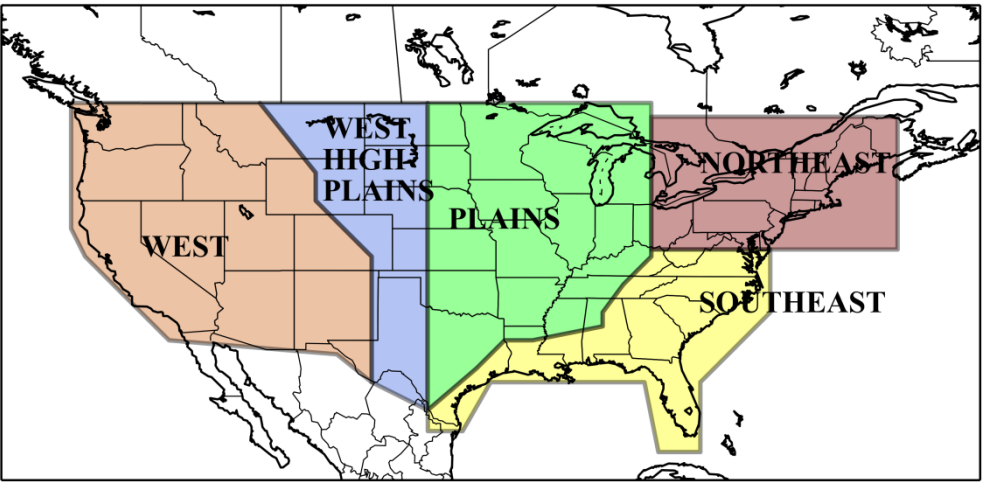
✓ *Decreased # of environments*

✓ *Decrease. in area of environments*

= % magnitude depends on baseline

Multi-way Discrimination Modeling

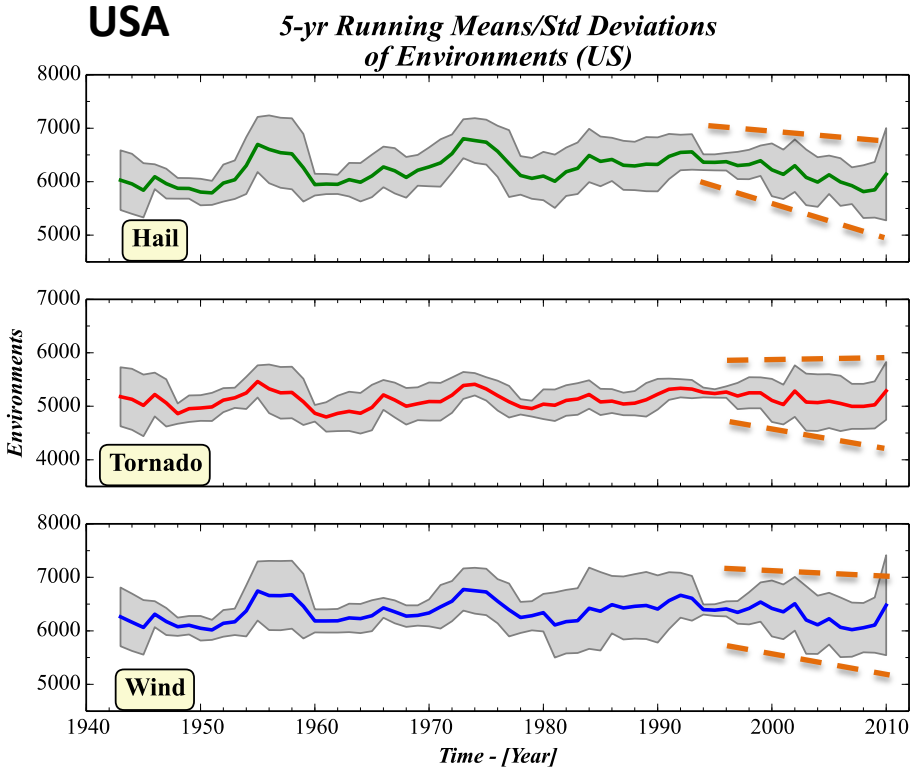
- We built new models that recognize hail-, tornado- and wind-producing conditions
- They identify, i.e., discriminate, favorable/non-favorable atmospheric environment for severe weather from primary, physical drivers
- Training period: 2000 – 2012
  - reconstruction of the climate + observations of severe weather = discriminant relationship
- Application period: 1940 – 2012



15 Independent Peril Models

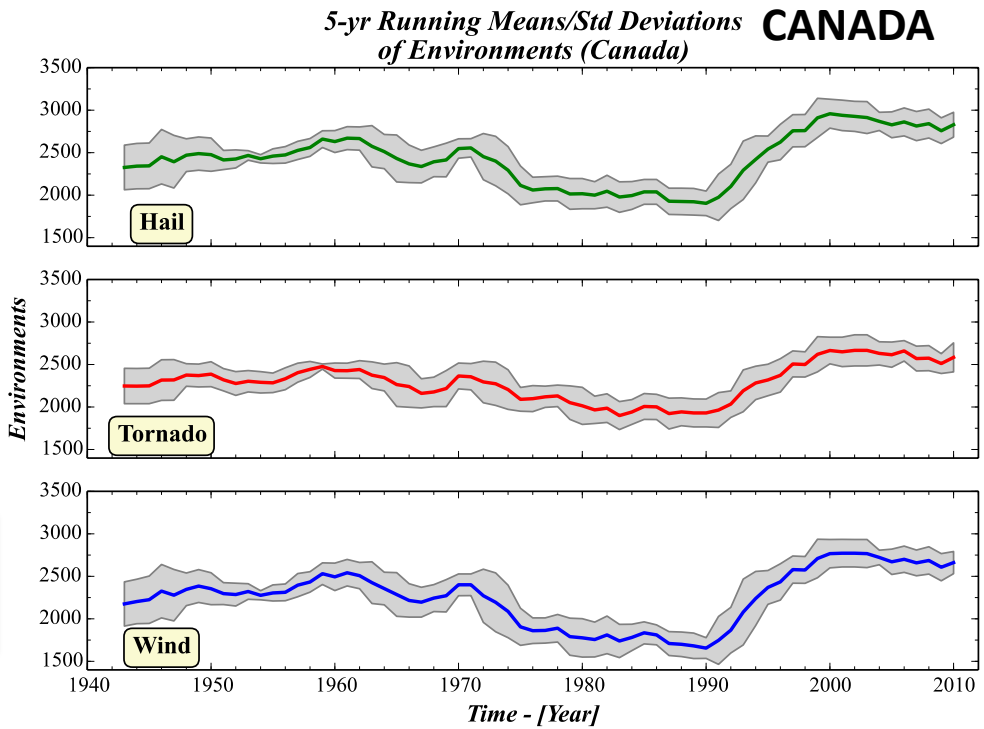
Region	Hail	Tornado	Wind
Plains	✔	✔	✔
West High Plains	✔	✔	✔
Southeast	✔	✔	✔
Northeast	✔	✔	✔
West	✔	✔	✔

Long-term diagnosis: US and Canada 1940 - 2012



These are 5-year running averages of annual environments – whole US/all of Canada:

- little drift overall, but
- yr-to-yr variance is ↑ over the last 15-20 yrs.

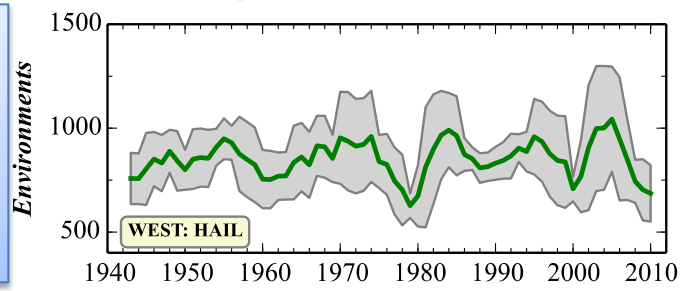


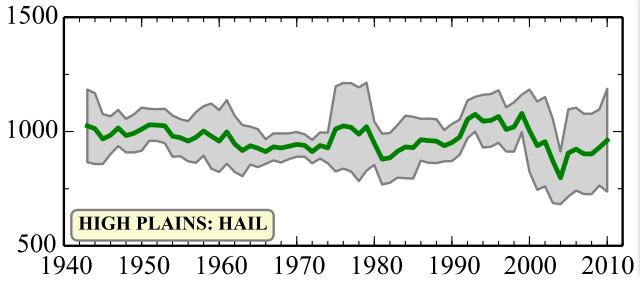
Canada is a very different story, including a marked increase in the 1990s.

Long-term *regional* diagnosis

hail environments, US

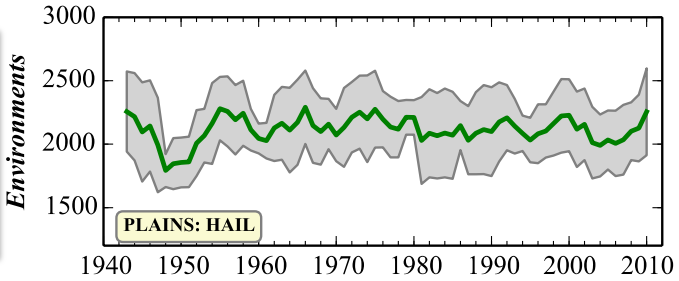
West: hail environments variable but not drifting.

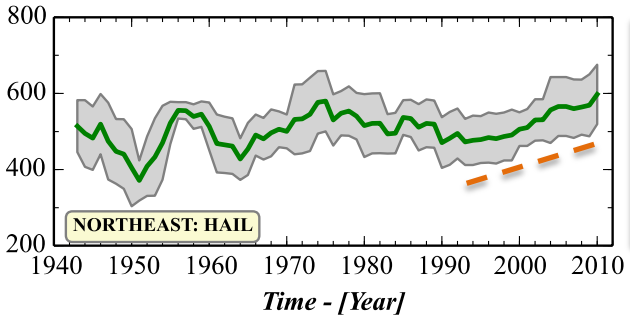




High Plains: hail environments variable but not drifting.

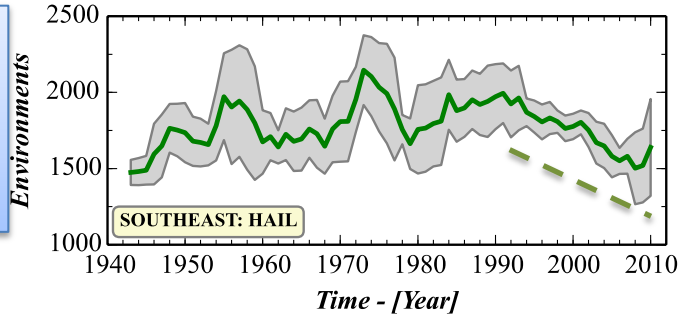
Plains: hail environments steady.





Northeast: hail environments ↑ last 20 yrs.

Southeast: hail environments ↓ last 20 yrs



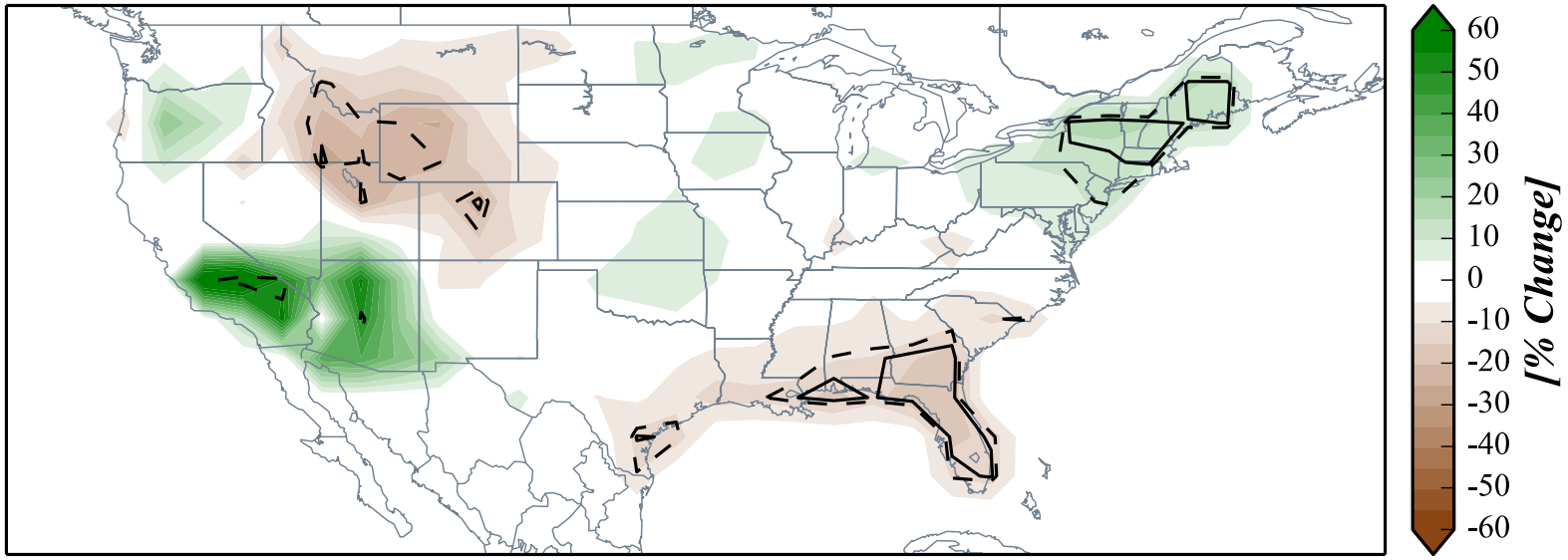
5-Year Running Mean / Standard Deviation (Hail)

Decadal Differences (US)

Hail

Most recent 10-year average – Most recent 30-year average

2003/2012 Mean – 1983/2012 Mean



Note the increases in the **Northeast** and decreases in the **Southeast** during the last 10 years compared to a 30-year average.

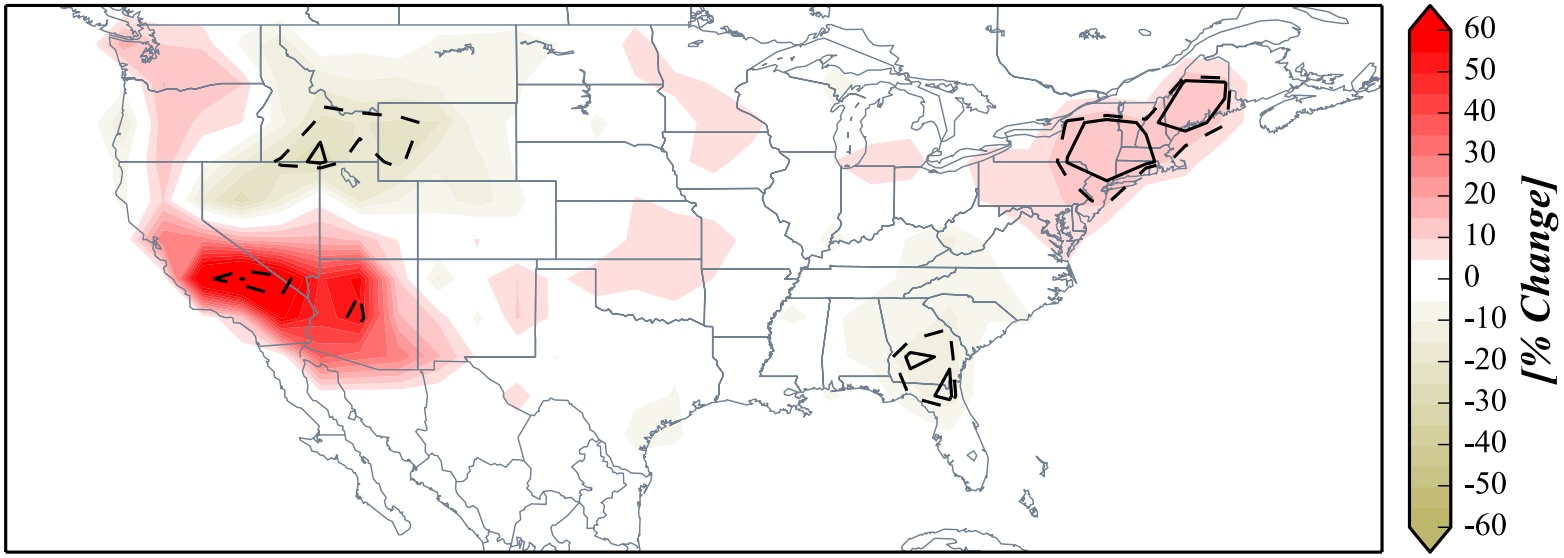
Dashed black = 80% significance
Solid black = 90% significance

Decadal Differences (US)

Tornado

Most recent 10-year average – Most recent 30-year average

2003/2012 Mean – 1983/2012 Mean



Differences between 10-yr and 30-yr average occurrence of tornado environments are more muted than hail.

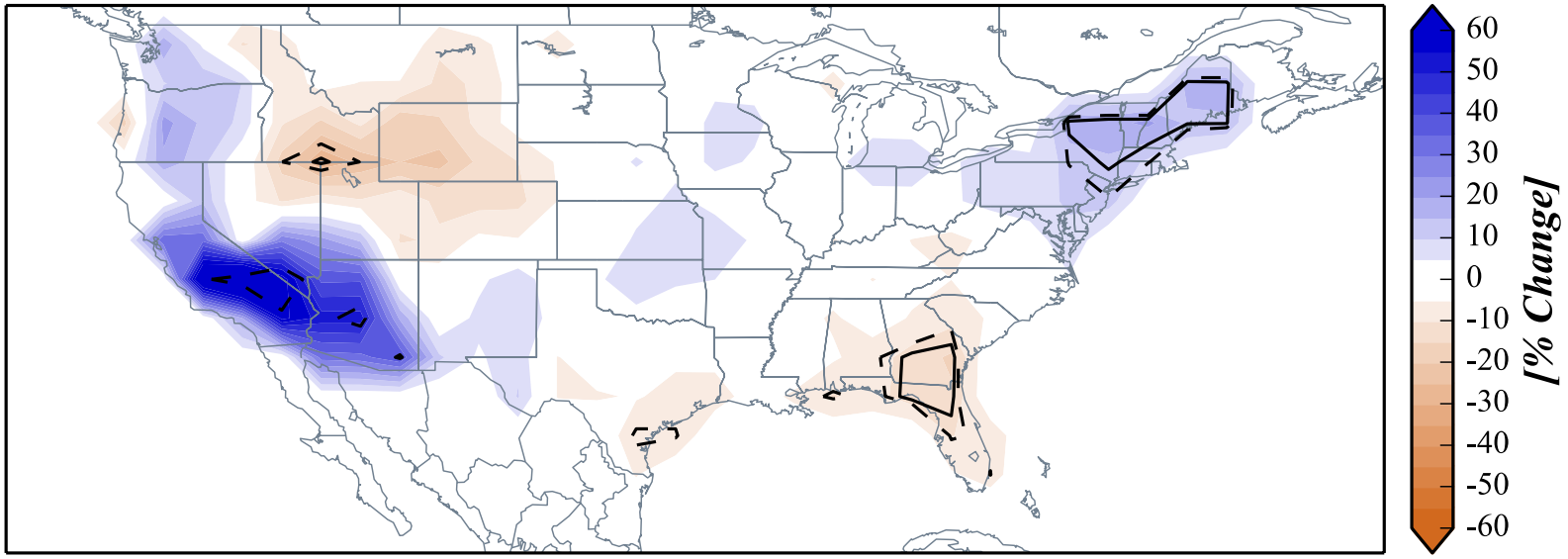
Dashed black = 80% significance
Solid black = 90% significance

Decadal Differences (US)

Wind

Most recent 10-year average – Most recent 30-year average

2003/2012 Mean – 1983/2012 Mean



Differences are similar to hail.

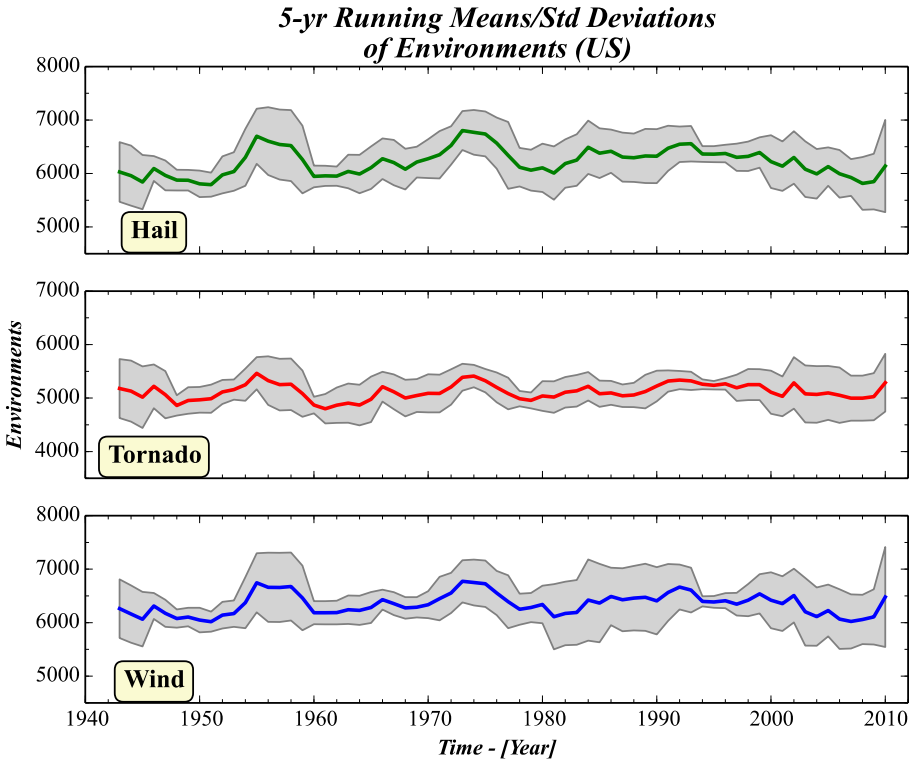
Dashed black = 80% significance
Solid black = 90% significance

Summary & Conclusions, 1

Phase I Hazard findings

Thus far in the research program, we find:

- national hail/tornado/wind environments in the US for the period 1940-2012 have not moved far from a long–term average.
- regional increases (decreases) in hail/wind environments are noted in the northeast (southeast).
- inter-annual variability has increased over the last 20 years.
- analysis of independent tornado and wind data corroborate fewer widespread severe weather days, while the effected area on those days is increasing.
- tornado occurrence is trending toward larger outbreaks on fewer days.



- We expect hail, tornado and wind environments to remain flat or decrease slightly in the next 5-10 years, while year-to-year variability is likely to stay at current, historically high levels or increase.

Summary & Conclusions, 2

Risk management implications

- *Distribution tails of US weather-related losses seem to be broadening on both ends.*
- *Hazard risk variability has increased, so assessment of capital adequacy and capital allocation will need to allow for a larger risk envelope going forward.*
- *Increased hazard risk is leading to larger, single-event catastrophic weather losses, perhaps shifting the balance of CAT versus non-CAT losses toward catastrophic losses.*
- *More aggressive loss reserving and a greater degree of liquidity will be needed to minimize unplanned reserve releases.*