

Latest Results of Warn-on-Forecast Research

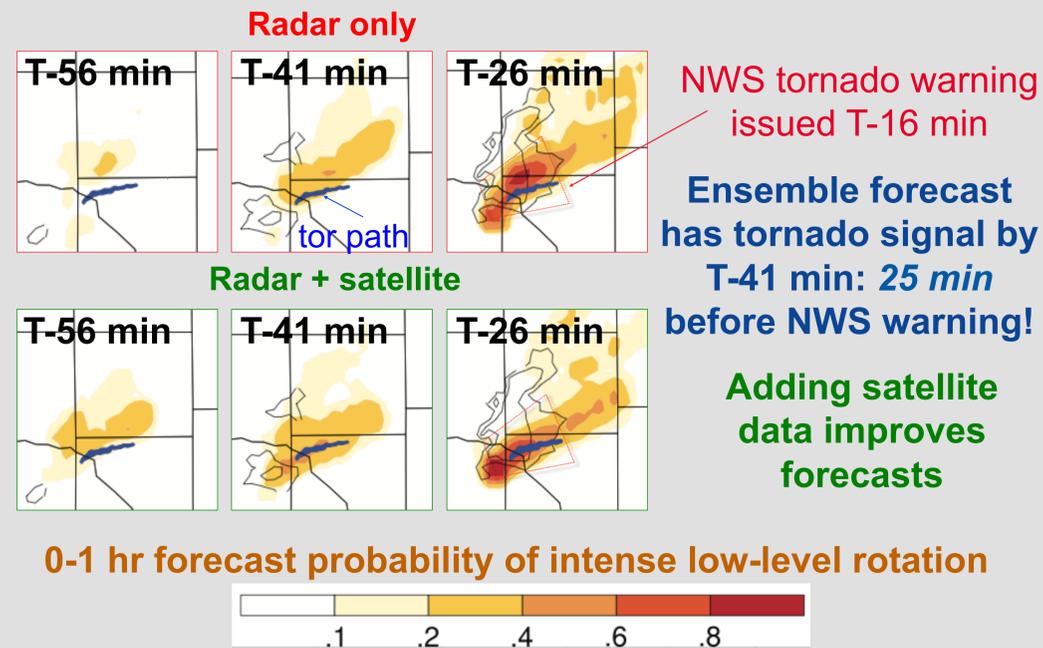
Corey Potvin, Jidong Gao, Thomas Jones, Kent Knopfmeier, Dustan Wheatley, Louis Wicker, and Nusrat Yussouf

NSSL Experimental WoF System - Ensemble (NEWS-e)

- Given current technologies, how skillfully can severe storm hazards be predicted 0-2 hours in advance?
- Coarse grid covering US provides initial/boundary conditions to a regional, weather-adaptive, storm-scale-prediction grid
- Assimilates conventional, surface, radar, satellite obs
- New storm-scale ensemble forecast generated every 15 min
- Probabilistic guidance generated from ensemble forecasts
- A dozen retrospective case studies demonstrate potential value
- May 2015, HWT: **First time** an hourly-updated, storm-scale ensemble prediction system will be run in real-time and evaluated by forecasters

NEWS-e Case Studies

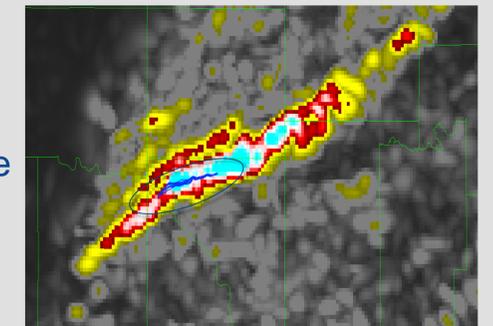
20 May 2013 Moore, OK EF-5 Tornado



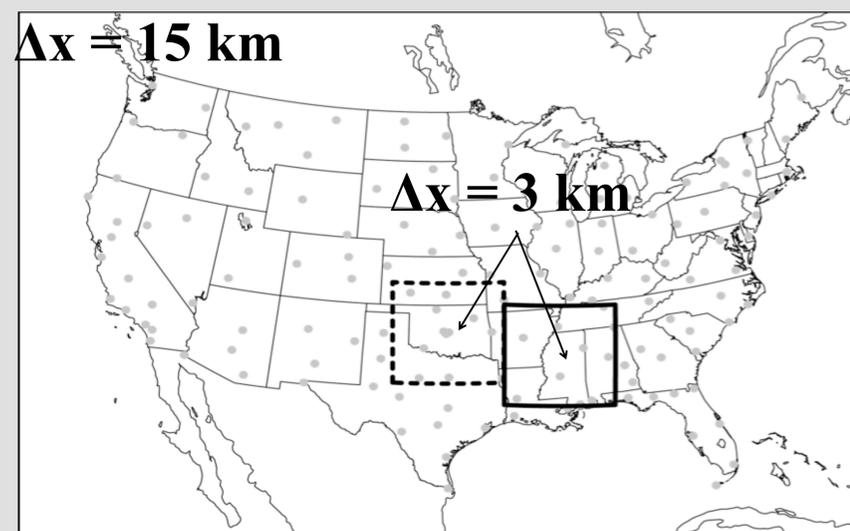
Weather-adaptive, real-time analysis system

- Blends multi-radar obs with operational model forecasts
- 1-km 3-D wind, rotation, reflectivity analyses every 5 min
- HWT forecasters report that system highlights storms of interest, adds confidence to decision process, and should therefore **increase warning lead times**

20 May 2013:
Real-time rotation analysis matches well with tornado (blue line) and mesocyclone tracks



Mesoscale & storm-scale domains

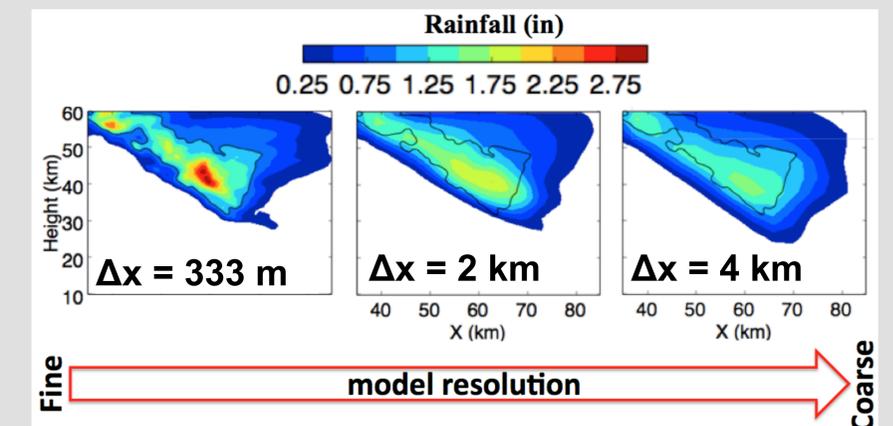


Significant Scientific Discoveries

- Idealized studies suggest thunderstorms are predictable for up to 2+ hours despite model/observational/computational limitations
- Real-data case studies from variety of storm environments are consistent with idealized experiments
- New observation types (satellite, phased array radar) improve analyses and forecasts
- Using high-resolution ensembles to improve forecasts of convective storm hazards appears viable

Model resolution requirements

- How much resolution needed to predict storm hazards?
- Explore using idealized (below) and real case studies
- Provide vital guidance for WoF system design

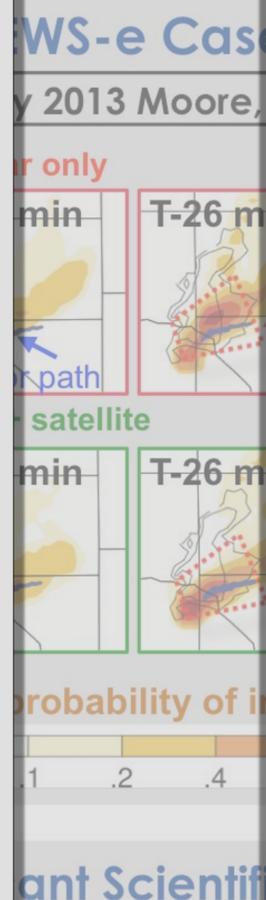


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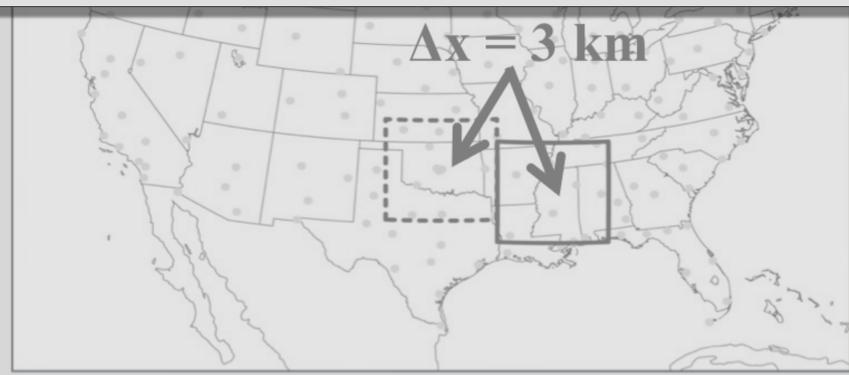
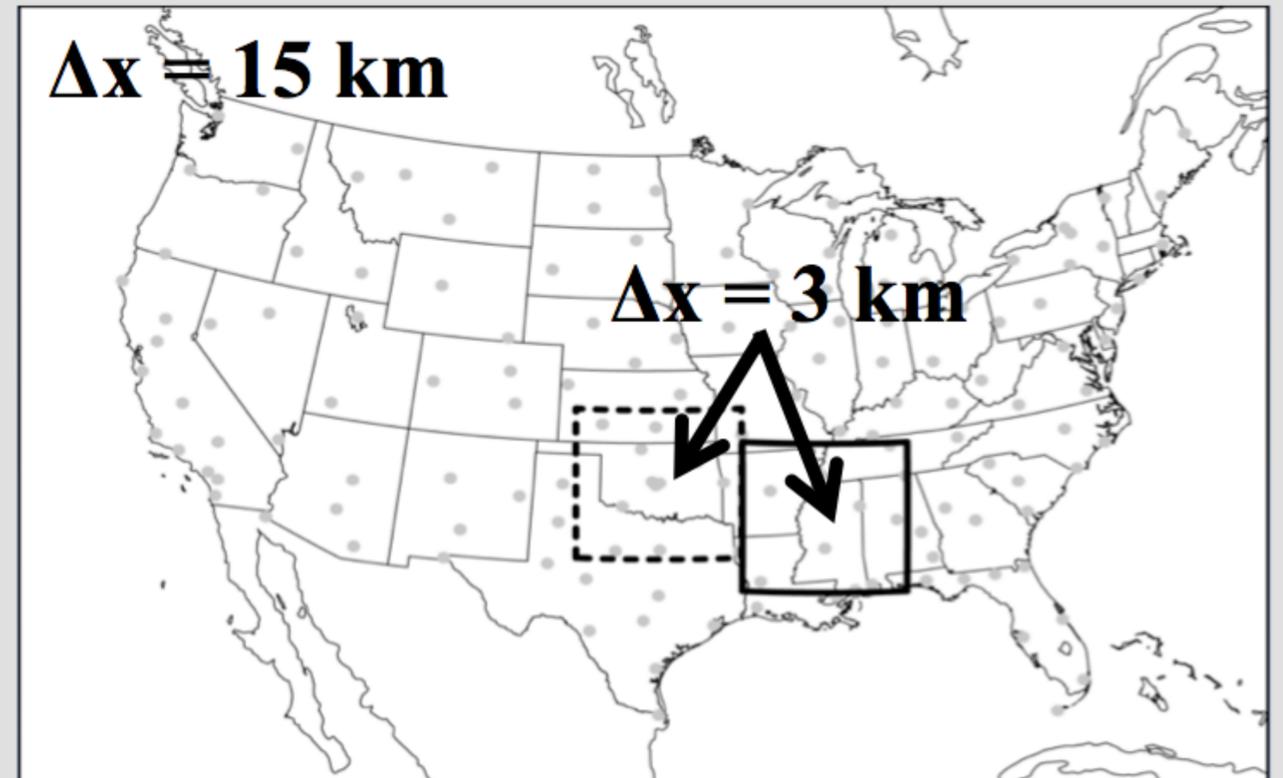
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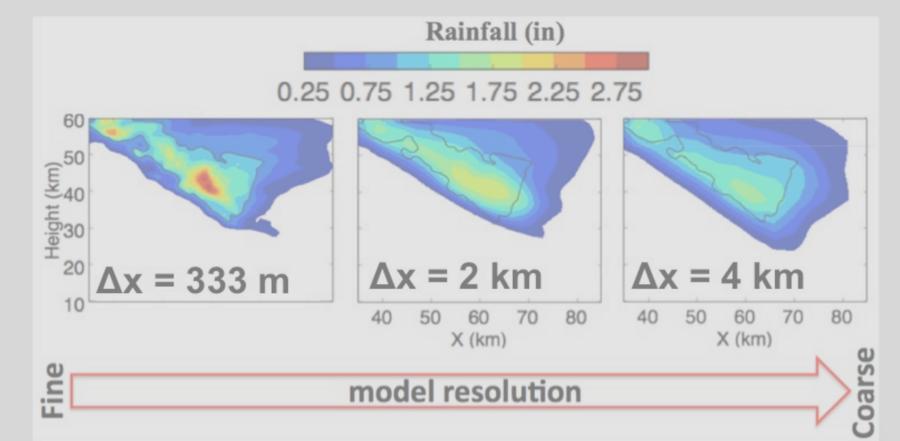


Mesoscale & storm-scale domains



Recent studies suggest thunderstorms are predictable for up to 2+ hours despite model/observational/computational limitations

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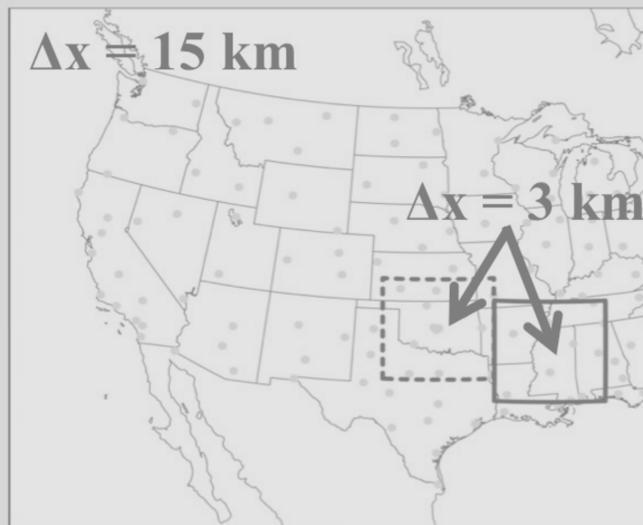
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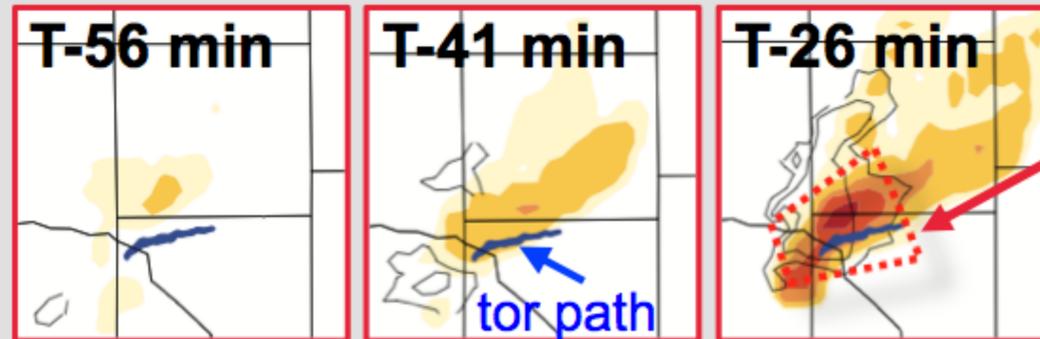
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NEWS-e Case Studies

20 May 2013 Moore, OK EF-5 Tornado

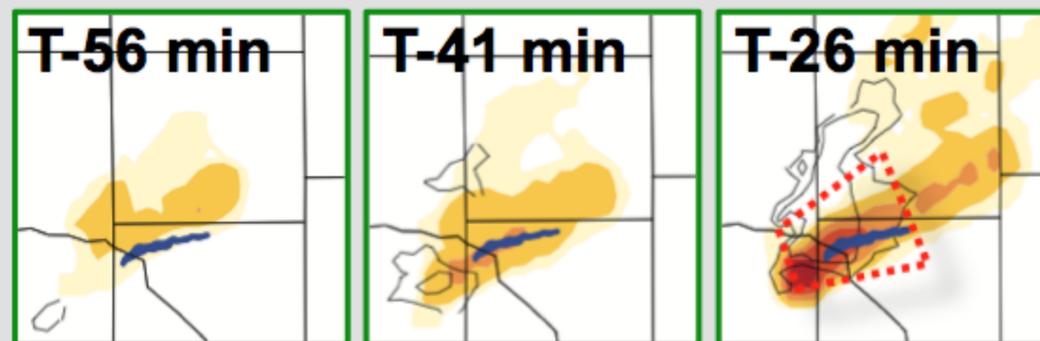
Radar only



NWS tornado warning issued T-16 min

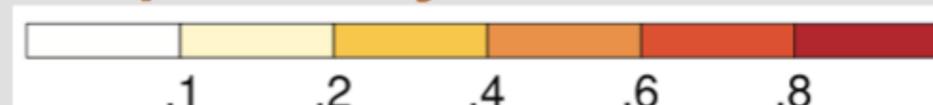
Ensemble forecast has tornado signal by T-41 min: 25 min before NWS warning!

Radar + satellite



Adding satellite data improves forecasts

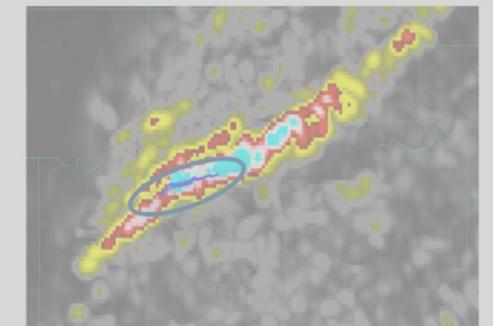
0-1 hr forecast probability of intense low-level rotation



- Using high-resolution ensembles to improve forecasts of convective storm hazards appears viable

Adaptive, real-time analysis system

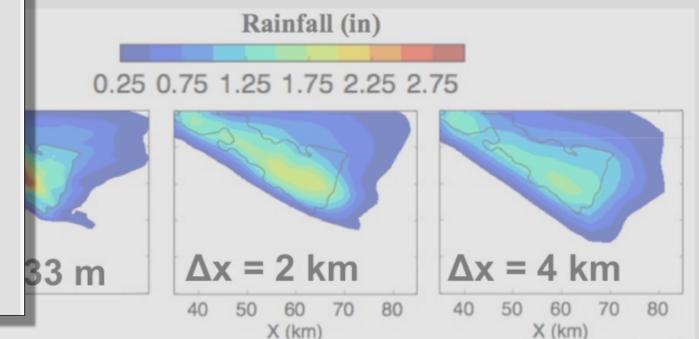
Assimilates radar obs with operational model forecasts
 Performs rotation, reflectivity analyses every 5 min
 Forecasters report that system highlights storms of high confidence to decision process, and should increase warning lead times



2013: Operational analysis with tornado mesocyclone

Model resolution requirements

Resolution needed to predict storm hazards? Idealized (below) and real case studies provide guidance for WoF system design



Fine model resolution Coarse



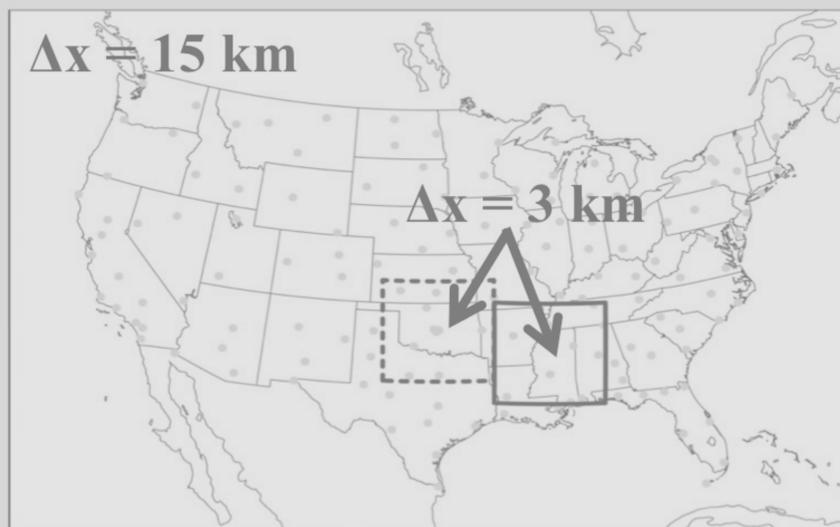
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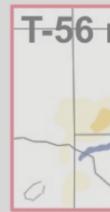
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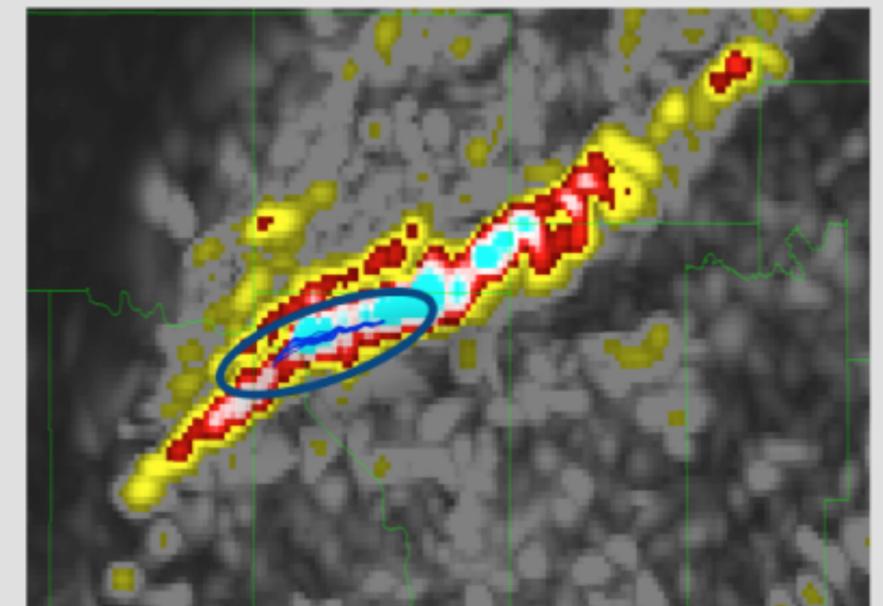
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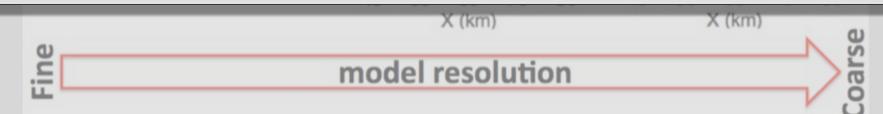
0-1 h

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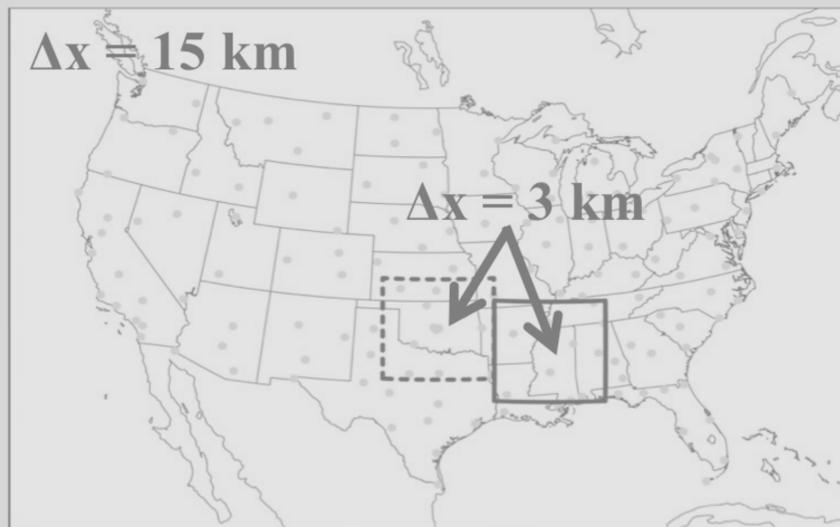
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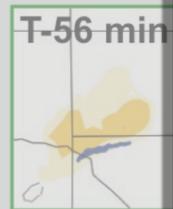
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NEWS-e Case Studies

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0-1 hr f

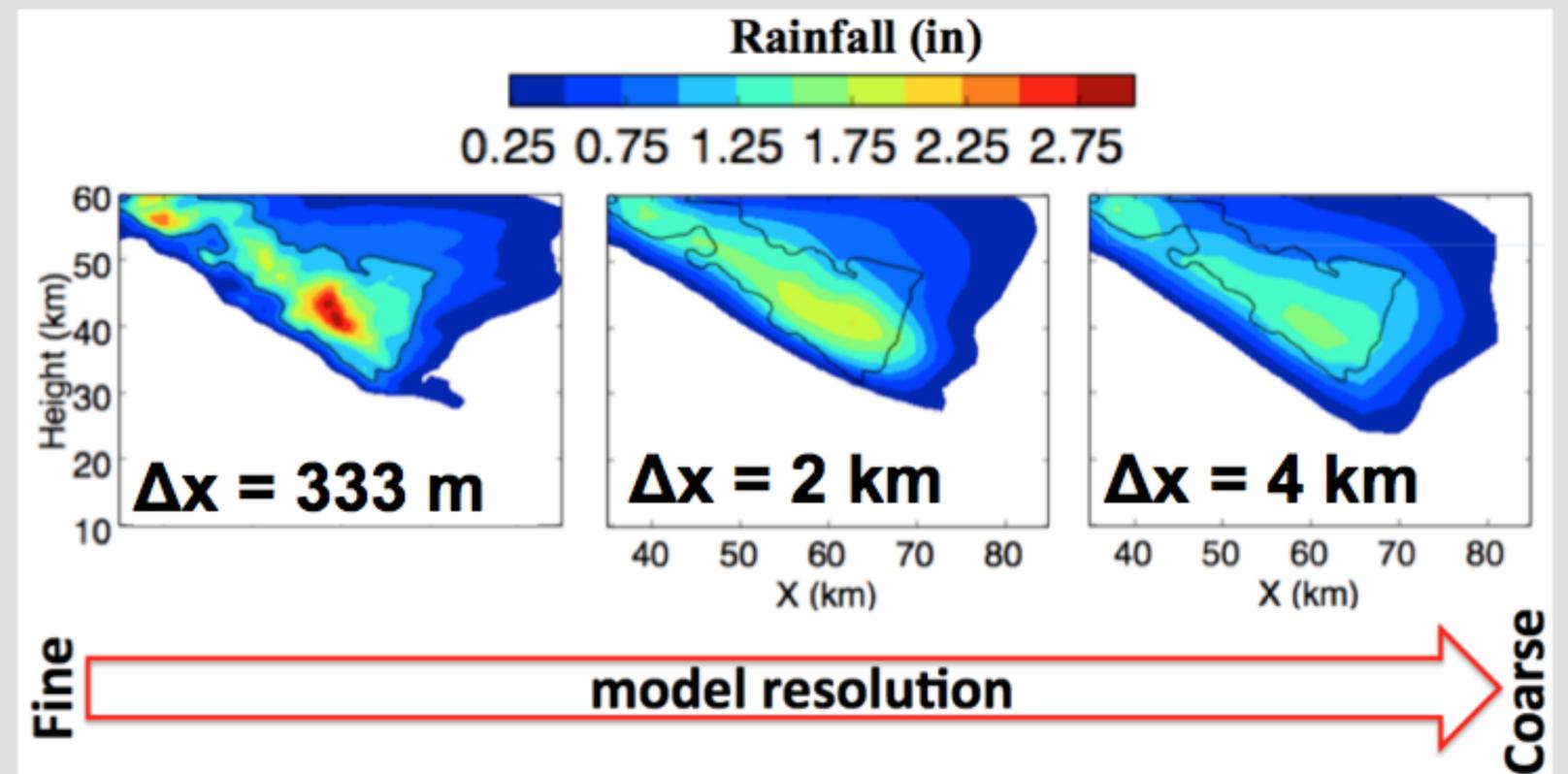
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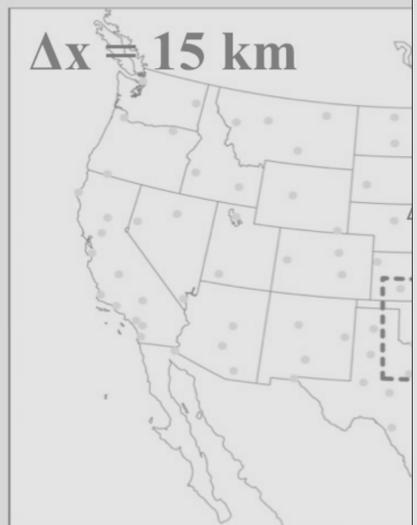
NEWS-e Case Studies

Weather-adaptive, real-time analysis system

(NEW)

- Given current technologies, how can convective hazards be predicted 0-2 hours in advance?
- Coarse grid covering US provides regional, weather-adaptive, storm-scale forecasts
- Assimilates conventional, surface, and satellite observations
- New storm-scale ensemble forecasting system
- Probabilistic guidance generated for forecasters
- A dozen retrospective case studies
- May 2015, HWT: **First time** an ensemble prediction system was used by forecasters

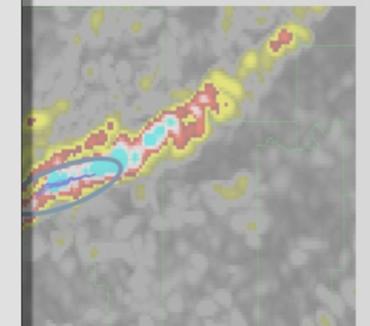
Mesoscale & storm-scale



Significant Scientific Discoveries

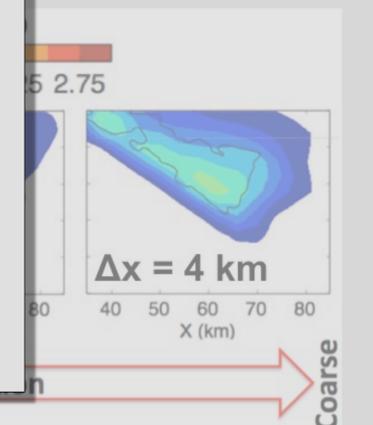
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Requirements

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real case studies
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