

Transdisciplinary Discovery and Convergence: The Coming Focus for Tackling Grand Challenges

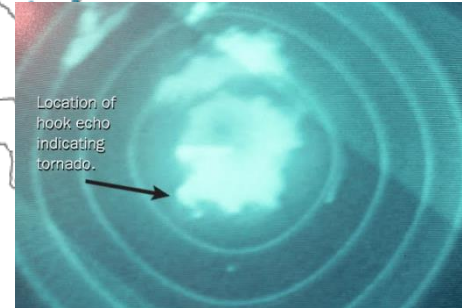
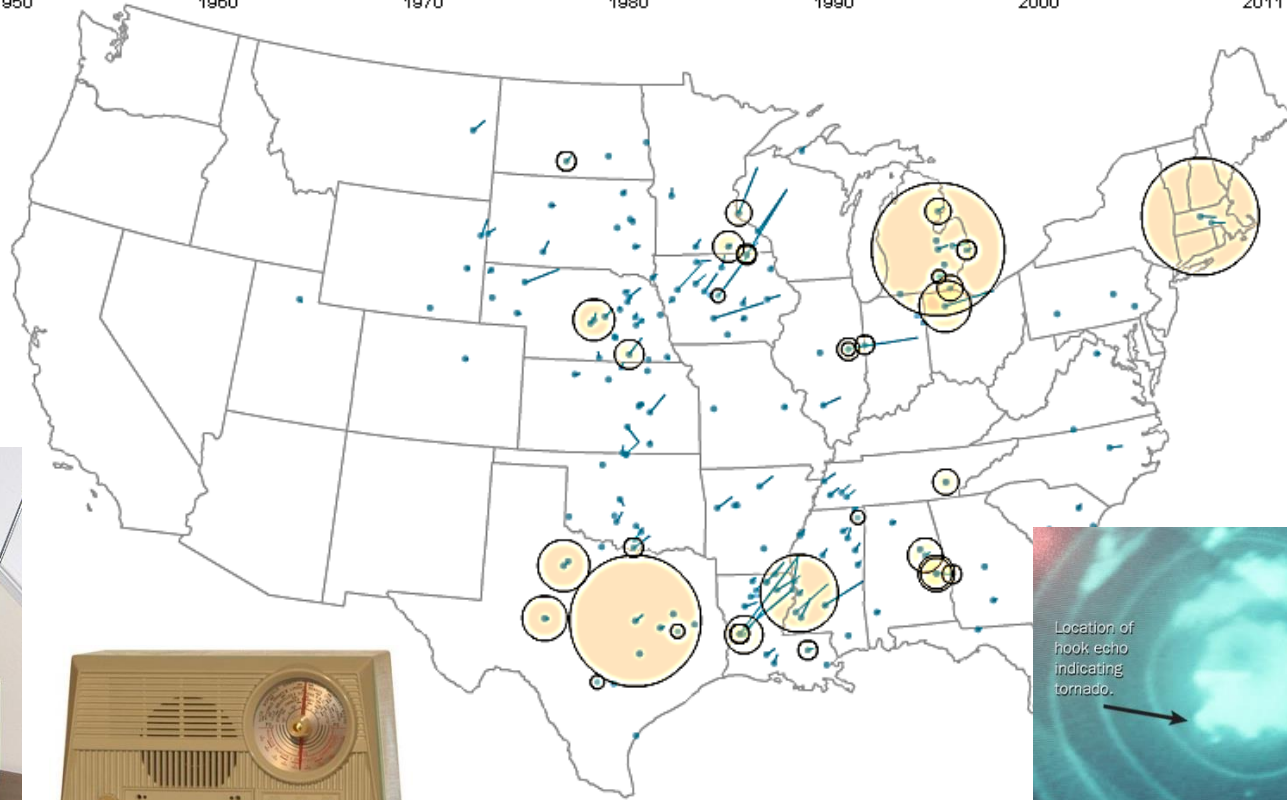
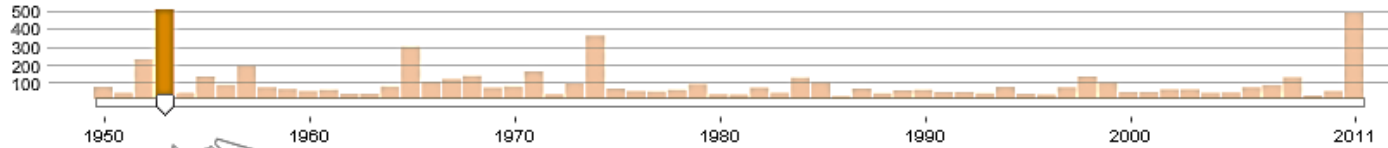


Kelvin K. Droegemeier, University of Oklahoma
2015 APLU Annual Meeting, Indianapolis
15 November 2015

The Endgame

- Key **issues or impediments** one faces in **applying** transdisciplinary approaches/convergence, especially to grand challenge problems
- Specific **actions that research officers can take**, or **ideas they can apply**, to help their faculty be more successfully in applying transdisciplinary/convergence concepts to research in general or grand challenges in particular
- Questions to help us all better **understand and improve the application** of trans-disciplinary research and convergence practices

The Challenge of Preventing Tornado-Related Deaths and Injuries: **The Year is 1953 (519 Deaths)**



Anything Wrong with this Tornado Warning?

BULLETIN - EAS ACTIVATION REQUESTED
TORNADO WARNING
NATIONAL WEATHER SERVICE JACKSON MS
1155 AM CST SUN FEB 21 2012

Answer: The Year!



*TORNADO WARNING FOR...
NORTHERN SUNFLOWER COUNTY IN NORTHWEST MISSISSIPPI
TALLAHATCHIE COUNTY IN NORTHWEST MISSISSIPPI
QUITMAN COUNTY IN NORTHWEST MISSISSIPPI

* UNTIL 1 PM CST

* AT 1155 AM CST...A TORNADO WAS REPORTED BY THE PUBLIC AND INDICATED
BY RADAR 5 MILES NORTHEAST OF CLEVELAND...AND IS MOVING TOWARD THE
NORTHEAST AT 55 MPH.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

IF THREATENING CONDITIONS ARE SIGHTED...BE PREPARED TO MOVE TO A
PLACE OF SAFETY. TO REPORT A TORNADO OR OTHER SEVERE WEATHER...PLACE
AN EMERGENCY CALL TO THE JACKSON MS NATIONAL WEATHER SERVICE OFFICE
AT 601 939 5751...OR ASK THE NEAREST LAW ENFORCEMENT AGENCY TO RELAY
YOUR REPORT TO THE NEAREST NATIONAL WEATHER SERVICE OFFICE.

Anything Wrong with this Tornado Warning?

BULLETIN - EAS ACTIVATION REQUESTED
TORNADO WARNING
NATIONAL WEATHER SERVICE JACKSON MS
1155 AM CST SUN FEB 21 1971

40+ years ago!!



*TORNADO WARNING FOR...

NORTHERN SUNFLOWER COUNTY IN NORTHWEST MISSISSIPPI
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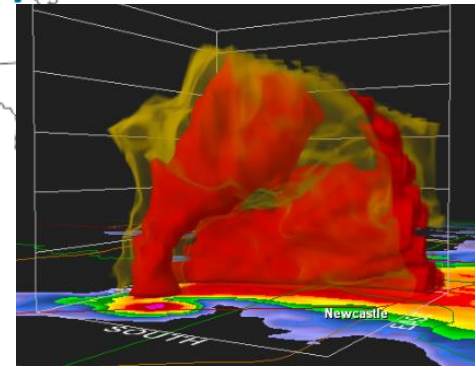
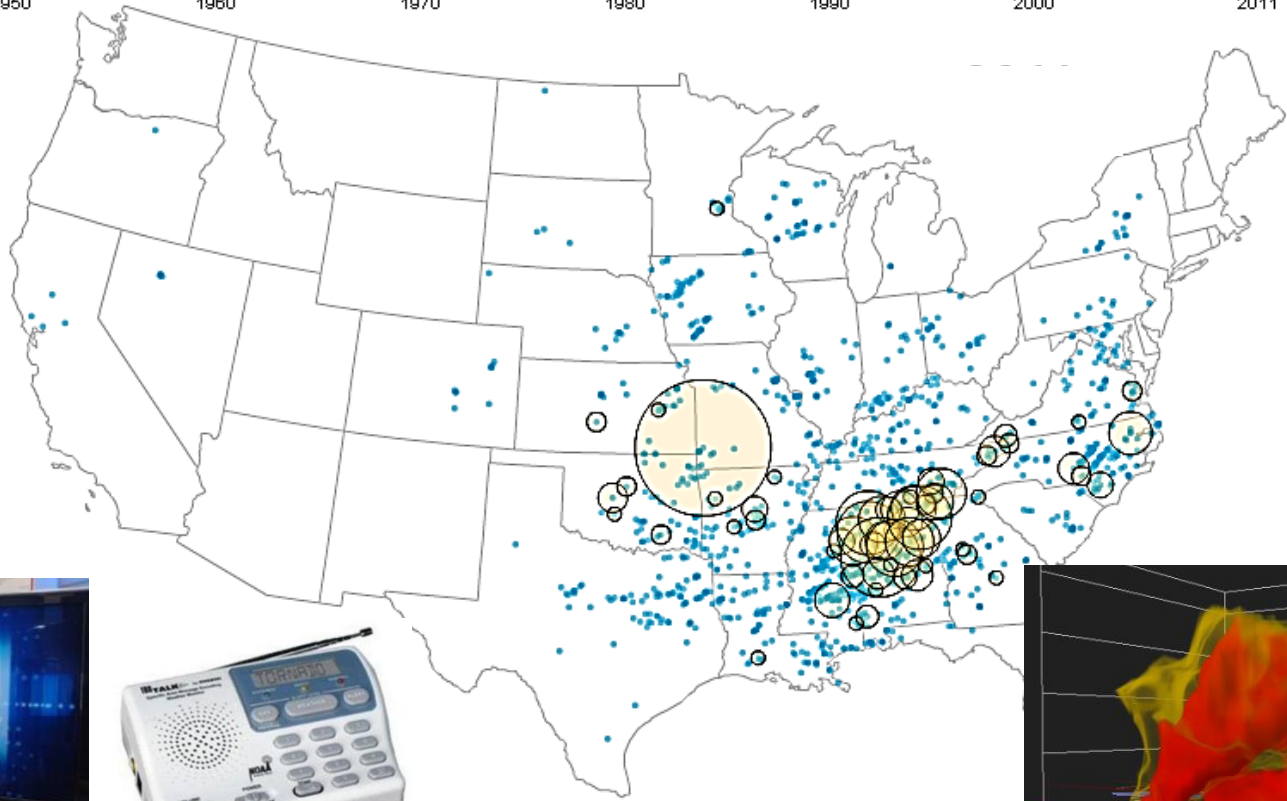
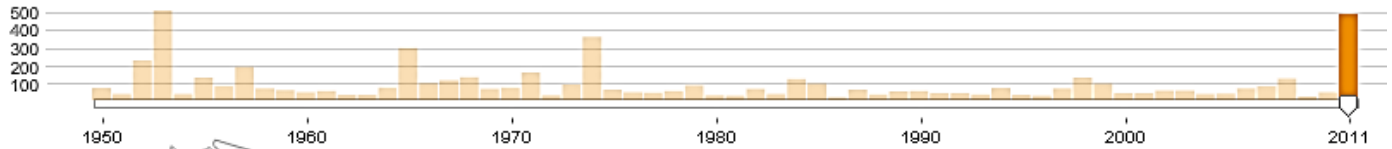
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Translation to Graphics



The Challenge of Preventing Tornado-Related Deaths and Injuries: **The Year is 2011 (550 Deaths)**



The Traditional Disciplinary Approach

**Meteorology
Education and
Training**

**Technology
(Computer
Models, Radar,
Satellites, etc)**

**NWS
Forecasters,
Private Sector
Meteorologists,
Radio and TV**

Multi-Disciplinary Approach: Tackling Problems at the Boundaries Together

**Meteorology
Education and
Training**

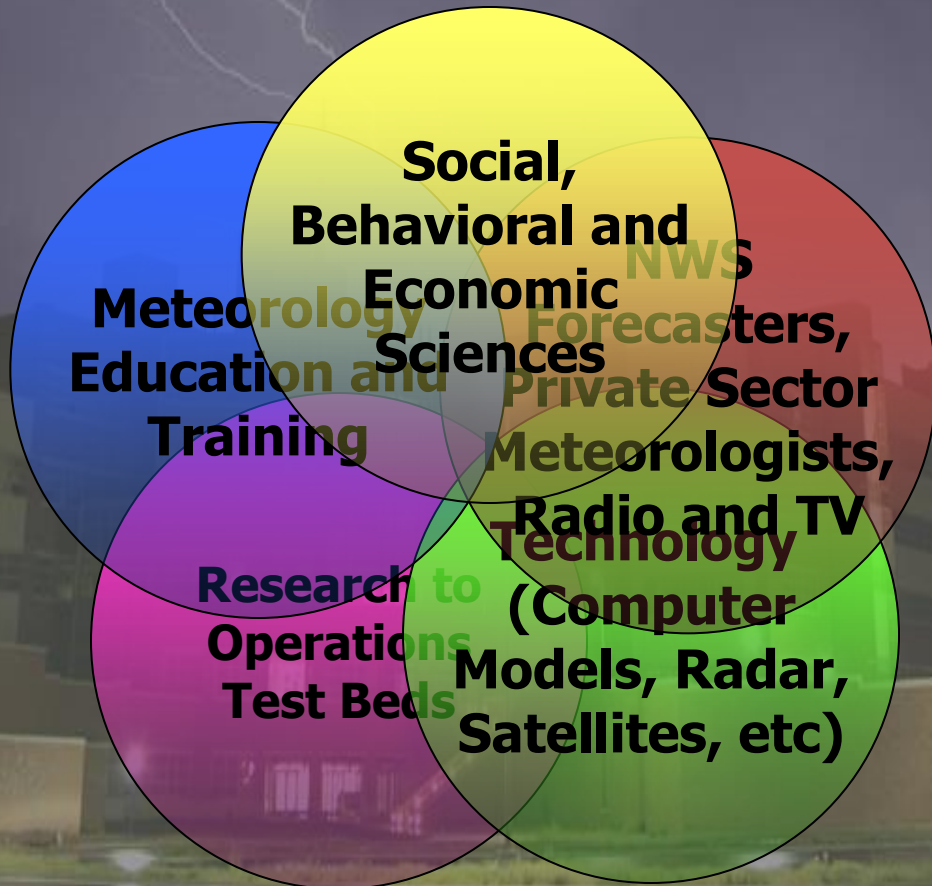
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(Computer
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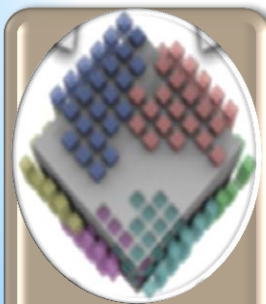
**NWS
Forecasters,
Private Sector
Meteorologists,
Radio and TV**

**Research to
Operations
Test Beds**

**Social,
Behavioral and
Economic
Sciences**

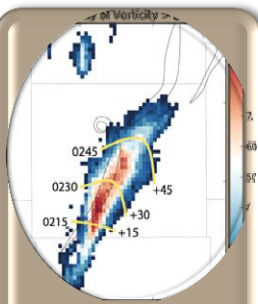
Trans-Disciplinary Approach: Tackling the Grand Challenge in an Integrative Manner with New Methodologies Born Out of Shared Thinking and Approaches





Grid-Based Probabilistic Threats

1



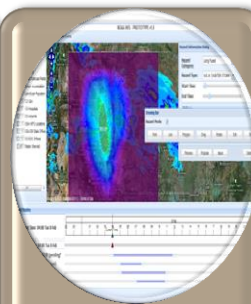
Obs & Guidance

2



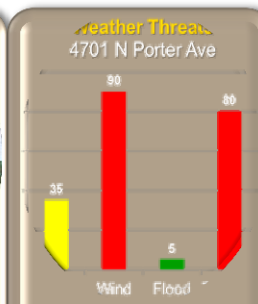
The Forecaster

3



Threat Grid Tools

4



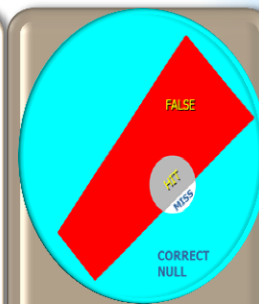
Useful Output

5



Effective Response

6



Verification

7

Integrated Social, Behavioral & Economic Sciences

For the Discussion Period...

- Key **issues or impediments** one faces in **applying** transdisciplinary approaches/convergence, especially to grand challenge problems
- Specific **actions that research officers can take**, or **ideas they can apply**, to help their faculty be more successfully in applying transdisciplinary/convergence concepts to research in general or grand challenges in particular
- Questions to help us all better **understand and improve the application** of trans-disciplinary research and convergence practices

Key Points for Discussion

- Key **issues or impediments** one faces in **applying** transdisciplinary approaches/convergence
 - **Semantic barriers** even when using the same language
 - **Role** confusion – who does what?
 - **Virtual work** is difficult
 - Institution-specific overhead, cost-sharing **structures** and different faculty teaching/service **expectations**/schedules
 - Lack of **incentive and credit structures** that both reward convergence activities and continue to support strong disciplinary scholarship. Not an either/or issue.
 - **Balancing** the trade-off between depth of knowledge and breadth of knowledge when designing integrated curricula
 - Scale and external **connectivity**
 - How best to **cultivate** locally, regionally, nationally

Key Points for Discussion

- Specific **actions that research officers can take**, or **ideas they can apply**
 - Provide **opportunities** for science team development at all levels (students, faculty, staff)
 - Provide **leadership development** opportunities
 - Provide clearly articulated **promotion and tenure criteria** for evaluating individual contributions to team-based research
 - Establish institutional **seed funding** programs (e.g., Mcubed)
 - Look for ways to **increase co-location** and the ability of diverse faculty to bump into each other
 - Exploit potential **generation gap** in which the next generation of researchers increasingly see convergence/transdisciplinary as a normal or expected research framework
 - Support **Kavli/NASEM** effort and encourage **G-U-I-F** nexus

Key Points for Discussion

- Some questions to **understand and improve application** of trans-disciplinary research and convergence practices
 - How can **collaboration** among faculty be fostered across a university disciplinary structure?
 - How can **students** be integrated into team science efforts and benefit from the experience?
 - How can a growing **culture** of interdisciplinarity thrive alongside those who wish to conduct disciplinary work?
 - How to **share** exemplary approaches
 - How to tackle grand challenges **regionally**?