Slide 1

NIU Weather, Climate, and Society Research Group
Peering into the Future of Weather Disasters

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

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Slide 2

NIU Weather, Climate, and Society Research Group
wcs.niu.edu

Current Students

Dr. Doug Miller
POSTDOC RESEARCHER
Climate Dynamics and Variability; Extreme Weather

Robert Fritzen
PH.D. STUDENT
Winter Weather; NWP

Dominique Watson
M.S. STUDENT
GIS, Forensic Meteorology

Kelly Swaney
M.S. STUDENT
Severe Weather; Climate Change

Bailey Stevens
M.S. STUDENT
Severe Storms, Hazards, GIS

Chris Battisto
M.S. STUDENT
Applied Climatology, Severe Storms

Jillian Goodin
M.S. STUDENT
Climatology; Severe Storms

Billy Faletti
B.S. STUDENT
Severe Storms, Mesoscale

Margo Andrews
B.S. STUDENT
Remote Sensing, Severe Storms

Dr. Walker Ashley
Ph.D. University of Georgia
PTP; PRP; CCM #668
mesoscale meteorology, atmospheric hazards, and disasters

Dr. Victor Gensini
Ph.D. University of Georgia
Associate Professor; CCM #752
MET Undergraduate Coordinator
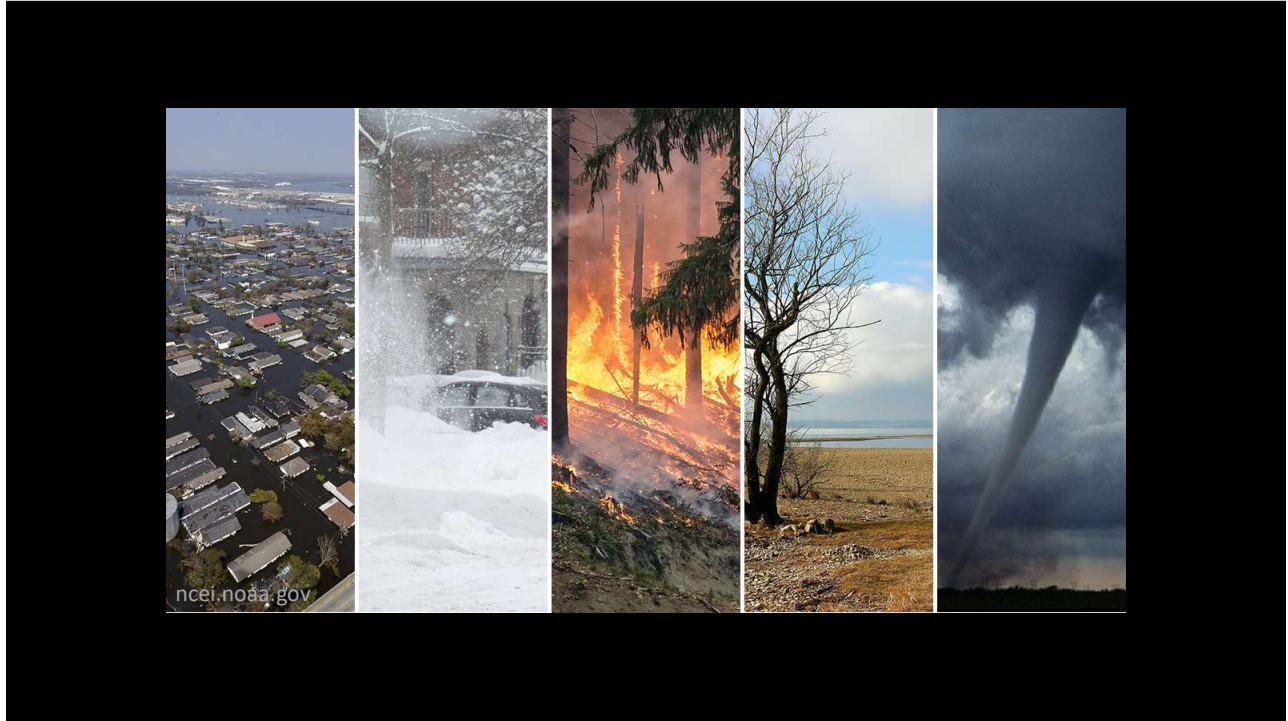severe weather climatology and prediction

Dr. Allison Michaelis
Ph.D. N.C. State University
Assistant Professor
climate change and tropical meteorology

Dr. Alex Haberlie
Ph.D. NIU
Assistant Professor
Joining August '21
artificial intelligence in the atmospheric sciences

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CO_2 Concentration

Global Mean Temperature (ºC relative to 1850-1900 mean)

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.

openclimatedata.net/climate-spirals

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

2013 Washington, IL tornado scar (Jessica Koscielniak)

Confidence in attributing specific perils to climate change

Northern Illinois University

Extreme Cold
Extreme Heat
Drought
Extreme Rainfall
Snowstorms
Tropical Cyclones
Hail   Wildfires
Tornadoes
Downbursts
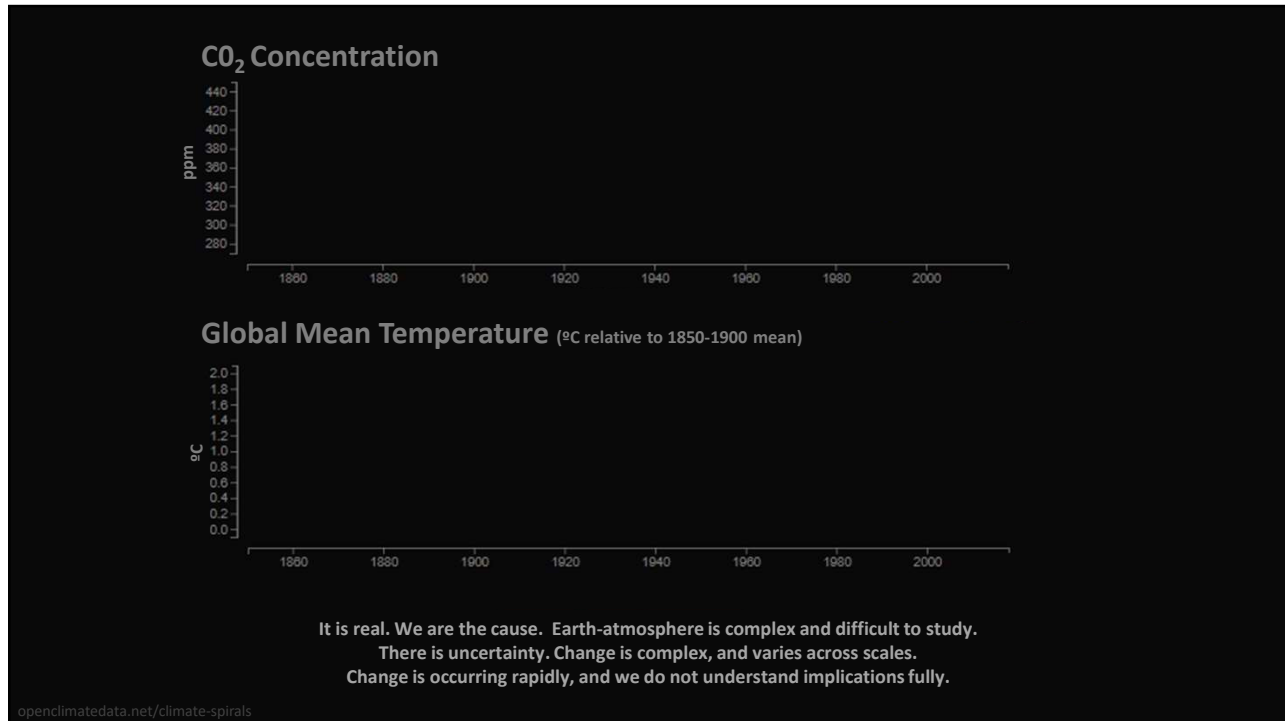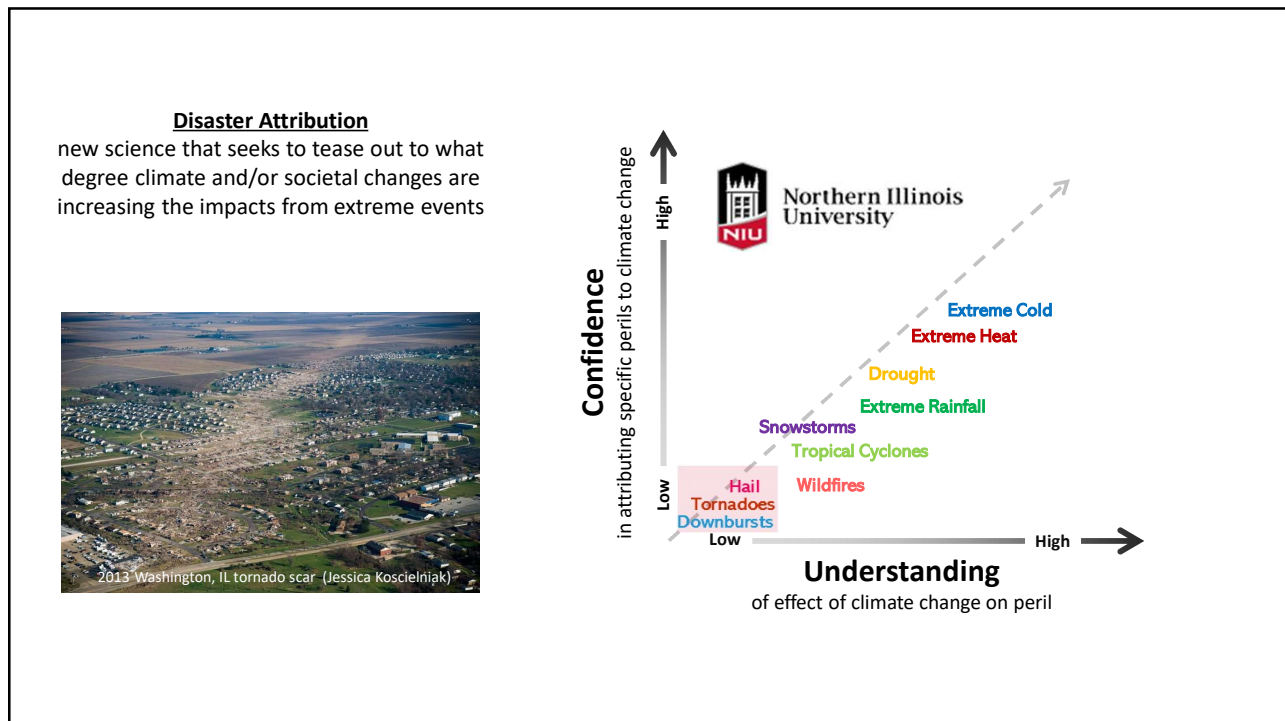
Understanding
of effect of climate change on peril

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Dynamical Downscaling
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
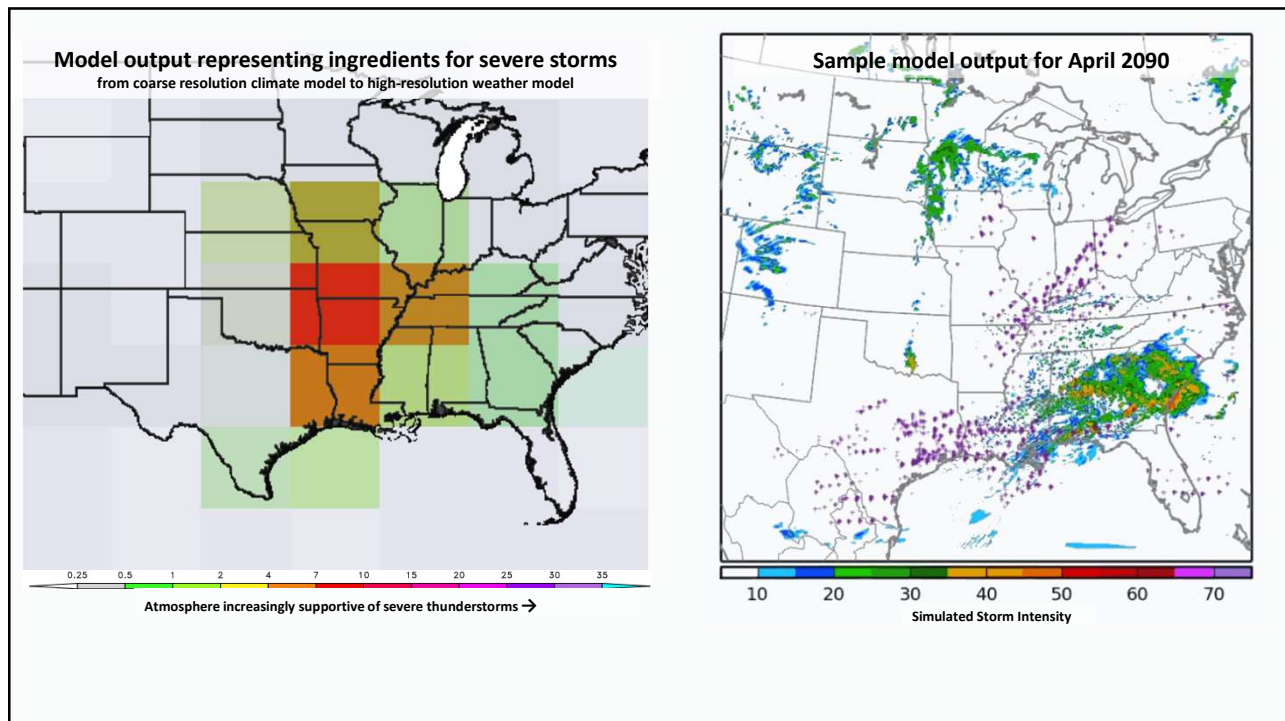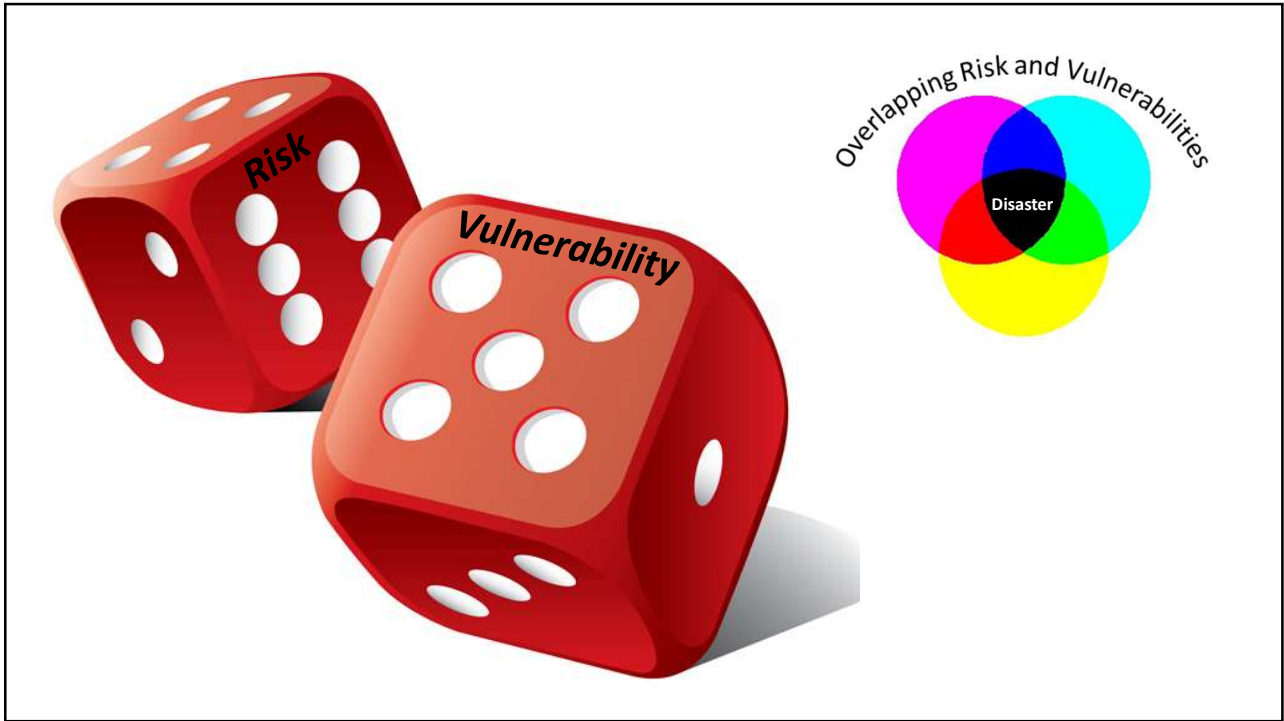
CRCD Compute Cluster

NORTHERN ILLINOIS UNIVERSITY
Center for Research Computing and Data
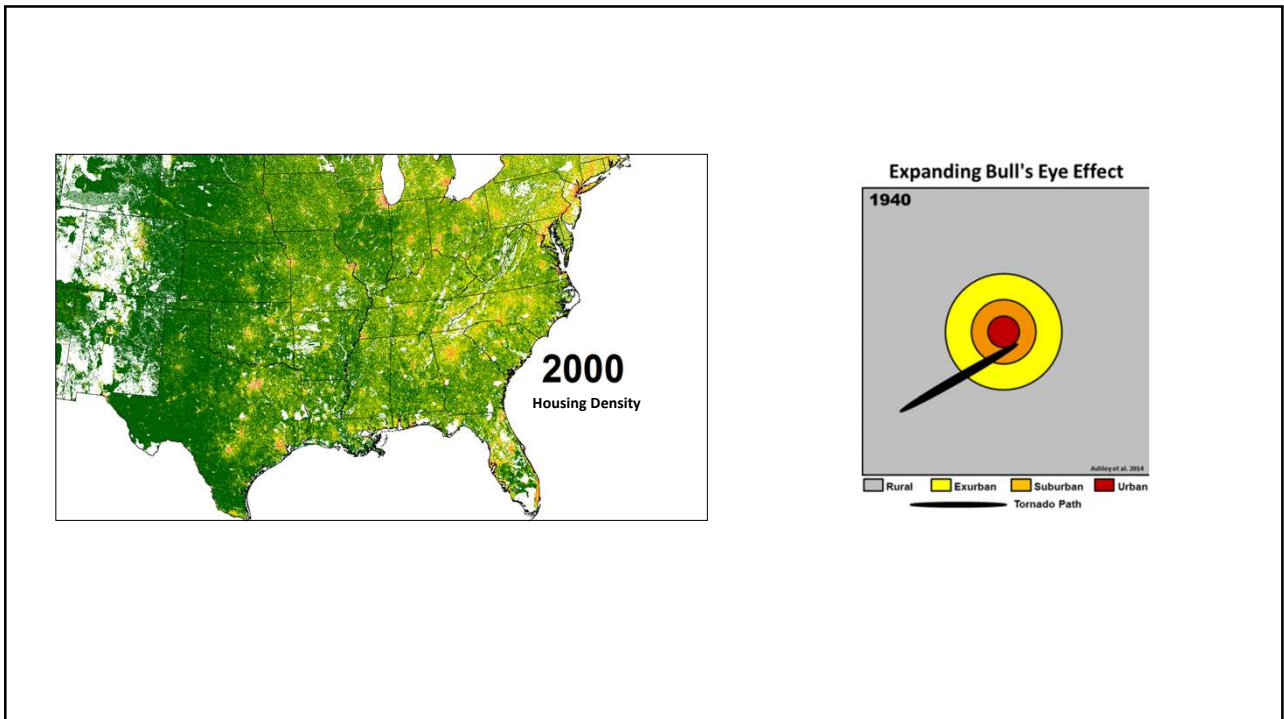*Division of Research and Innovative Partnerships*

NCAR-Wyoming Supercomputing Center

CHEYENNE

NSF

THETA

MIRA

Argonne
NATIONAL LABORATORY

Aurora
ENERGY
intel
CRAY

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Model output representing ingredients for severe storms
from coarse resolution climate model to high-resolution weather model

0.25 0.5 1 2 4 7 10 15 20 25 30 35
Atmosphere increasingly supportive of severe thunderstorms →

Sample model output for April 2090

10 20 30 40 50 60 70
Simulated Storm Intensity

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August 10, 2020 Derecho: Lowest Angle NWS Radar Reflectivity at One-Hour Time Steps
All times in CDT

8 a.m. 9 a.m. 10 a.m. 11 a.m. 12 p.m. 1 p.m. 2 p.m. 3 p.m. 4 p.m. 5 p.m. 6 p.m. 7 p.m.

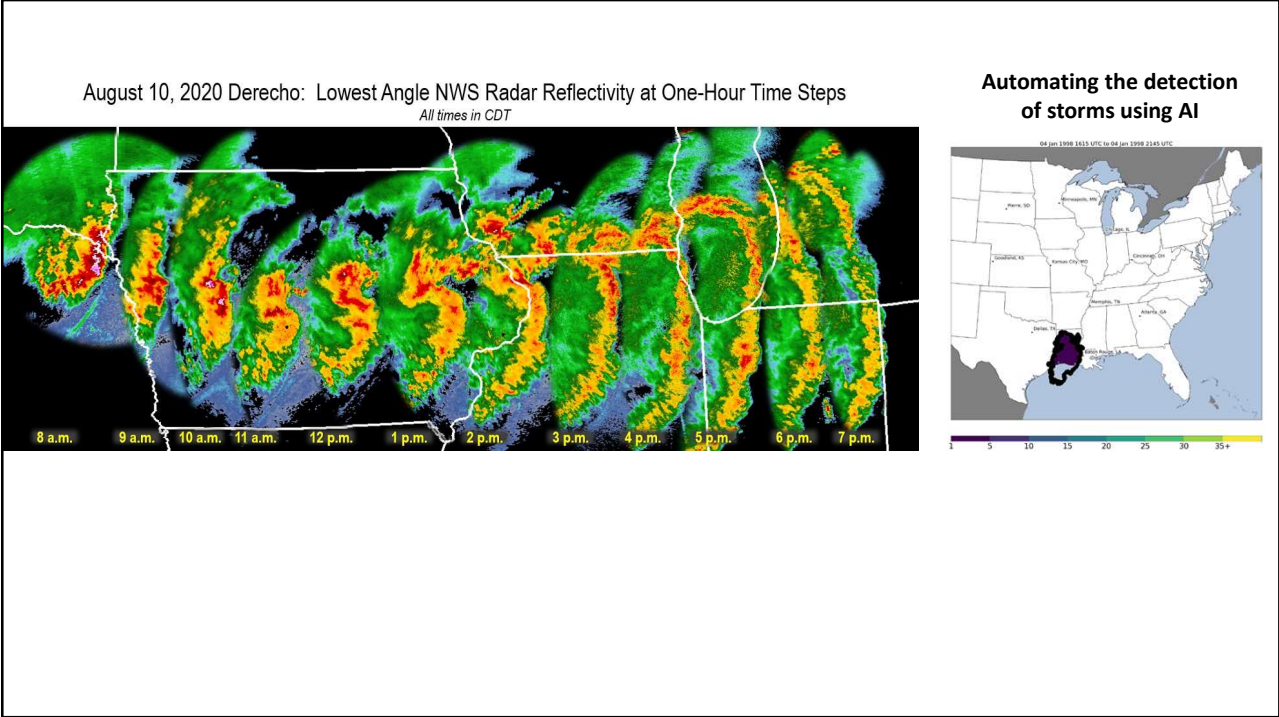**Automating the detection of storms using AI**

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9 April 2015 Ogle/DeKalb Tornado
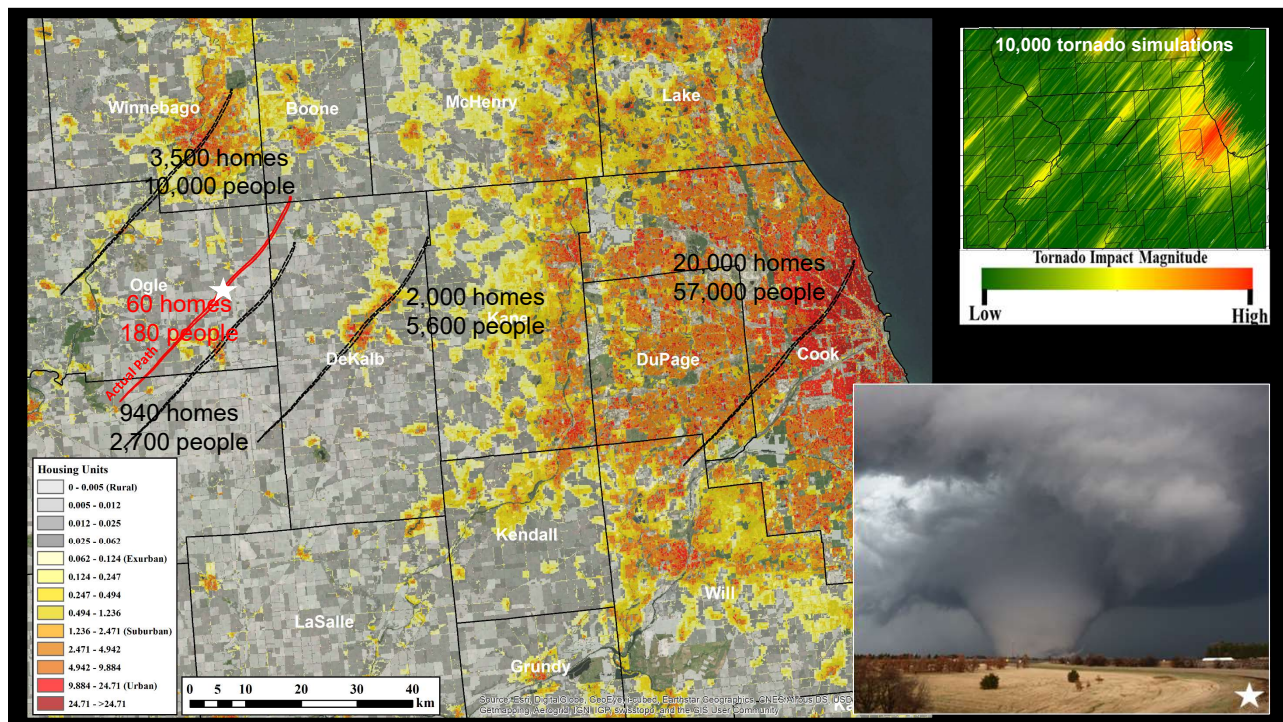
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Ongoing and Future Efforts

- 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**

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- 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

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