

Weather Research as a Catalyst for Discovery, Workforce Development, and Upward Mobility

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Science Foundation and National Oceanic
and Atmospheric Administration



Northern Illinois University

Your Future. Our Focus.



Racial/Ethnic Minority	56%
First Generation	52%
Pell Eligible	53%

**Emerging Research Institution
Innovation and Economic Prosperity University**



NIU Research Vision

“Preparing Northern Illinois and the nation for a century of change”

Addressing a changing climate

Preparing for changing demographics

Leading the evolution of technology

Interpreting our changing world



NORTHERN ILLINOIS UNIVERSITY

**Division of Research and
Innovation Partnerships**

NIU CCS

NORTHERN ILLINOIS
CENTER FOR COMMUNITY SUSTAINABILITY

Creating a **Sustainable** Future

A partner of the Illinois Innovation Network

Weather, Climate, and Society (WCS) Research Group

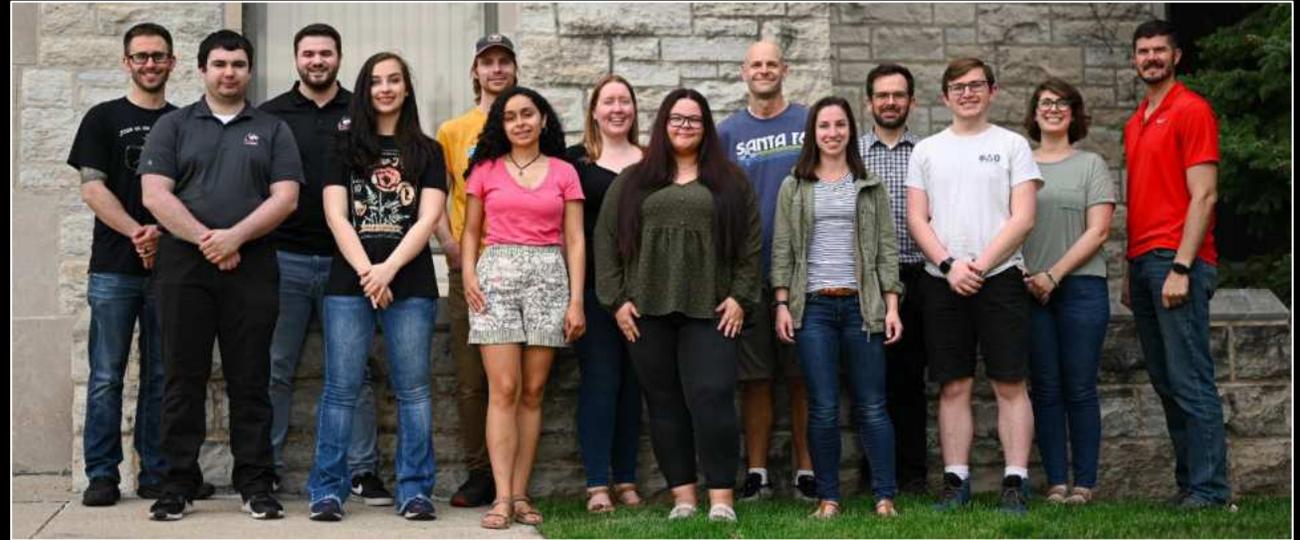
wcs.niu.edu



Dr. Walker Ashley, CCM



Dr. Victor Gensini, CCM



Dr. Allison Michaelis



Dr. Alex Haberlie



18 Ph.D./M.S. students and numerous undergraduate students

Research Group Snapshot

Two-thirds of our publications co-authored with students!  > 100 Journal Publications

8 Federal Research Grants



1 National Laboratory Partnership



1 Presidential Research Professor



3 Editorships



2 Certified Consulting Meteorologists



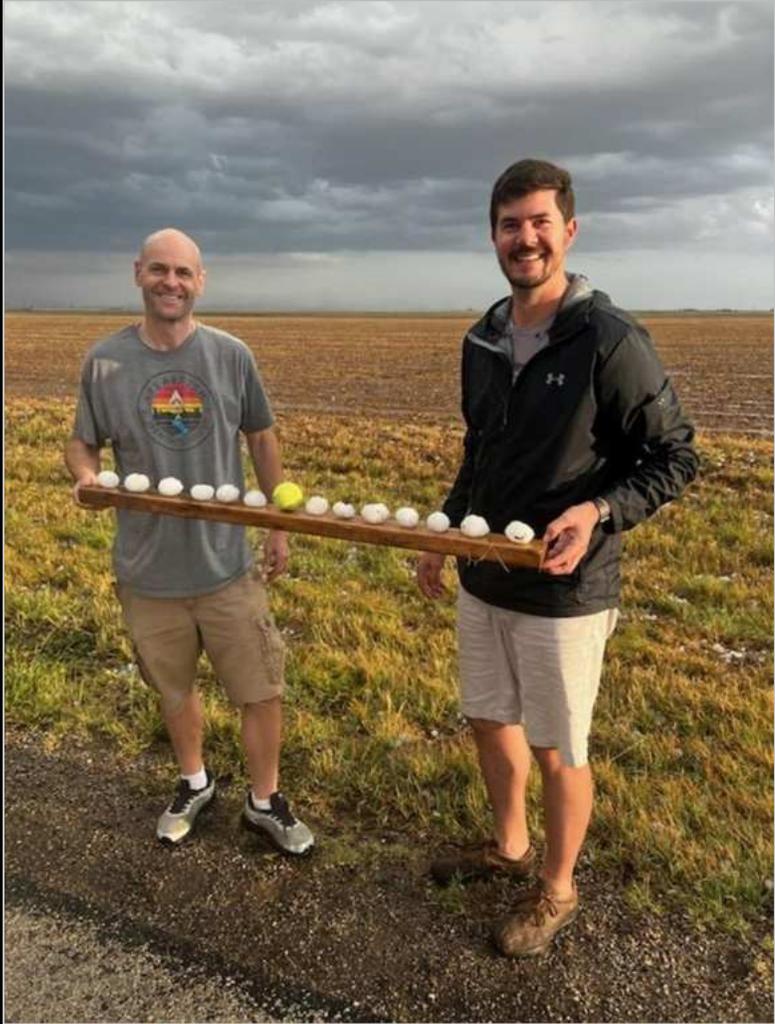
1 Distinguished Teaching Professor



- High-resolution Climate Modeling
- Climate Change
- Short- and long-range Forecasting
- Vulnerability Assessment
- Extreme Weather
- Machine Learning and AI



“International leaders in cutting-edge climate analytics applied to extreme weather perils”



100s of professional media hits on research; 10,000+ name mentions; a potential reach of over 9 billion readers/viewers; publicity value equivalency of >\$105 million

The Changing Disaster Landscape



Severe convective storms = thunderstorms that produce large hail, damaging winds, and/or tornadoes

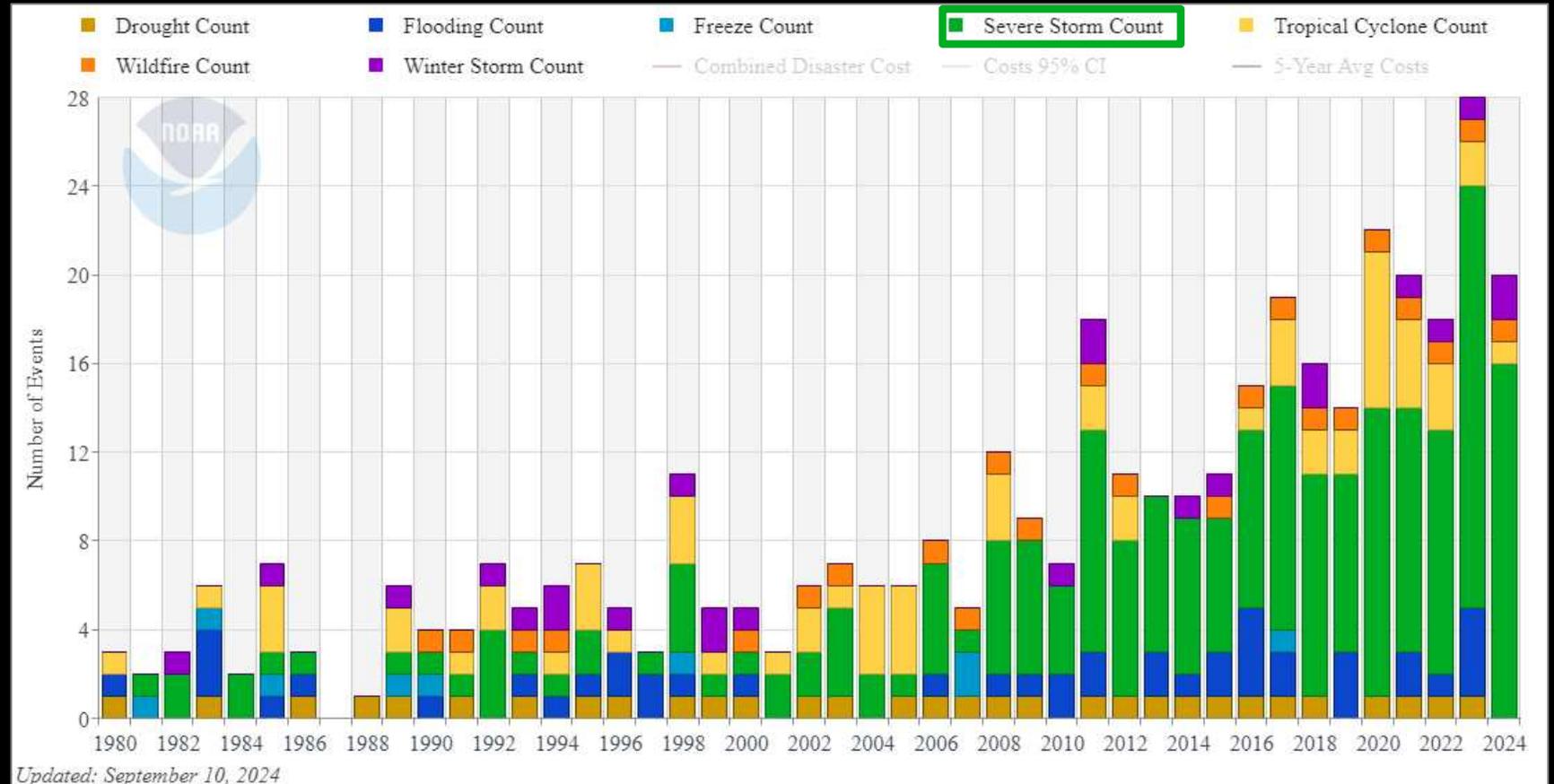
U.S. Billion-dollar Disaster Events

70% of global insured losses driven by **severe thunderstorms**

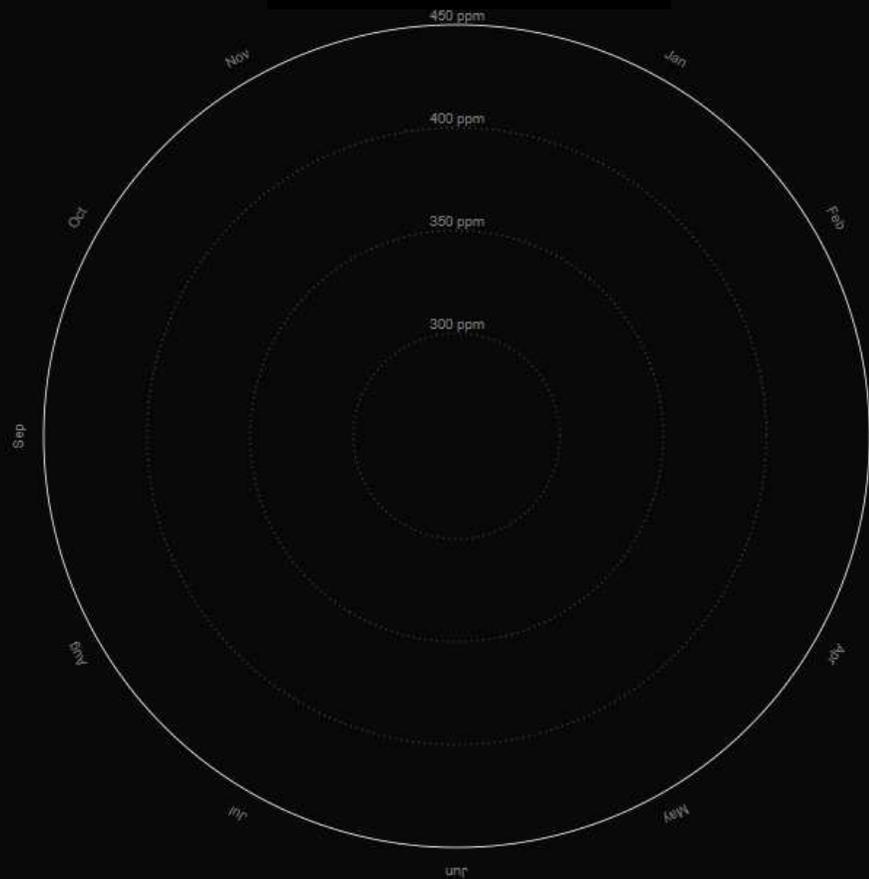
(Aon 2023)

U.S. **severe thunderstorm** losses >\$50bn in '23 and >\$60bn in '24

(Gallagher Re 2023)



CO₂ Concentration

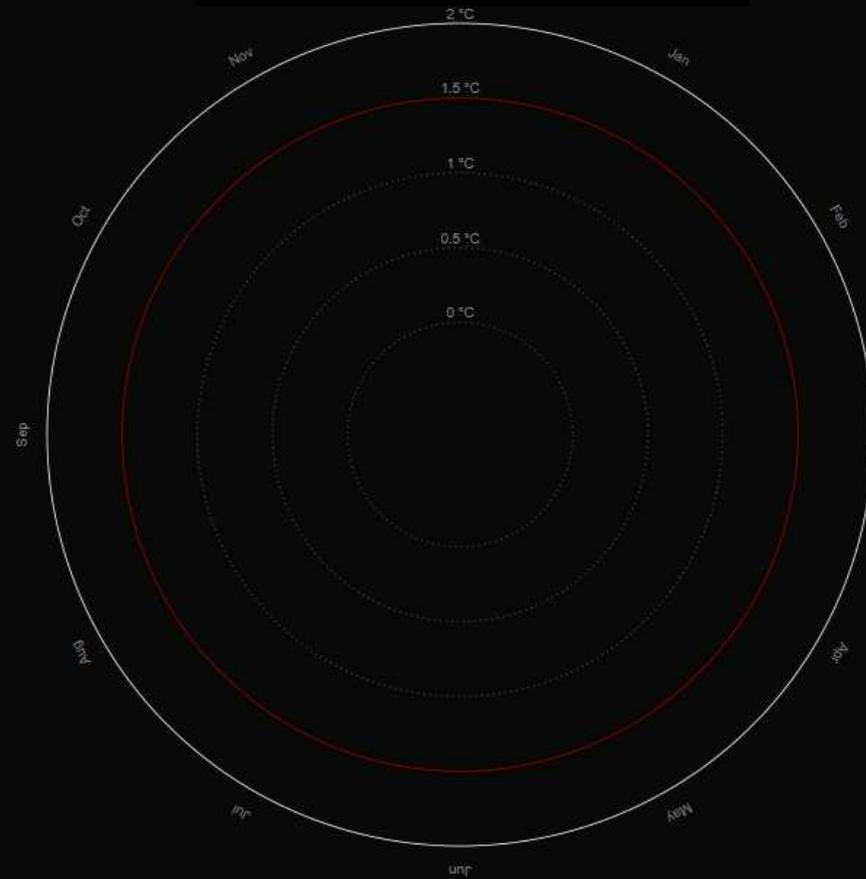


Monthly CO₂ concentration in ppm

440
420
400
380
360
340
320
300
280

1880 1880 1900 1920 1940 1960 1980 2000

Global Mean Temperature



Global Mean Temperature in °C relative to 1850 - 1900 average

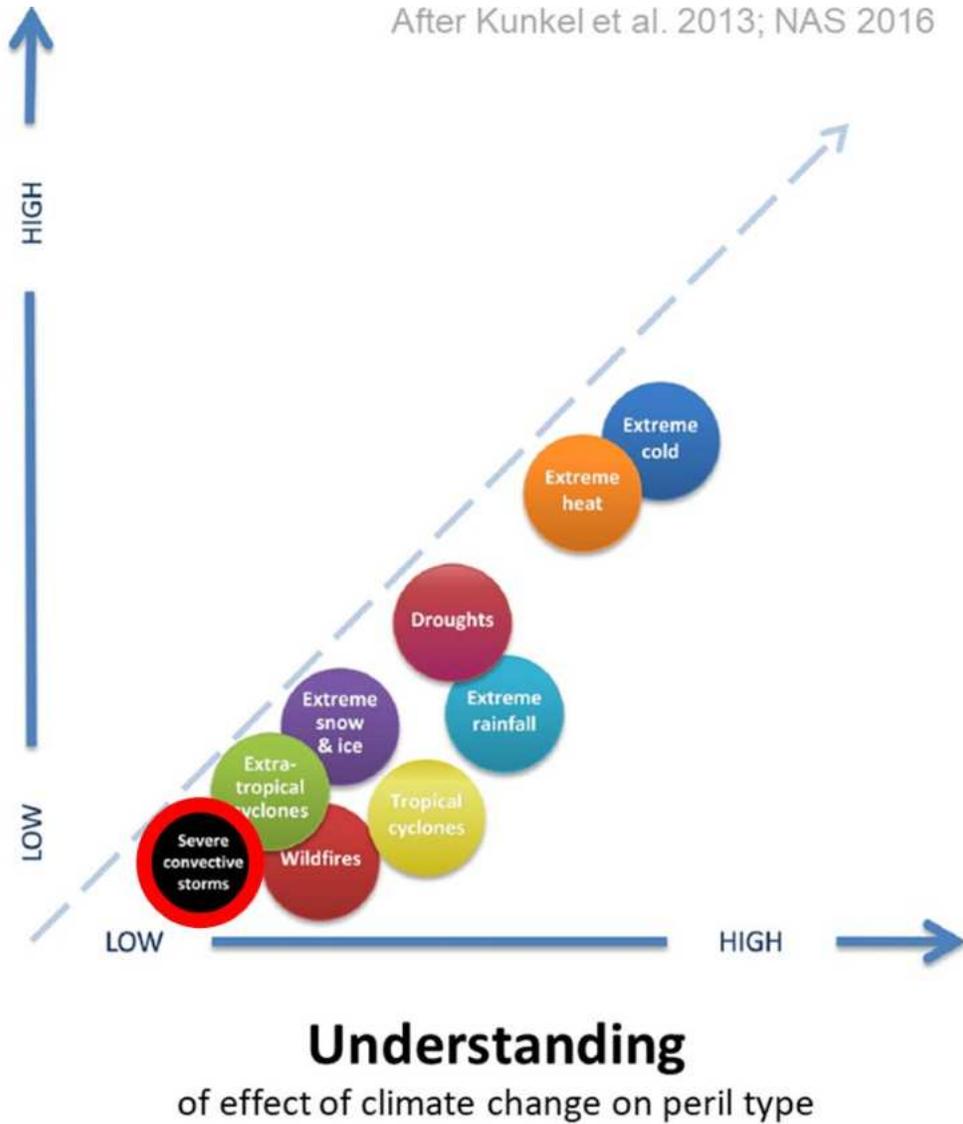
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0

1880 1880 1900 1920 1940 1960 1980 2000

openclimatedata.net/climate-spirals Ed Hawkins, Robert Gieseke, and Malte Meinshausen

**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.**

Confidence
in attributing specific perils to climate change



Post-Sandy Cover

Can climate change be **blamed**?

Blamed for what?

Framing it as **cause** vs. **contributor**

Two Approaches

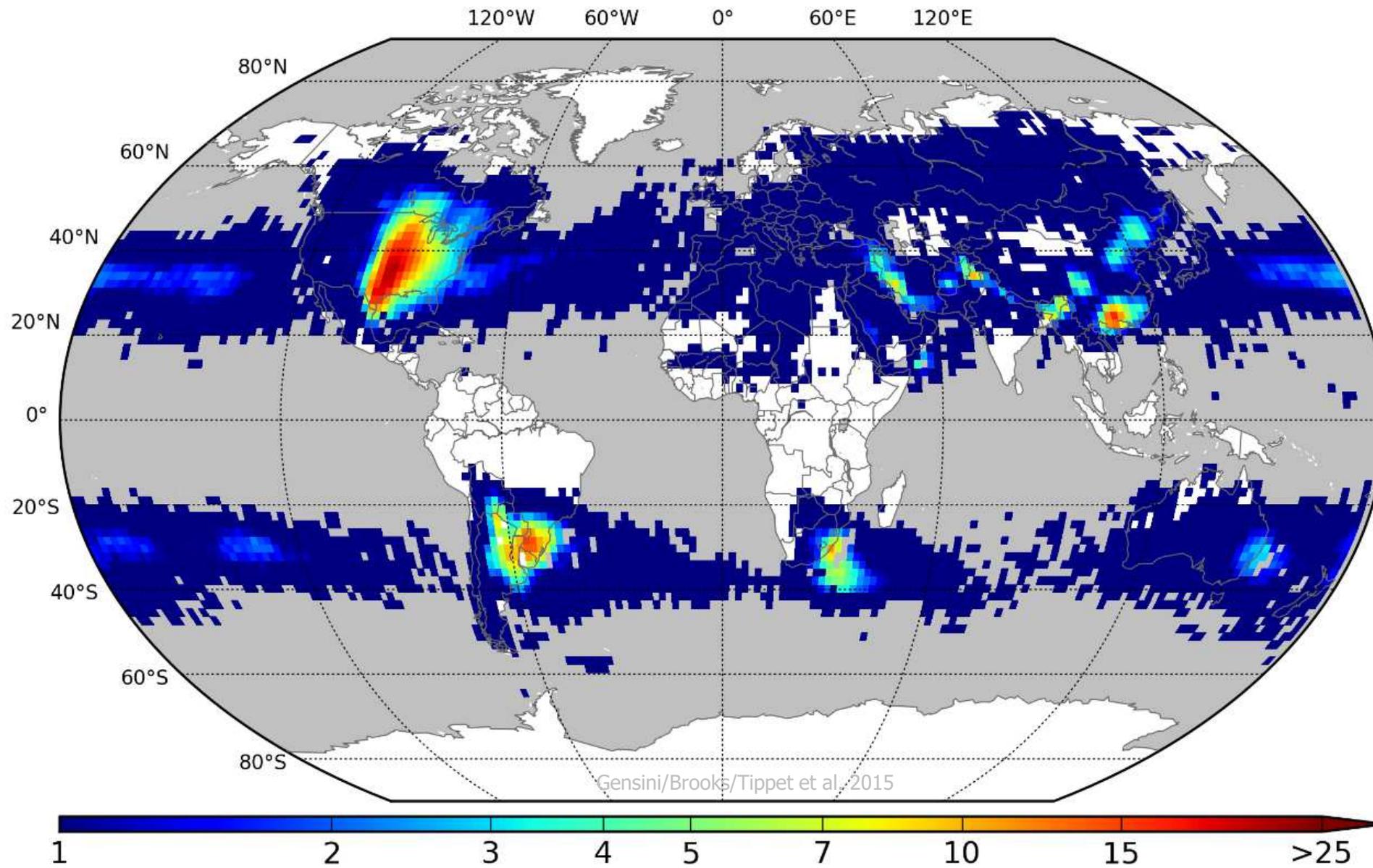


Examine **Ingredients** for Severe Storms



Explicitly Resolve Severe Storms and Perils

Where Do Severe Thunderstorm Ingredients Come Together?



Annual days with environments supportive of tornadoes



≠



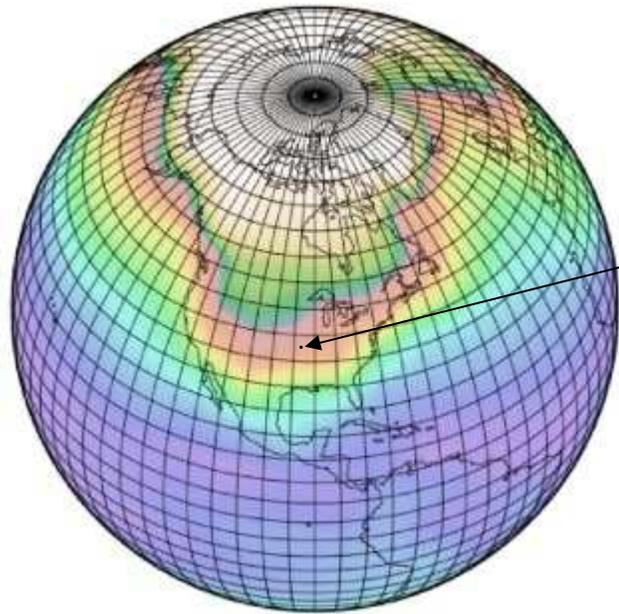
Storm type that produces most hazards, including nearly all strong tornado and significant hail events

Characterized by deep, persistent, rotating updraft

The Future of Supercells?



Global Climate Model

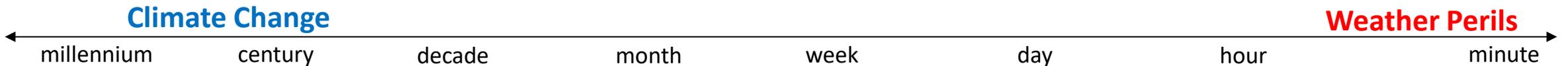


Grid Spacing 100-250km

Peril Producer



25 km wide





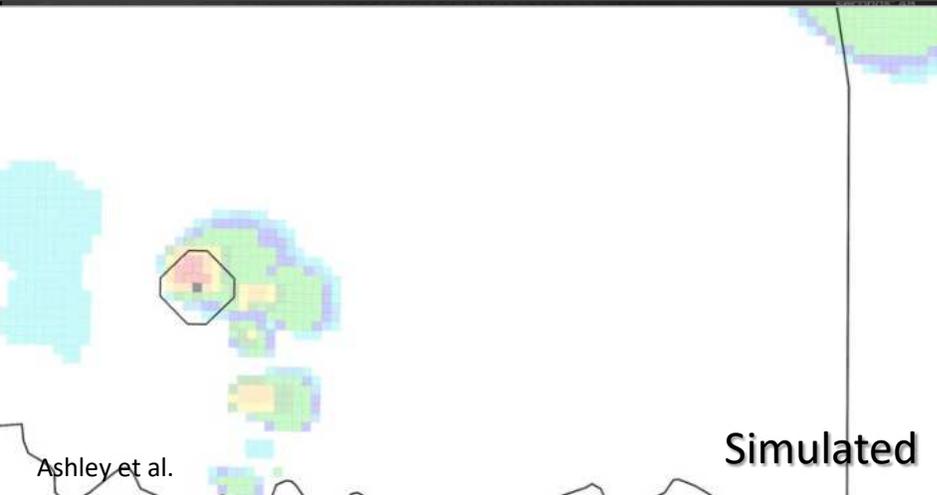
Observed

Walker Ashley



Simulated

Leigh Orf



Simulated

Ashley et al.



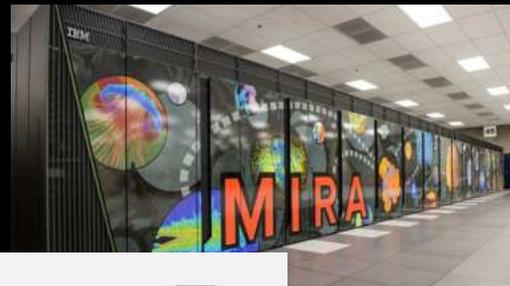
SDSC



SAN DIEGO SUPERCOMPUTER CENTER



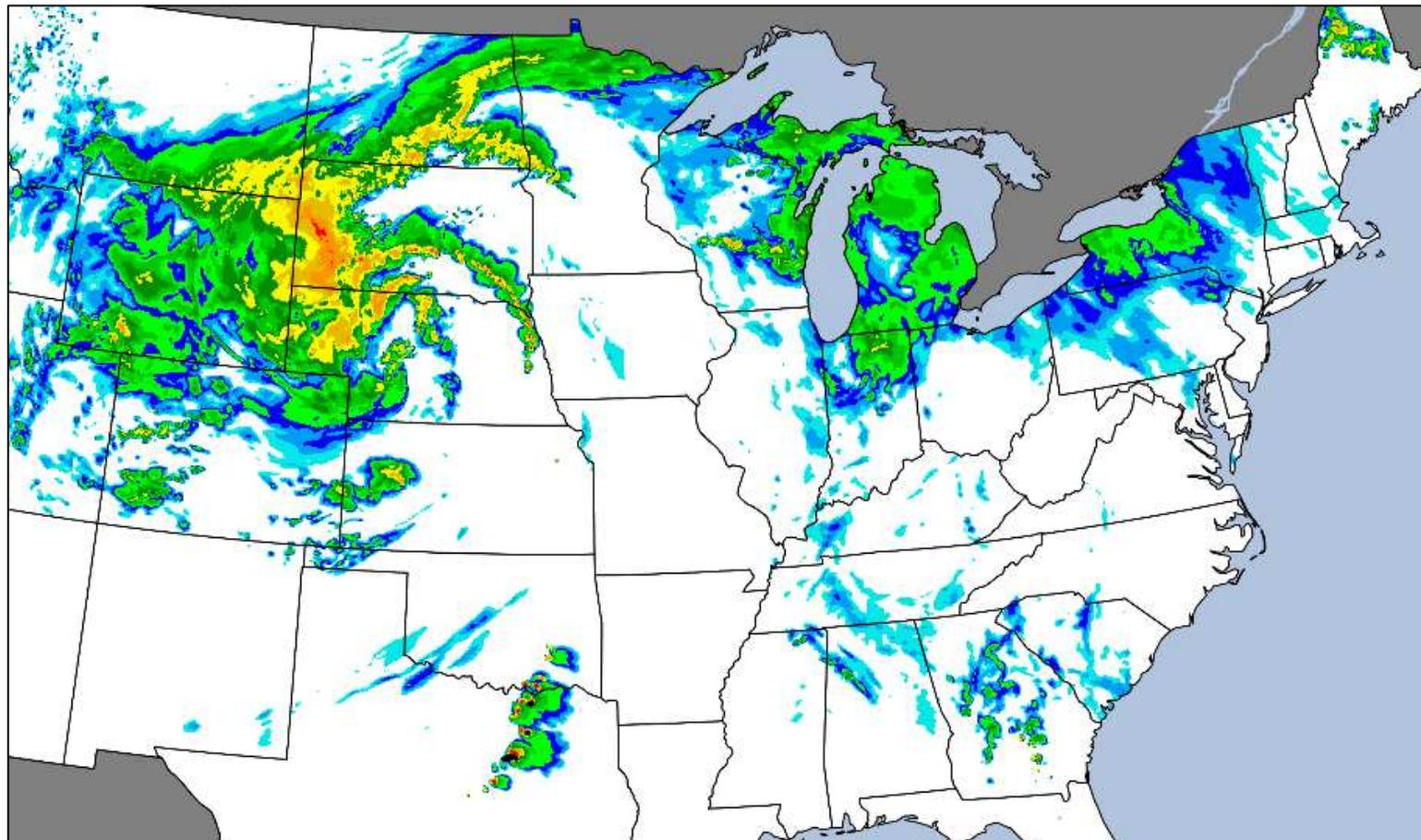
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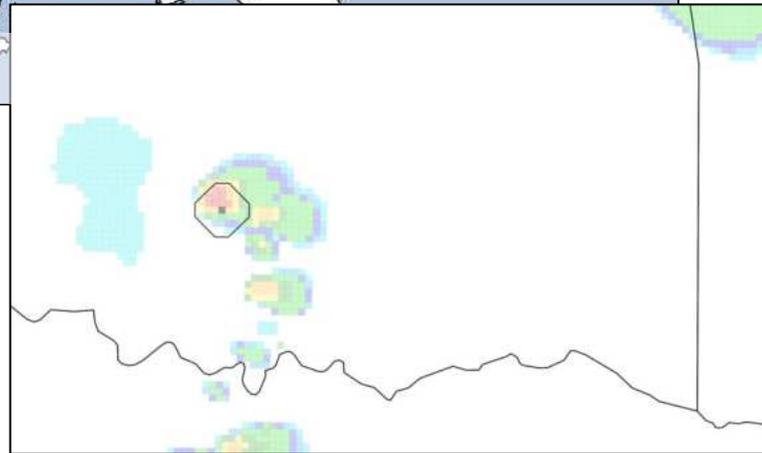
Argonne NATIONAL LABORATORY
 U.S. DEPARTMENT OF ENERGY
Aurora

intel CRAY





Tracking supercells in Model Radar Data



Harvest TBs to PBs of Data!

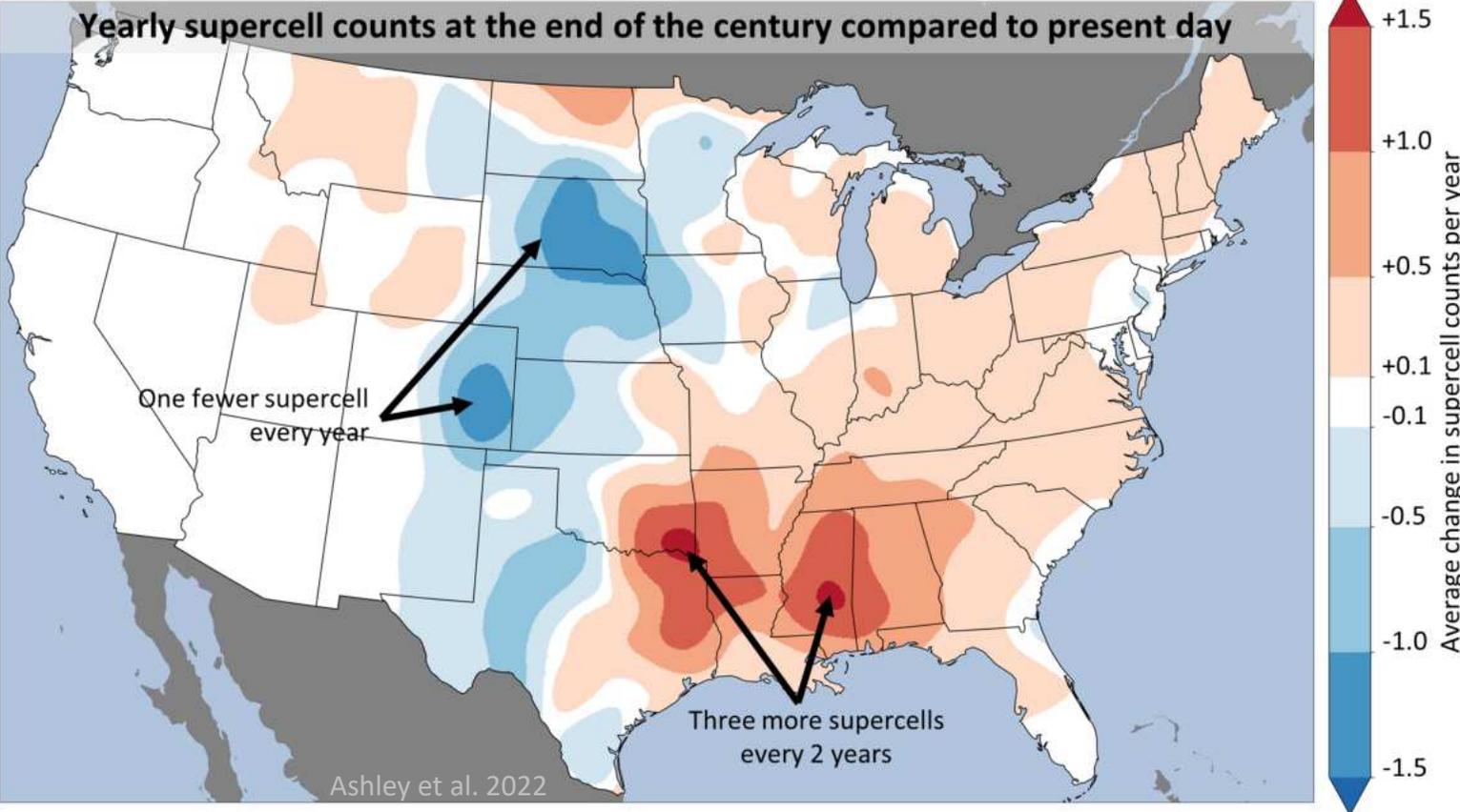
Image Classification

ML/AI

Data Analytics

Communication

21st Century Change in Annual Supercells



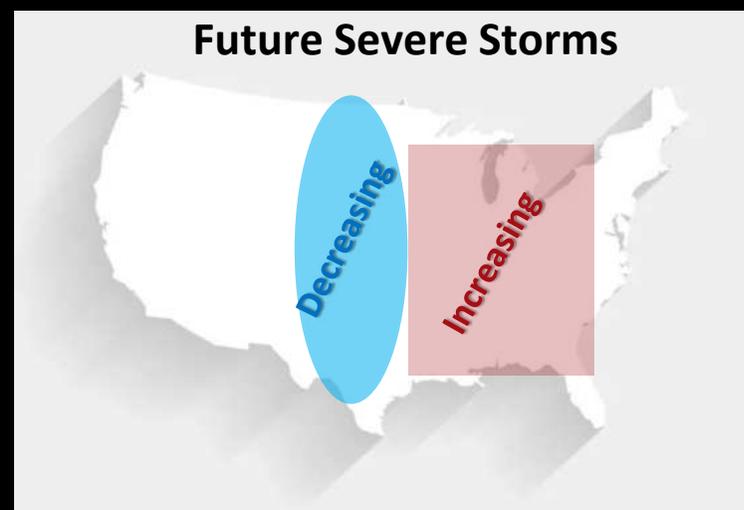
supercell counts increase 7-15%

most intense supercells
increase 26-60%

*Result = more frequent and
intense hail and tornado events
in the future*

NIU WCS Results to Date

- ✓ increase in frequency of severe thunderstorm environments *and* resulting storm events
- ✓ notable increase in “intense” storms
- ✓ earlier season
- ✓ increased variability
- ✓ general shift eastward in risk





Marc Wells youtube.com/watch?v=HFrgSVoJi1U



Tasos Katopodis/Getty Images

History of Disaster Research

“Acts of God”

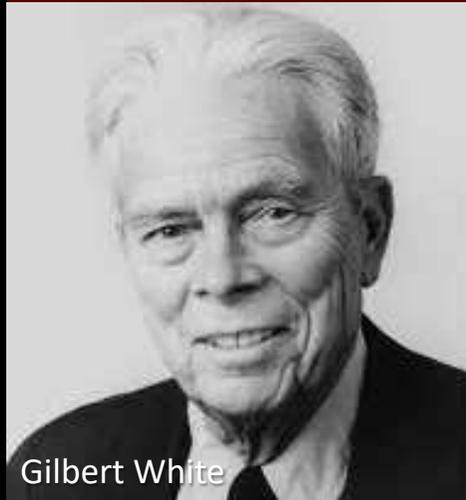
Disasters are external, inevitable



Divine punishment for moral misbehavior

Human Ecology

Disasters are not physical phenomena outside of society ... they are linked to decisions to settle and develop in hazard-prone land, often for economic motives



Gilbert White

Western View

Contain extremes through engineering (dirt and steel); warnings and planning

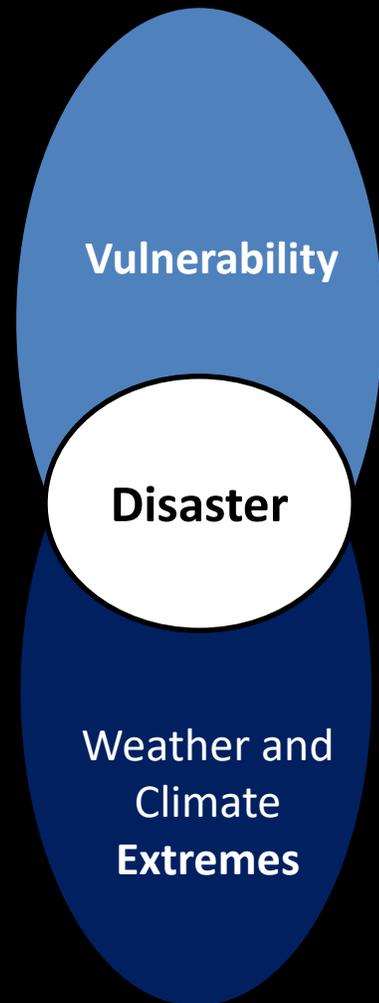


Development View

Events are “triggers” of deeply-rooted problems



Lack resources to counteract “misfortunes”



Disasters are a product of society
and are caused by extreme events
interacting with societal vulnerabilities
through multifaceted human decision-
making processes

The deepest causal factors—
socioeconomic and political—may
often be quite remote from the
disaster event itself!



© Walker Ashley

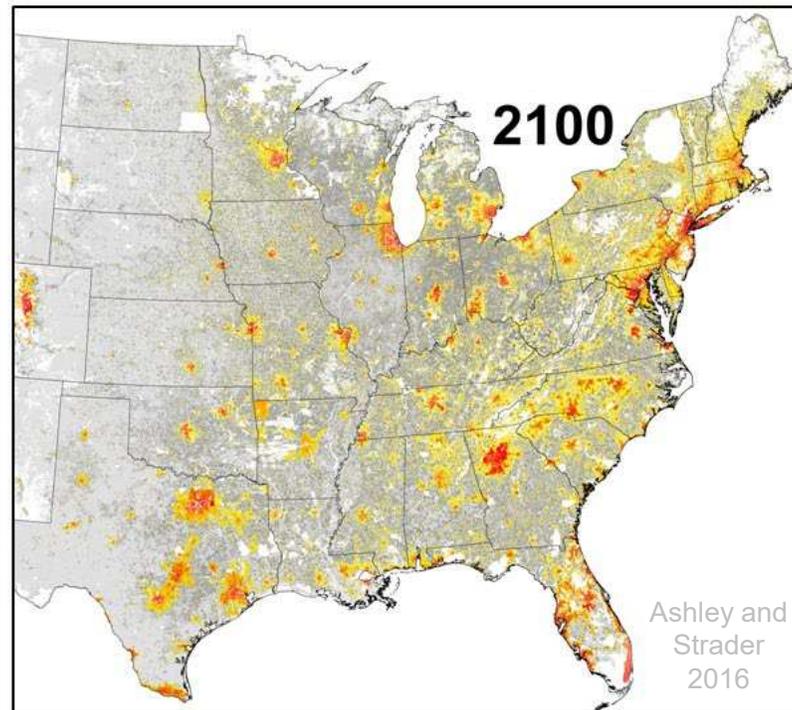
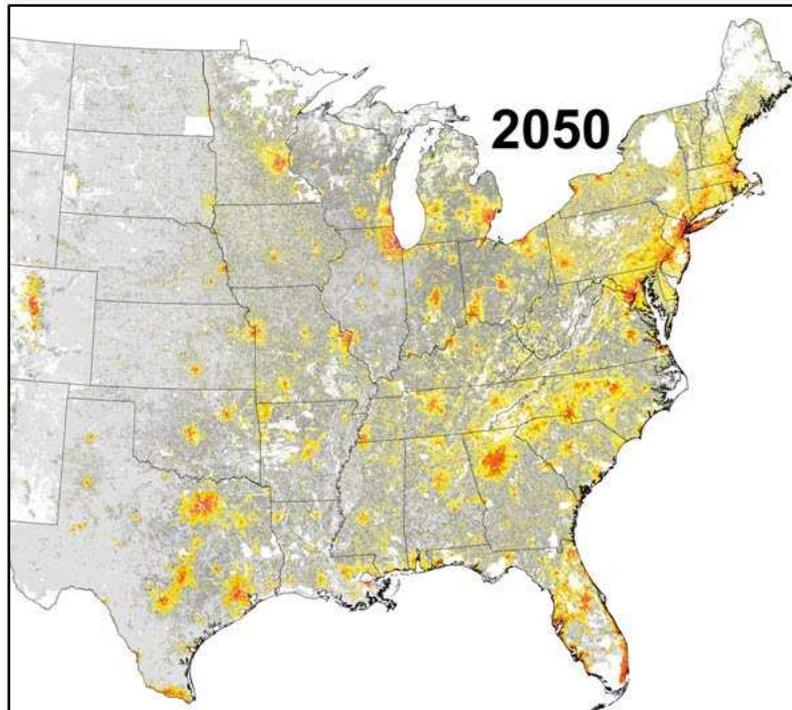
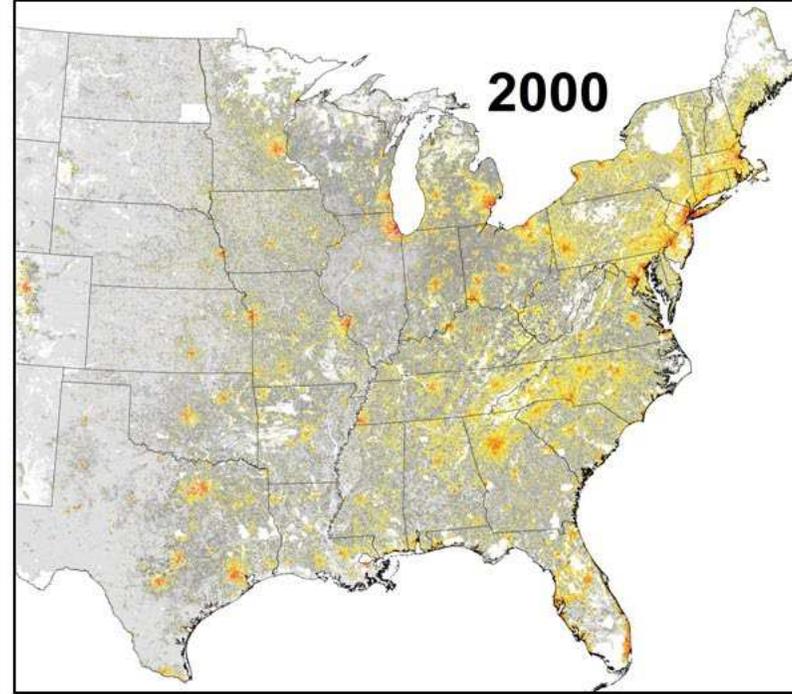
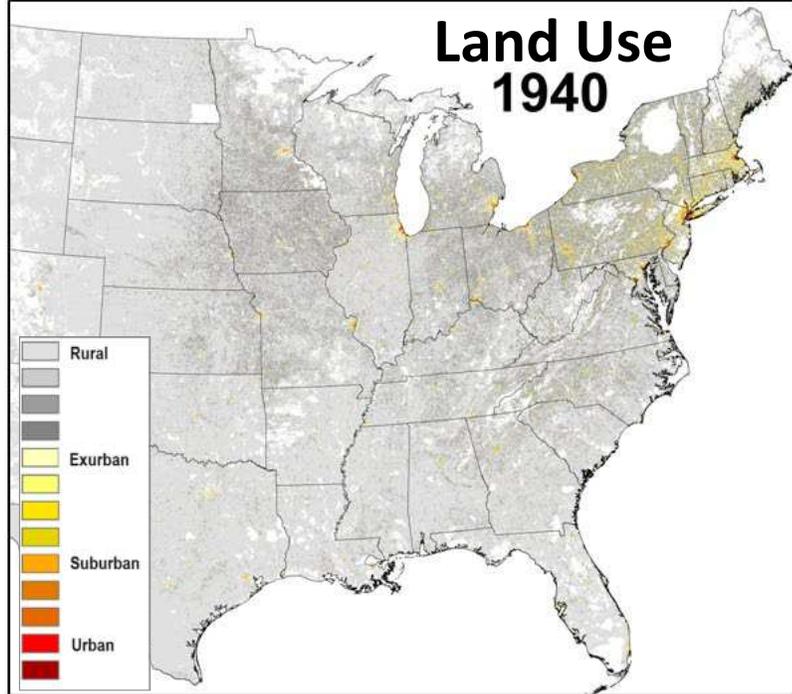
Population more than doubled the past 80 years

Housing increased well over 300%

Transitioned from a rural to urban to suburban development character

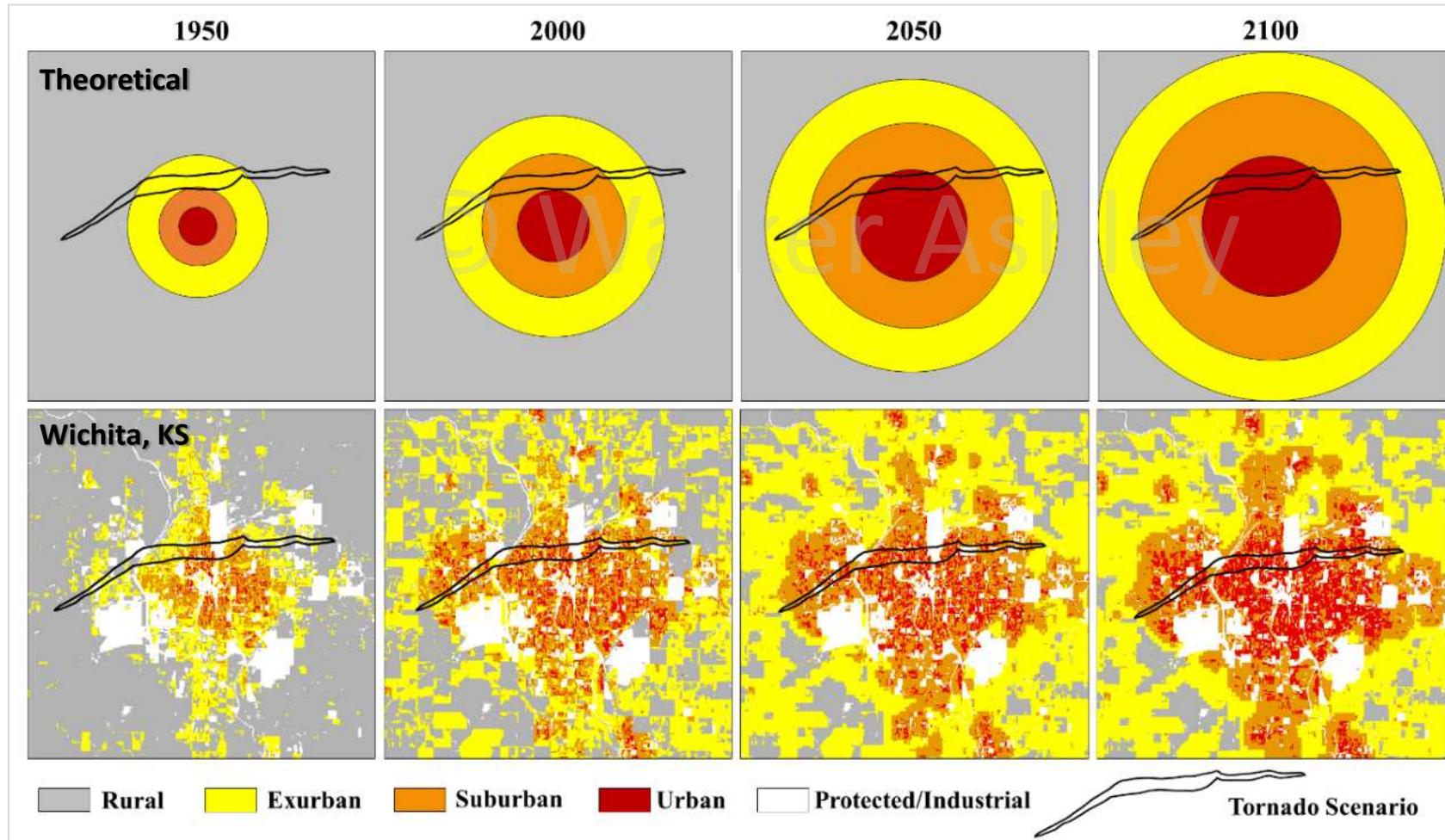
Urban footprint 5X

Escalated exposure of population and built environment to hazards



Ashley and Strader 2016

Expanding Bull's Eye Effect



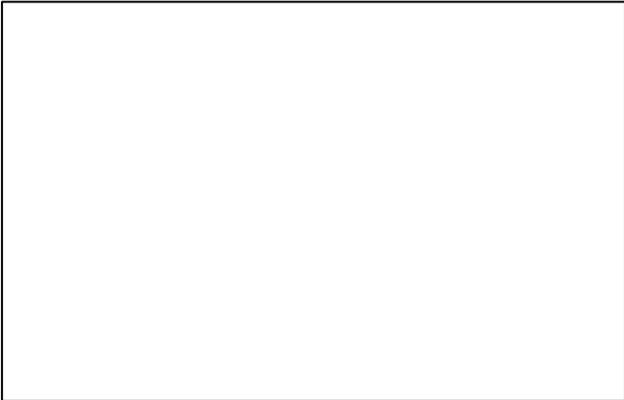
*“Targets”—i.e., humans and their possessions—of hazards are increasing as populations grow ... **and spread***

Dublin, Calif., in 2009



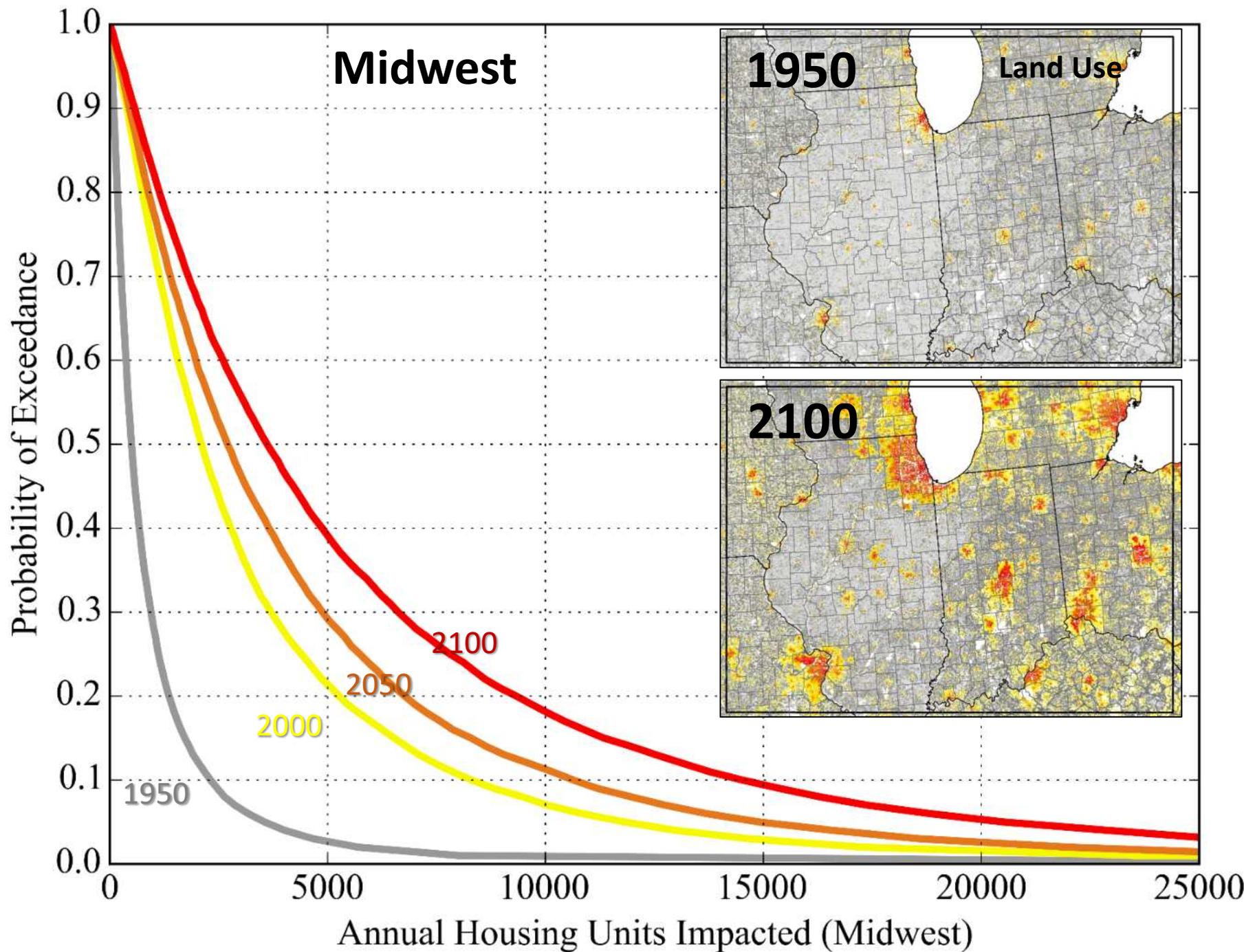
Land newly developed last decade



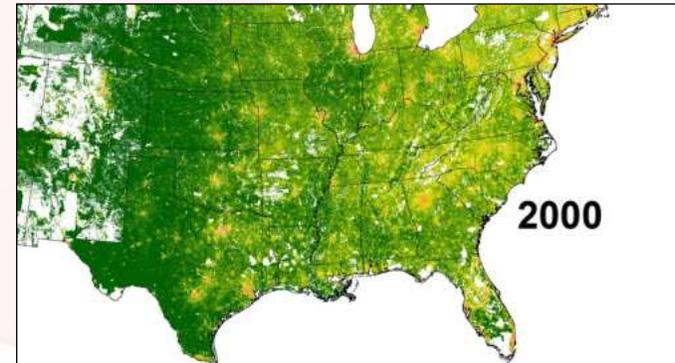


We developed a tool to simulate 10,000 years of tornadoes across landscapes

Sample Result
likelihood of number of housing units impacted by tornadoes per year



- Climate change may modify severe thunderstorms; however, **disasters are social constructs**
- Increasing magnitude—and spread!—of built-environment exposure is the primary contributor to the disaster problem
- Individual odds of being affected by an extreme event may not be changing much, but odds of an extreme event hitting something or someone are increasing significantly



"It's not acts of God, it's failure of people"

-Roger Edwards

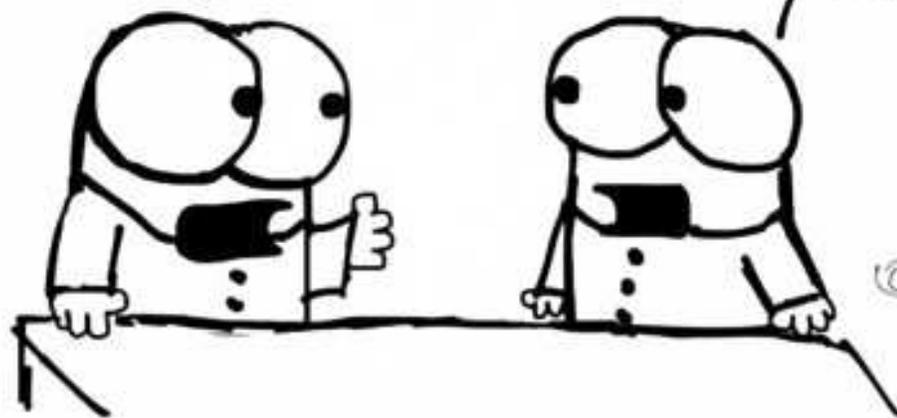
"There are no natural disasters, only social catastrophes"

-Sergio Abranches



I ASKED
SANTA
FOR A
RESEARCH
GRANT.

YOU STILL
BELIEVE IN
RESEARCH
GRANTS?

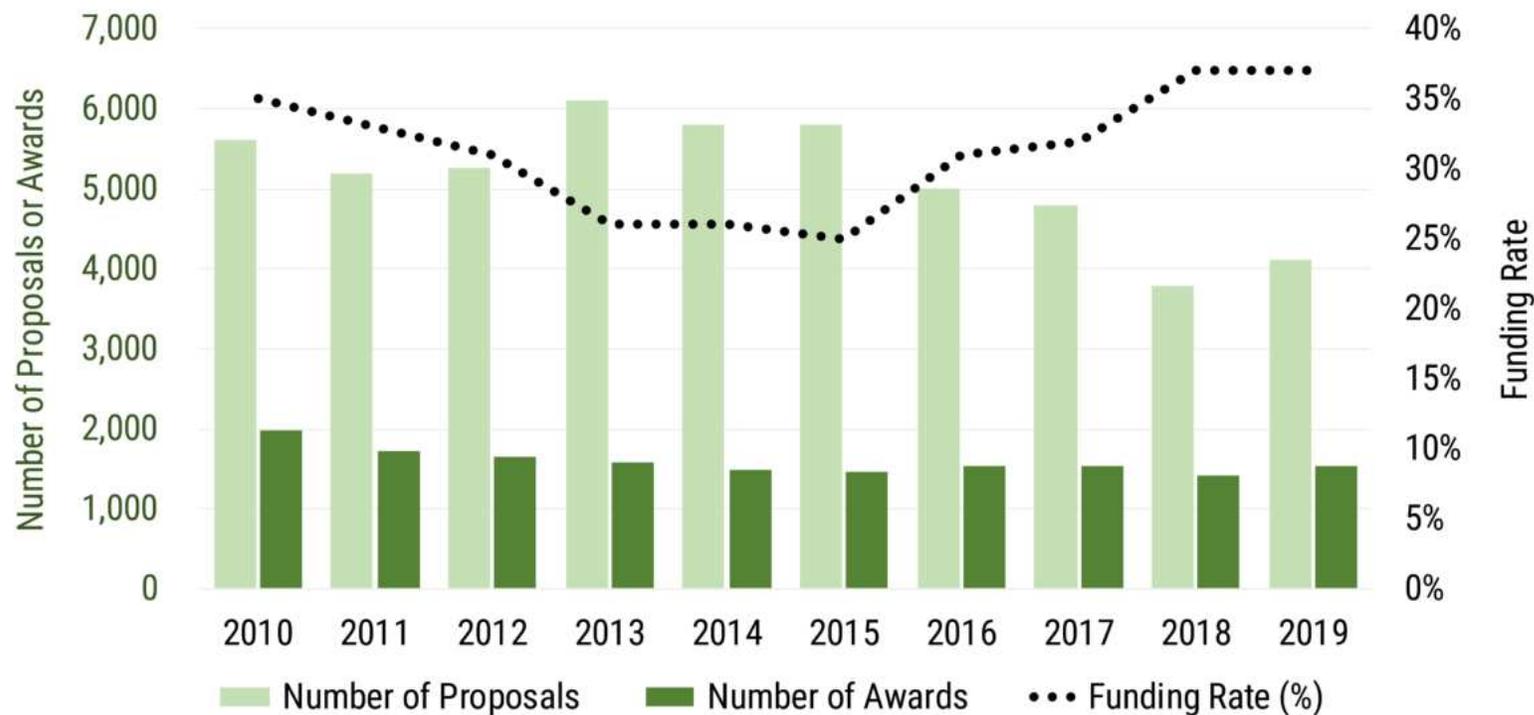


© THE
UPTURNED
MICROSCOPE

Traditional Funding Sources for Atmospheric Sciences



Outcomes of Proposals Submitted to the NSF Geosciences Directorate



34% Success Rate in FY 2024





COMMUNITY PROJECT FUNDING PROGRAM

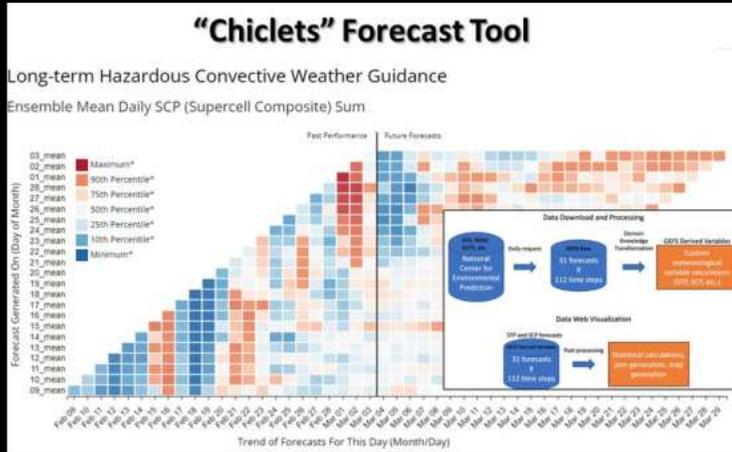
- ✓ Each House Member may submit **up to 10** project funding requests.
- ✓ **Limited to 1%** of overall discretionary spending.
- ✓ All requests must be **posted online**.
- ✓ Member must certify **no financial interest** by Member or immediate family.
- ✓ For-profit entities not eligible (**only government and nonprofits**).
- ✓ Priority given to projects with **evidence of community support**.
- ✓ GAO will **audit** sample of enacted requests.



NIU WCS Project
*Using an interdisciplinary
approach, conduct research and
build partnerships focused on
addressing the effects of
extreme weather on **agriculture***

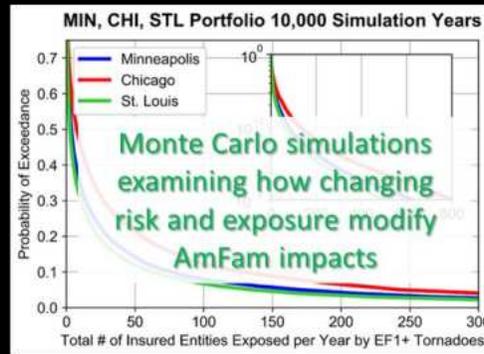
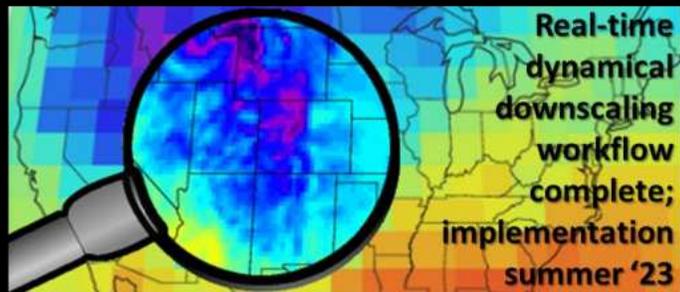


Mutual Co. and NIU: A collaborative loop with the goal of increasing the *tangible application* of new research



Navigating IP, data security, and contract issues can be very sticky!

Good admins are invaluable!



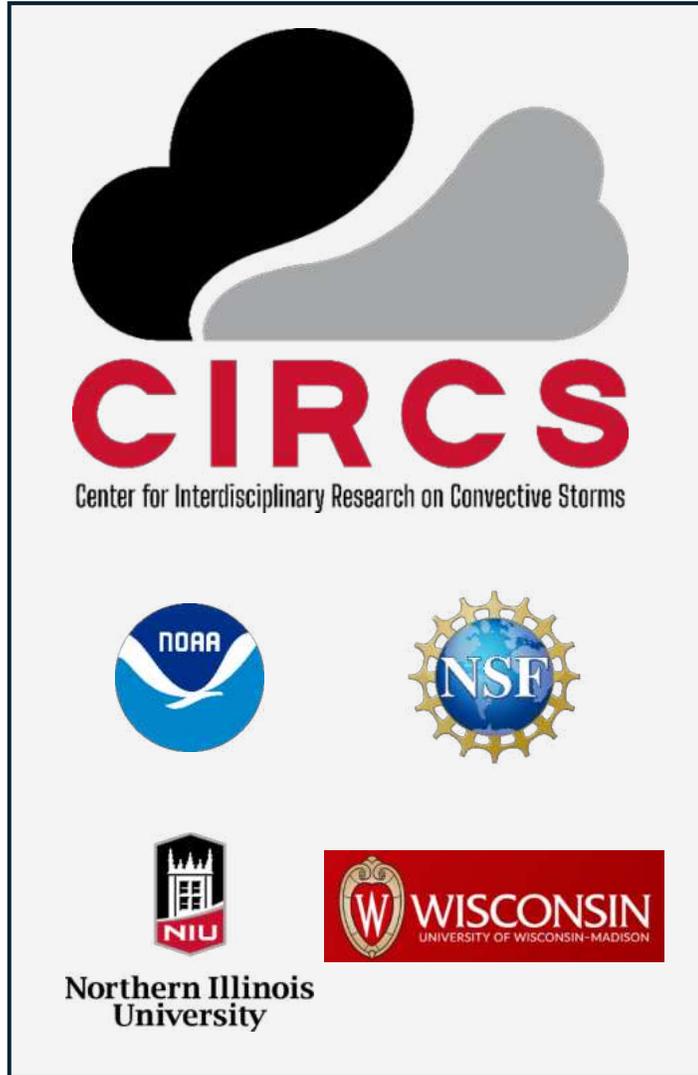
Heads Up Projections of Subseasonal Peril Potential

VG Victor Gensini (Guest) 11/9/2022 9:59 AM

Active MJO cycle continues, will lead to anomalous cold for most of eastern 2/3rds of CONUS over the next 7-10 days...thereafter, convection should reestablish in the maritime/west pac leading to a build in AAM. Thus, next forecast of opportunity would tend to indicate toughening returning to the west by late Nov/early Dec.



Industry-University Cooperative Research Center (IUCRC)

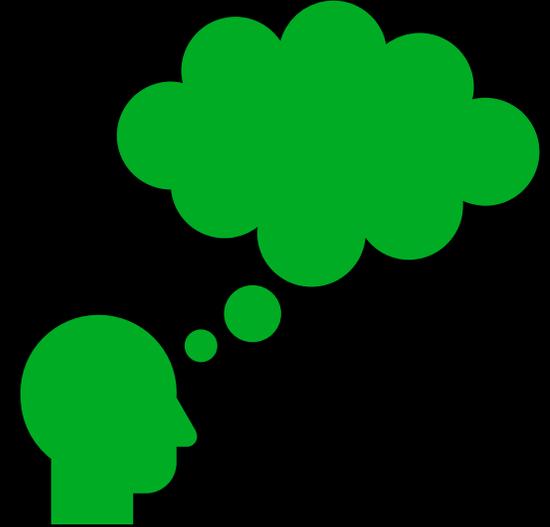


~100 discovery conversations by PIs leads to ...



From a PI perspective...

- NSF RFP is convoluted and nontraditional
- Can we actually do this?
- How do we make this work?
- Where does it fit within the University?
- Who do we talk to?
- If we are successful, who will cover all our other responsibilities?
- NIU SPA has helped make this a “go”



Find out what keeps your PIs up at night*

- We often spend our time worrying about details that could instead be used to do research, mentor students, or write additional grants



*the gratuitous PI “whine” slide

Simple programs can make a big difference

NIU PI Academy

- PI identifies 3-5 leaders in their respective field
- VPR solicits interest from leaders in serving as mentor
- Mentor visits campus to give research seminar and network with PI and Department

- Minimal investment, big potential dividends
 - Research collaborations
 - Committee & award nominations
 - Graduate student cross-pollination
 - Connects early-career PI to senior fellow



People make the most difference

- Admins that see the “bigger picture”
- Reduce friction points ... be facilitators!
- We have goals well beyond an individual grant
- Visit and get to know your most productive PIs and research groups, but
- Empower *all* PIs
 - An issue for one PI may be an issue for all PIs
 - Invest in *local* resources (e.g., HPC, *people*) for *external* funding success
 - If there’s a regulatory roadblock, explain it to PIs like they are 2-year-olds ... don’t just say “no”
 - Do not make policy that affects PIs w/out the presence of PIs in discussions





Northern Illinois University

Your Future. Our Focus.



*More than the required curriculum
in math, physics, and atmospheric
science ...*

**Student engagement
in research and
community projects
is cornerstone of our
program**



21st century skillset development—**programming, AI/ML, numerical modeling, data analytics**—and the *application* of atmospheric science knowledge in decision making

Career break-out room listings:

Geography:

Geographic Information Science/Geovisual Mapping Lab: ROOM 115

Human (Urban/Economic) Geography: ROOM 116

Physical/Environmental Geography: ROOM 117

Technology:

Applied/Research Meteorology: ROOM 211

Broadcast Meteorology: ROOM 212

Operational/Forecasting: ROOM 213

Management: ROOM 121





NORTHERN ILLINOIS UNIVERSITY

Office of Student Engagement and Experiential Learning

Division of Academic Affairs

Undergraduate Research Workshops

OSEEL offers workshops designed to help students reach their goals for research and creative inquiry as an undergraduate student. Various sessions are offered each semester with a range of topics. Sessions are led by OSEEL staff, undergraduate research ambassadors or topic area experts from across campus.



Civic Engagement

The Office of Student Engagement and Experiential Learning offers students multiple civic and community engagement opportunities. These programs can help you develop skills, while participating in activities and research beneficial to your community and beyond. We encourage you to consider and learn more about these opportunities.

Conference Travel Funding

Students can apply for conference travel funding to help make it possible for them to present their work at academic and professional conferences.



Conference on Undergraduate Research and Engagement

Faculty, students and community members are invited to participate in the Conference on Undergraduate Research and Engagement (CURE) on April 29, 2025, as we recognize 15 years of celebrating undergraduate research and engagement at NIU.



Huskies Engage

Huskies Engage is your source to find experiences, credit and non-credit bearing, to prepare you for career and life success. These opportunities will help you grow as leaders and make an impact on the world around you locally and globally, and transition to your next path whether it's job market or graduate school.

Undergraduate Research Funding

Faculty members can apply for the following undergraduate research funding opportunities:

Student Engagement Fund (SEF): provides student compensation and/or project supply funds

Research, Engagement and Academic Diversity (READ) Grant: can be used for projects related to social justice and diversity, social entrepreneurship or social innovation

Simple programs can make a big difference



NORTHERN ILLINOIS UNIVERSITY

Office of Student Engagement and Experiential Learning

Division of Academic Affairs



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Undergraduate Research

→ **Research Rookies**

→ Resources

→ Research Rookies Frequently Asked Questions

→ Faculty Mentor Interest Form

→ Frequently Asked Questions

→ Workshops

→ Request a Presentation

→ Undergraduate Research Ambassador

→ Undergraduate Research Month

→ NIU ForagerOne

Research Rookies

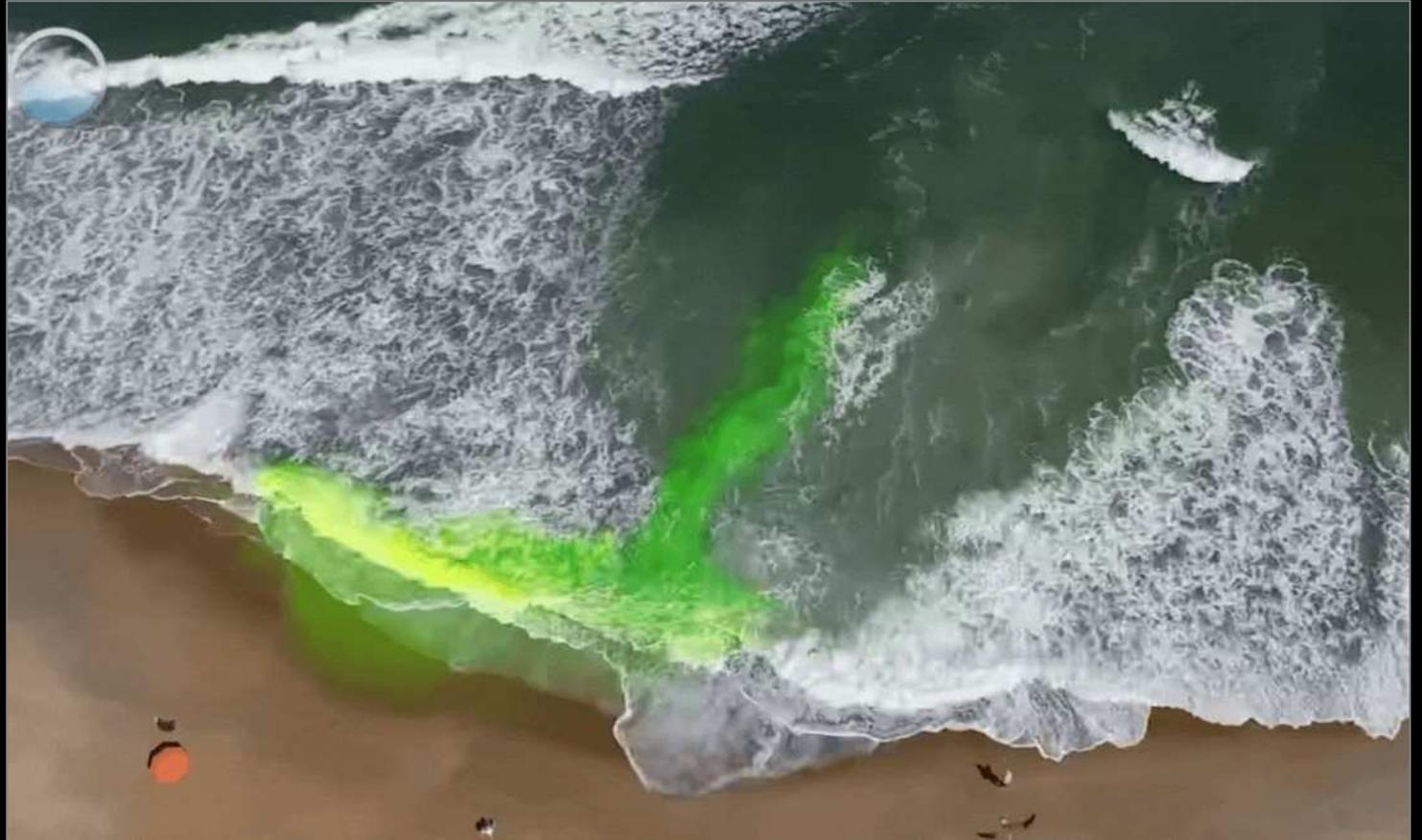


An examination of rip current fatalities in the United States

Victor A. Gensini · Walker S. Ashley

Received: 29 April 2009 / Accepted: 27 August 2009
© Springer Science+Business Media B.V. 2009

Abstract This study analyzes fatalities caused by rip currents in the conterminous United States for the period 1994–2007. Results include the frequency of fatalities from rip currents, their cause, and their unique spatial distributions. An analysis of historical hazard event data illustrate that, on average, 35 people reportedly die from rip currents each year in the United States. Also, similar to other hazard events where unique differences in gender vulnerability have been found, men are over six times more likely to fall victim to a deadly rip current than females. Rip current fatalities are most common in the southeastern United States, with a nonuniform spatial distribution along other Atlantic, Pacific, and Great Lakes coastlines. Physical vulnerabilities are suggested as the primary cause for the unique fatality distribution found. Temporally, summer season weekends are shown to have the more fatalities than any other time of the year. A classification scheme was developed to categorize synoptic-scale weather conditions present during deadly rip current events. More than 70% of all rip current fatalities are associated with onshore winds. Specifically, a rip current fatality is most likely when a surface high pressure system creates these onshore winds. The quality of the fatality reporting database available for researchers is also assessed.



Two-thirds of WCS publications co-authored with students!

Via Skype
Sugar Grove, Illinois

Saturday
Rolling Fork, Mississippi




EXTREME WEATHER

THE CHANGING PATTERNS OF TORNADO ACTIVITY IN THE U.S.

Mobile homes pose the biggest challenge to surviving tornadoes

LIVE

CNN

3:10 AM ET

CNN NEWSROOM

Tornadoes are spinning up farther east in US, study finds

Tornado frequency has increased in the Midwest and Southeast and decreased in the central and southern Great Plains.



Shill the top area
Next spring's



LIVE

DeKalb County, IL

TORNADO OUTBREAK IS CLIMATE CHANGE TO BLAME?

pattn

OUR PLANET'S OUR FUTURE



CLIMATE READY

Northern Illinois University leading study of hail in thunderstorms

By WFT Chicago Digital Team and [David Baker](#) on Wednesday, October 1, 2020



CLIMATE READY

NIU HAIL STUDY

NIU leading study of hail in thunderstorms: Northern Illinois University created Department Atmospheric Science Professor Steven Garber is helping lead a study on hail and thunderstorms.

Scientists hone long-range forecasting of U.S. tornadoes, hail

Identify patterns halfway around the globe that heighten tornado probability

May 27, 2022




Engaging
with our
future





Engaging with
community and K-12

STEMFests and STEMCafes





Vision

Northern Illinois University's vision is to be an engine for innovation to advance social mobility; promote personal, professional and intellectual growth; and transform the world through research, artistry, teaching and outreach.

Mission

The mission of Northern Illinois University is to empower students through educational excellence and experiential learning as we pursue knowledge, share our research and artistry, and engage communities for the benefit of the region, state, nation and world.