Climate, Weather and the Utility Industry

Bob Pasken and Bill Dannevik
QuantumWeather® Project
Earth and Atmospheric Sciences
Saint Louis University
Climate, Weather and the Utility Industry

• As the climate changes, so does the weather.
• This change is creating an environment that enhances the risk of severe weather.
• The enhanced risk of severe weather has profound consequences on society in general and the infrastructure that supports society specifically.
• The loss of supporting infrastructure can be particularly profound when multiple systems fail.
• The utility industry is faced trying to support 21\textsuperscript{st} century expectations with an aging 20\textsuperscript{th} century infrastructure.

• This is particularly true with the electric power industry.

• Historically much of the electric grid is above ground and built in the mid 20\textsuperscript{th} century.

• This infrastructure is vulnerable to weather-induced outages.
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• As an example in 2006 AmerenMissouri suffered through two major weather related power outages.
  – On July 19, 2006 a derecho resulted in 500,000 customers without power for more than a week in 100° heat.
  – November 30, 2006 an ice storm resulted in roughly 500,000 customers without power for a week in temperatures in the teens.

• AmerenMissouri made the decision to find away to better respond to weather related outages and hence QuantumWeather® was born.
QuantumWeather®

• QuantumWeather® is a weather-based decision support system for determining mesoscale events relevant to specific business operations.

• Combines information about the above ground infrastructure with high spatial and temporal resolution meteorological forecasts to create a probability of damage that evolves over time.
QuantumWeather®

• QuantumWeather® has a network of 100 surface weather stations deployed in key locations throughout Missouri.
• The weather stations report on a minute by minute basis.
• QuantumWeather® has three launch on demand radiosondes.
• QuantumWeather® has experimented with other sensor suites.
  – Two 3cm Doppler radars
  – Fleet of quad-rotor UAS’s
QuantumWeather®

First generation
RainWise sensor suite

Second generation Luftt sensors suite
QuantumWeather®

Quad-rotor UAS with test sensor suite
QuantumWeather®

• After the mesonet data has been quality controlled it is used to feed a high resolution mesoscale model.

• Mesonet data assimilation is done via 3-D VAR or observation nudging both with digital filter initialization.

• Model generates a 6 to 12 hour forecast.
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• Success stories
  – In January 2009 QuantumWeather forecasters notified AmerenMissouri that a major ice storm would hit southern Missouri.
  – QuantumWeather forecasters told AmerenMissouri that ice would accumulate at a rate of 0.15” an hour beginning in the late afternoon/early evening and end at Midnight.
  – Again AmerenMissouri trusted QuantumWeather Forecasters.
Does your safety measure up?
“The Forecast from SLU and Quantum Weather have been extremely valuable. Not only can they tell us when something is going to happen they also help us understand when we are not at risk. This helps our Customer and our employees. We can respond faster, often in advance and let employees go home when the threat is not a threat.”

“This partnership provided huge benefits to all of our stakeholders during the 2009 Ice storm. We had people, equipment, and materials in place before any ice ever formed. This improved our response and also reduced needed travel during difficult driving conditions. They got it right so we got it right. We got our customer restored faster than thought possible, geographically correct and specific advanced warning is the key”

David N. Wakeman
Vice President Energy Delivery
AmerenMissouri
QuantumWeather®

• Success stories
  – April 8 2015
    • No severe weather forecasted
    • Tornado was not forecasted but a tornado occurred in the town of Potosi MO
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With mesonet data

Without mesonet data
QuantumWeather®

• Success stories
  – April 8 2015

  • Raises some interesting points
    – From AmerenMissouri’s point of view this forecast was accurate.
    – From a meteorologists point of view the forecast was a bust.
    – AmerenMissouri is interested in how to allocate resources
    – Having a forecast that missed by half a county and is 20 minutes early is not important to AmerenMissouri
    – Resources and crews are allocated on a district level.
• Success stories
  – April 8 2015
    • Raises some interesting points
      – The key issue is that AmerenMissouri was able to pre-position crews in the “correct” location.
      – Driving a “few more” miles to a damaged site from the staging point is not important.
      – Again, given that they had to stage crews many hours earlier, a error on the order of 10’s of minutes is not important
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• Management issues
  – Requires a forecasting staff
    • Currently handled by two lead forecasters (read faculty members).
    • Staff forecasters (read graduate students)
    • Graduate students make a forecast.
      – If things look “bad” then all the forecasters get together and create a forecast that the lead forecaster issues to AmerenMissouri
  • Forecasters rotate responsibilities
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• Management issues
  – AmerenMissouri provides the sensors, does maintenance and calibration, and handles sensor communications to a central site.
  – AmerenMissouri owns the raw data
  – Saint Louis University owns the products.
• Management issues
  – AmerenMissouri places very few restrictions on the use of data
  – Saint Louis University can use the data for research and field campaigns.
  – The only real restriction is that Saint Louis University gives AmerenMissouri credit in any publication.
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• Management issues
  – Office of Research Services (ORS)
    • QuantumWeather® has been in existence for 8 years
    • Current contract for 10 more years is just starting its second year.
    • ORS decided to patent the tools and processes
    • Currently two patents issued, three additional patents are awaiting final action and should be issued before the end of the year.
QuantumWeather®

• Management issues
  – Office of Research Services (ORS)
    • ORS initially had trouble with the contract.
    • Many administrators even after 8 years still have trouble with the contract.
    • The QuantumWeather® team has to “explain” the contract when a new administrator comes on board.
• Management issues
  – Office of Research Services (ORS)
    • ORS initially had trouble with the contract.
      – It is not a fee for services contract
      – It is not a research contract
      – The contract contains elements of both
      – AmerenMissouri wants to be seen as a leader in the utility industry and as such wants to have the best possible weather-based decision support system.
QuantumWeather®

• Management issues
  – Office of Research Services (ORS)
    • AmerenMissouri’s wants the “gold standard” for a weather-based decision support system
  – QuantumWeather® Research
    • Model verification
    • Ensemble forecasts
    • Data Assimilation
    • New sensor suites
• Returning the talk back to the idea of climate change and the utility industry:
  – The utility industry, particularly the electric power industry, is having to alter its management of resources to respond to the changing climate.
  – Industry leaders are beginning to understand that the kind of research that we all are familiar with can have significant benefits and they are willing to pay for access to the expertise and research.