Peering into the Future of Weather Disasters

With thanks to collaborators and co-authors, many of them current and former students!

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It is real. We are the cause. Earth-atmosphere is complex and difficult to study.
There is uncertainty. Change is complex, and varies across scales.
Change is occurring rapidly, and we do not understand implications fully.

Disaster Attribution
new science that seeks to tease out to what degree climate and/or societal changes are increasing the impacts from extreme events

Understanding
of effect of climate change on peril
**Dynamical Downscaling**

A computationally intensive technique that uses relatively coarse climate model output to inform high-resolution weather models that provide long-range (weeks to decades) insight into the future weather peril landscape at regional or local scales.

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**Model output representing ingredients for severe storms**

From coarse resolution climate model to high-resolution weather model.

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**Sample model output for April 2090**

Simulated Storm Intensity

Atmosphere increasingly supportive of severe thunderstorms →
Overlapping Risk and Vulnerabilities

Risk
Vulnerability

Expanding Bull's Eye Effect
1940
2000
Housing Density

Rural
Exurban
Suburban
Urban
Tornado Path
Automating the detection of storms using AI

September 10, 2020 Derecho: Lowest Angle NWS Radar Reflectivity at One-Hour Time Steps

9 April 2015 Ogle/DeKalb Tornado
Ongoing and Future Efforts

- Combine expertise with existing and new computing infrastructure via NICCS to inform stakeholders on the changing weather peril landscape via extended-time-horizon modeling

- Examples:
  - Inform insurance pricing and claims preparation
    - AmFam
  - Explore future thunderstorm and snowstorm water cycle inputs and perils
    - NSF
  - Facilitate meaningful and usable information that will inspire action to mitigate agricultural impacts from future weather extremes
    - Community Project Funding/NOAA
• Understand how/why/where the risk to extremes is changing ... while revealing that disasters occur because people are vulnerable – that for physical, economic, and/or social reasons, they are exposed and will suffer if a hazard strikes

• Transfer new knowledge from research to application (R2A) to better inform policy and decision-making regarding water inputs and impending perils to improve mitigation and build resiliency

• Always with a focused eye on student involvement and engagement so that we may train the next generation of data scientists, interdisciplinary researchers, and skilled/informed citizens to tackle these acute issues