Long-term Statistical Relationships of Hail and Tornado with Mesoscale Convective Systems

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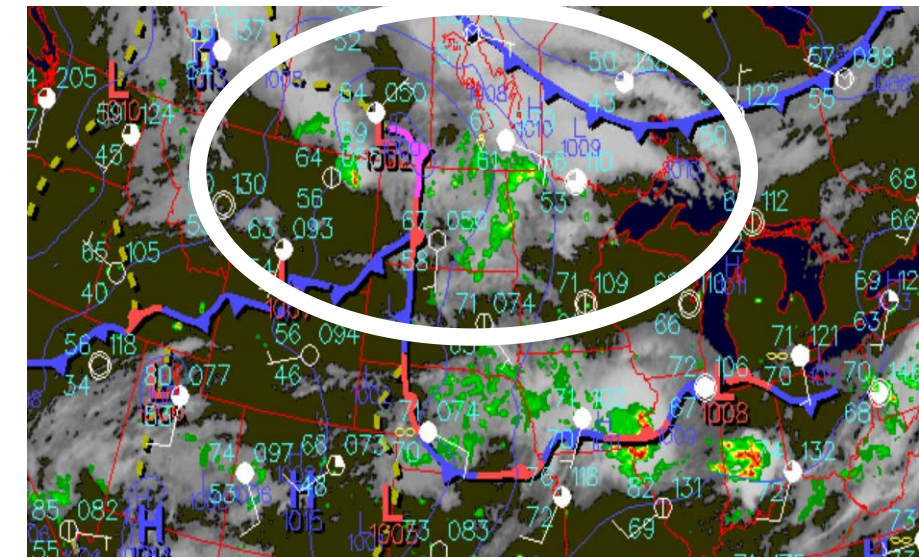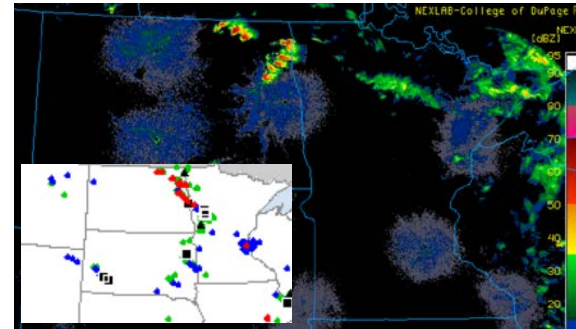Pacific Northwest National Laboratory

Motivation

July 11, 2017, North Dakota

- Strong convective systems (e.g., supercells at scale of hourly, 10s km) generate devastating hails and tornadoes.

- Those small, intense hazard-producing systems are frequently embedded in the MCSs featuring much larger spatiotemporal scale (days, 100s km).

- The connection between hazards and MCSs has not been quantified.

- The long-term statistics between hazards and MCSs have an important implication to the improvement of the hazard forecast lead time through the intermedia of MCSs.
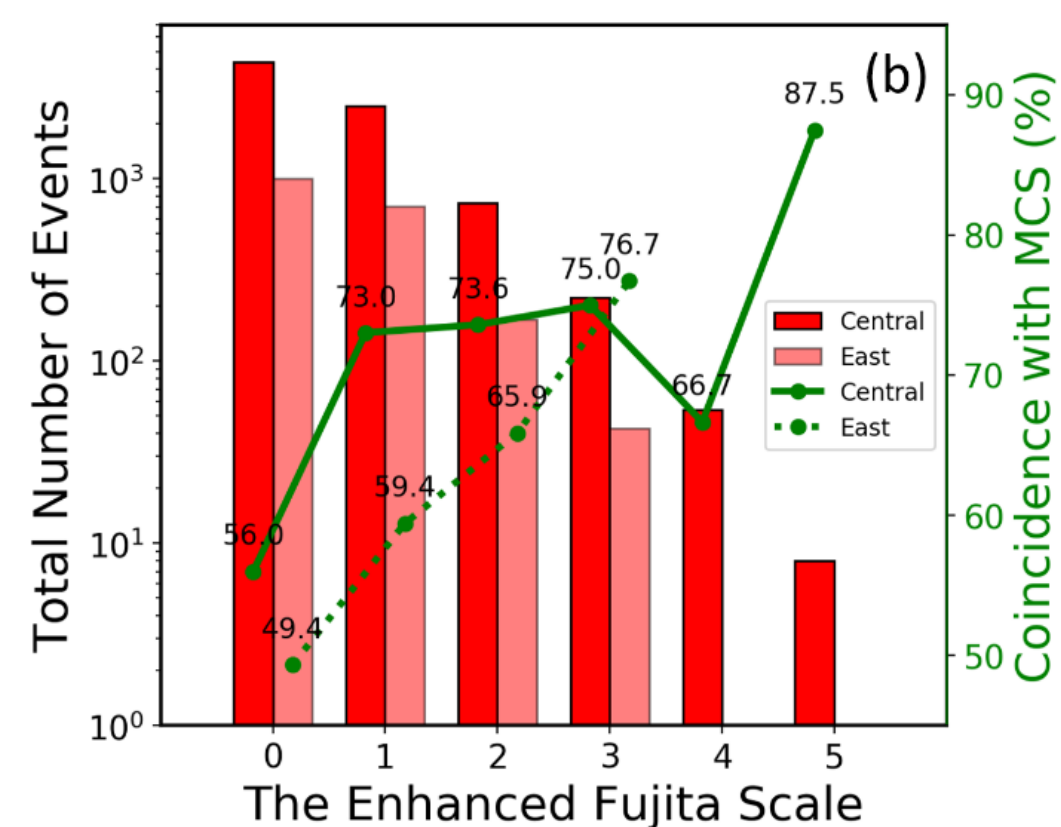
Key Results
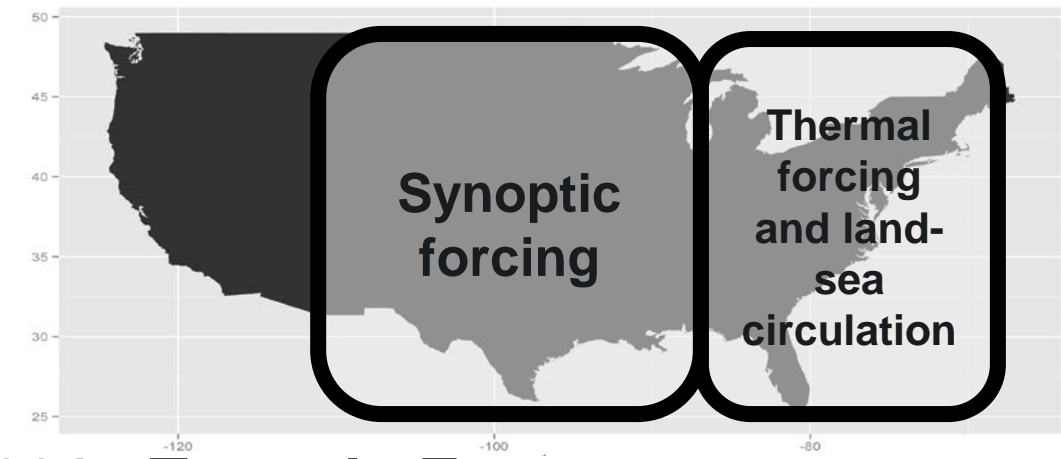
2004-2017 Hail Events
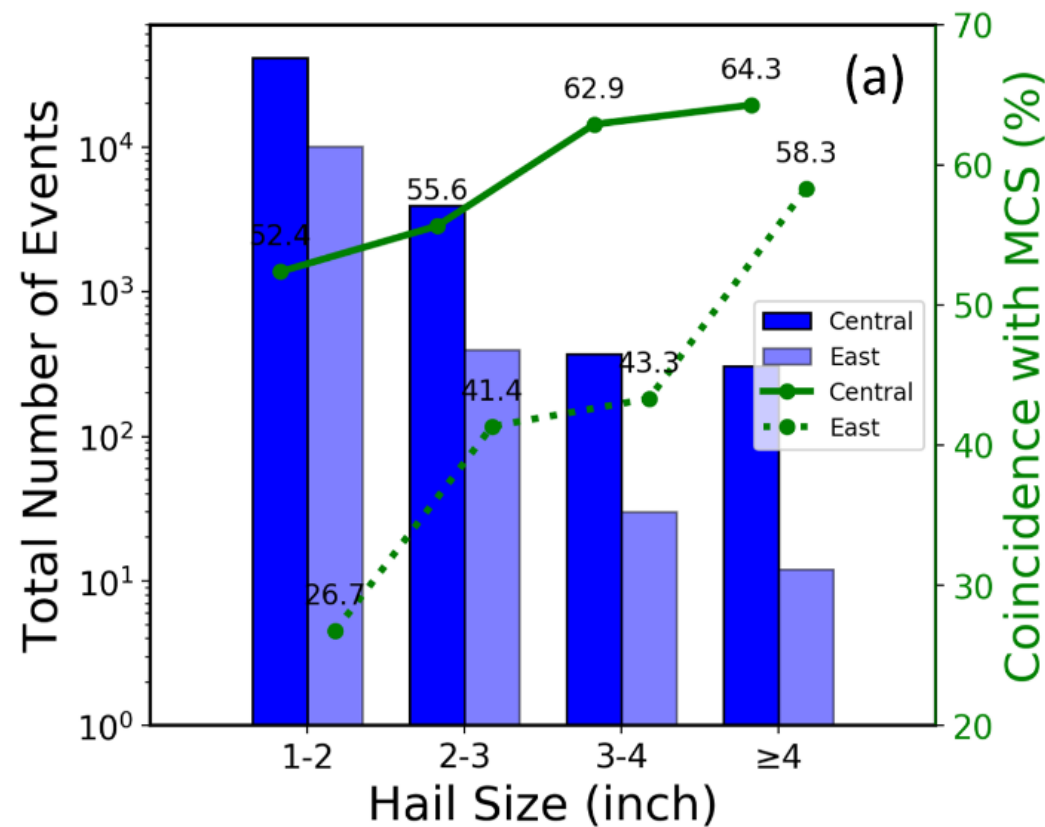
2004-2017 Tornado Events

Central

53% MCS vs.
30% non-MCS

Eastern

27% vs. 47%

Central

64% vs. 16%

Eastern

55% vs. 22%

- 48% of hails and 62% of tornadoes over the Central and Eastern U.S. are associated with MCSs.
- The MCS-percentage increases with the severity of the hazard.

Possible Improvement to the Hazard Predictability

- Complete the spectrum of forecast lead time

Outlook of 0-3 days
by reginal climate model

Subseasonal forecast
(2-5 weeks) by MJO

Seasonal forecast
(> 1 month) by ENSO

**MCS fills the gap of forecast scale
from sub-weekly, weekly, and subseasonal forecast**

- Further understand how large-scale atmospheric perturbations influence the hazard activities through affecting MCS

**Large-scale
perturbations** → **MCS** → **Hail and Tornado Activities**