QuantumWeather®

A weather based decision support system for the utility industry

Bob Pasken and Bill Dannevik

Saint Louis University

QuantumWeather®

- Before we start I would like to say thank you to
  - Dave Wakeman
  - Kevin Anders
  - Steve Brophy
  - John Simmins

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- Begin with a short history of how AmerenMissouri and Saint Louis University became partners.
- Describe of what QuantumWeather is and how it works.
- Describe work in progress.
- Leave time for questions

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- The project had its origins as a tool to forecast pollen concentration for Asthma sufferers.
- The tool produced very accurate pollen concentration forecasts.
- The success of the pollen forecasts led to the question, can this level of accuracy be maintained on a daily basis or were we just lucky?
- A graduate student began running the tool 4 times a day every day to determine the long term accuracy of the tool.

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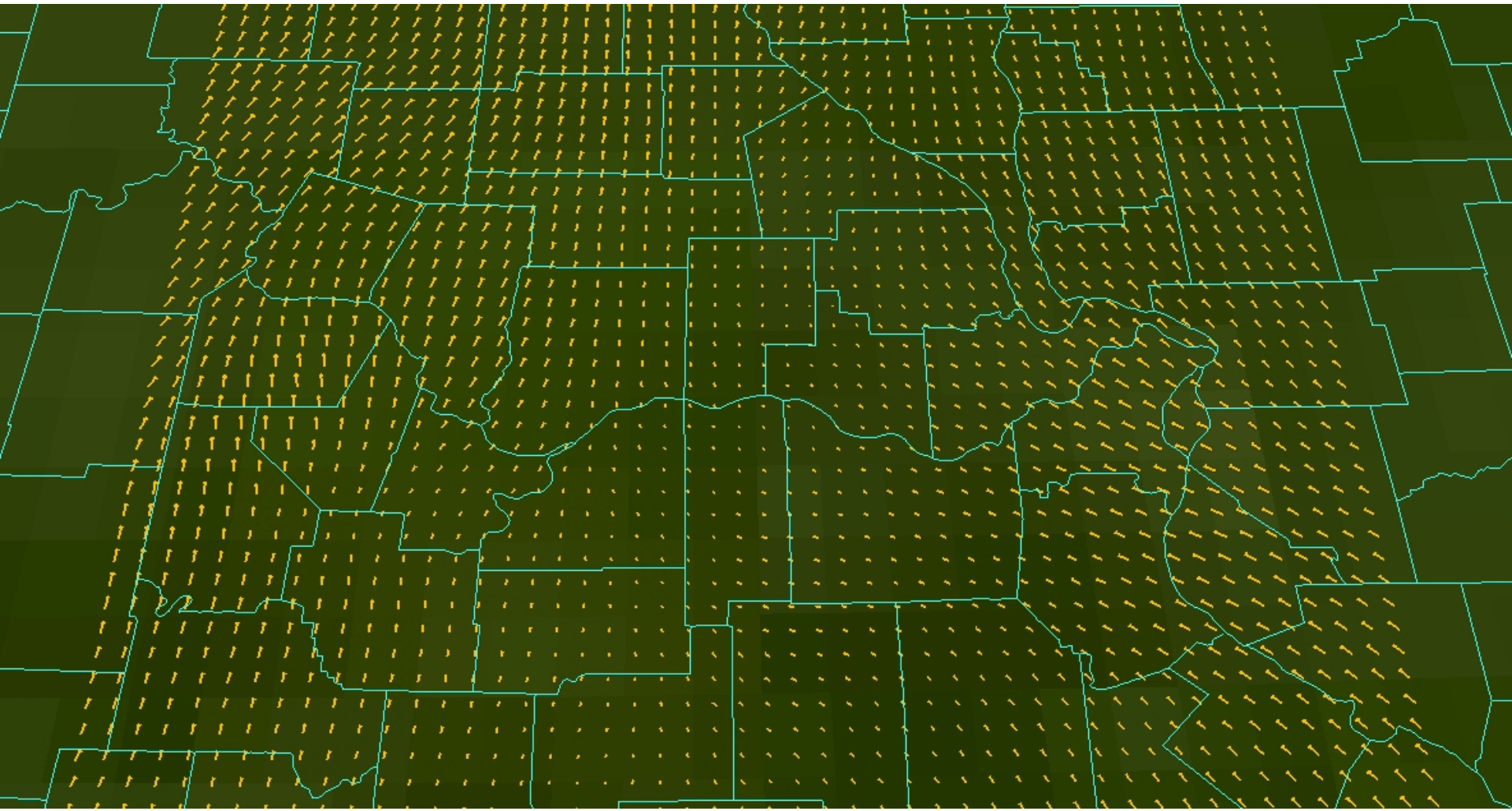
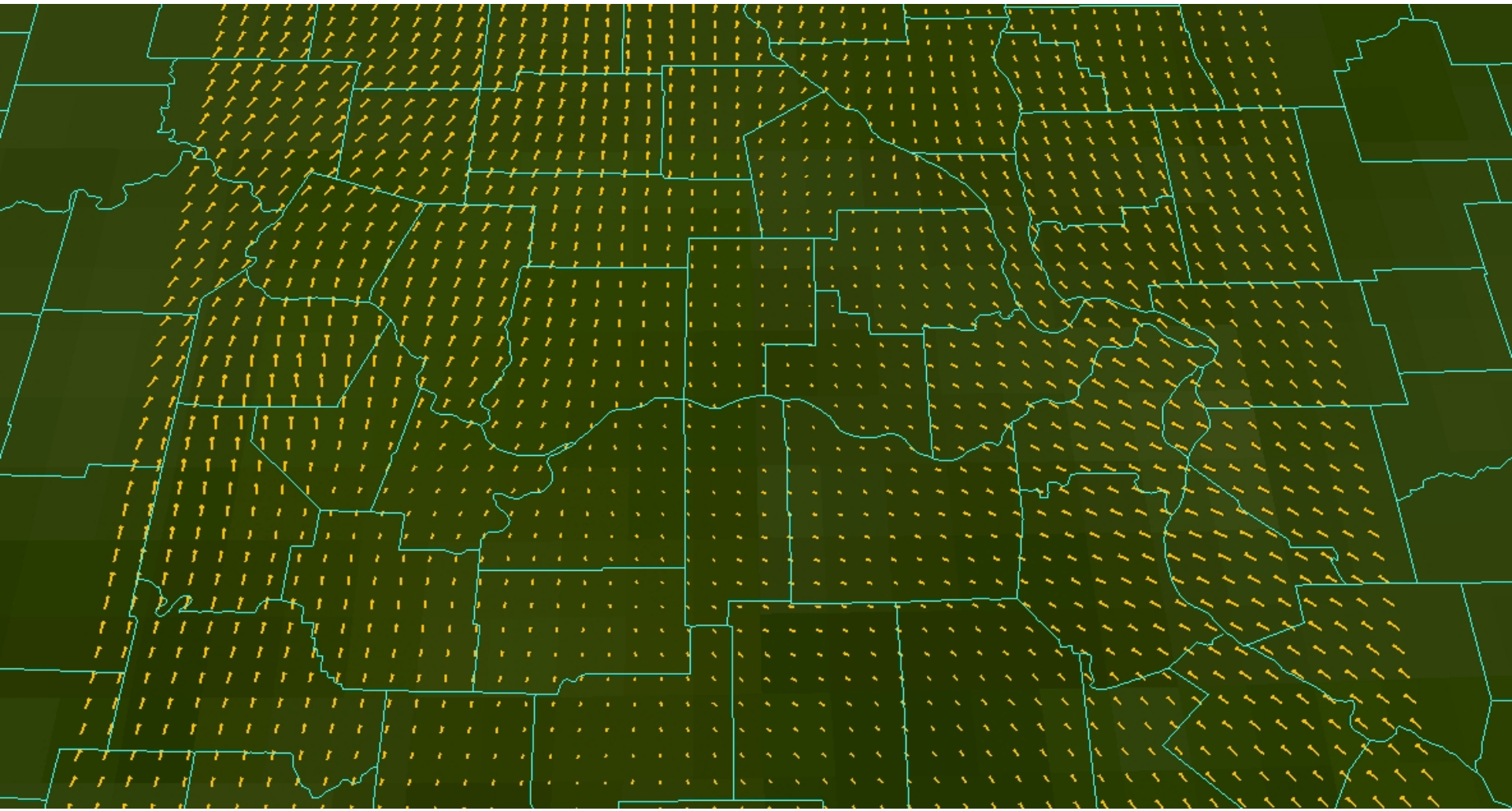
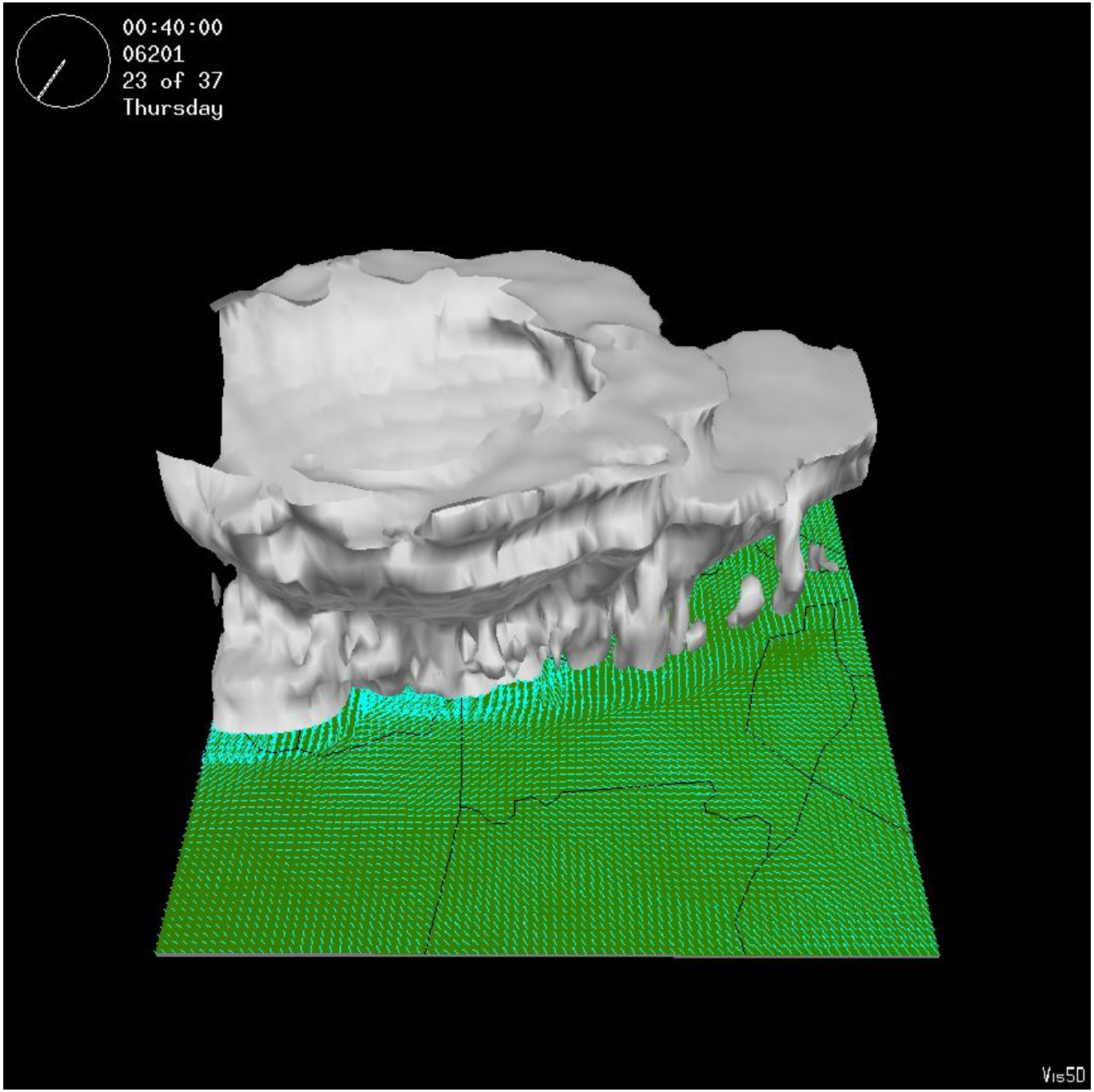
- On July 19th, 2006 the early morning forecast runs indicated that St. Louis would experience severe weather
- The late morning forecast indicated the kind of severe weather.
- Unfortunately St. Louis University does not have the authority to issue severe weather warnings.



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- AmerenMissouri had 500,000 customers without power in 100° heat.
- Then starting on November 30th 2006 an ice storm across southern Missouri resulted in another 500,000 Ameren customers without power in below freezing temperatures.

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- In January 2007 an editorial in the Saint Louis Post-Dispatch chastised AmerenMissouri for not responding in a more timely fashion.
- Bill Dannevik and I approached AmerenMissouri with a plan to help them respond more quickly.
- The joint AmerenMissouri/Saint Louis University project is called QuantumWeather.

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- QuantumWeather is a weather-based decision support system.
- QuantumWeather combines high spatial and temporal resolution meteorological forecasts with information on the power grid configuration, local ground and tree cover information, and historical power outage information to pinpoint areas at highest risk of power interruption.

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- Provides AmerenMissouri the ability to prioritize efforts to restore service by focusing efforts in those areas most severely affected by the event.
- Direct crews to those areas known to be affected rather than searching for damage post event.
- Aid in positioning crews in areas that make them as effective as possible.

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- How does QuantumWeather® make these forecasts?
  - What makes us better than NWS? TWC? AccuWeather?
  - Combination of high quality data and a cutting edge numerical forecast model
  - We start higher resolution data

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- We have a network of 100 surface observations spread through out eastern Missouri.

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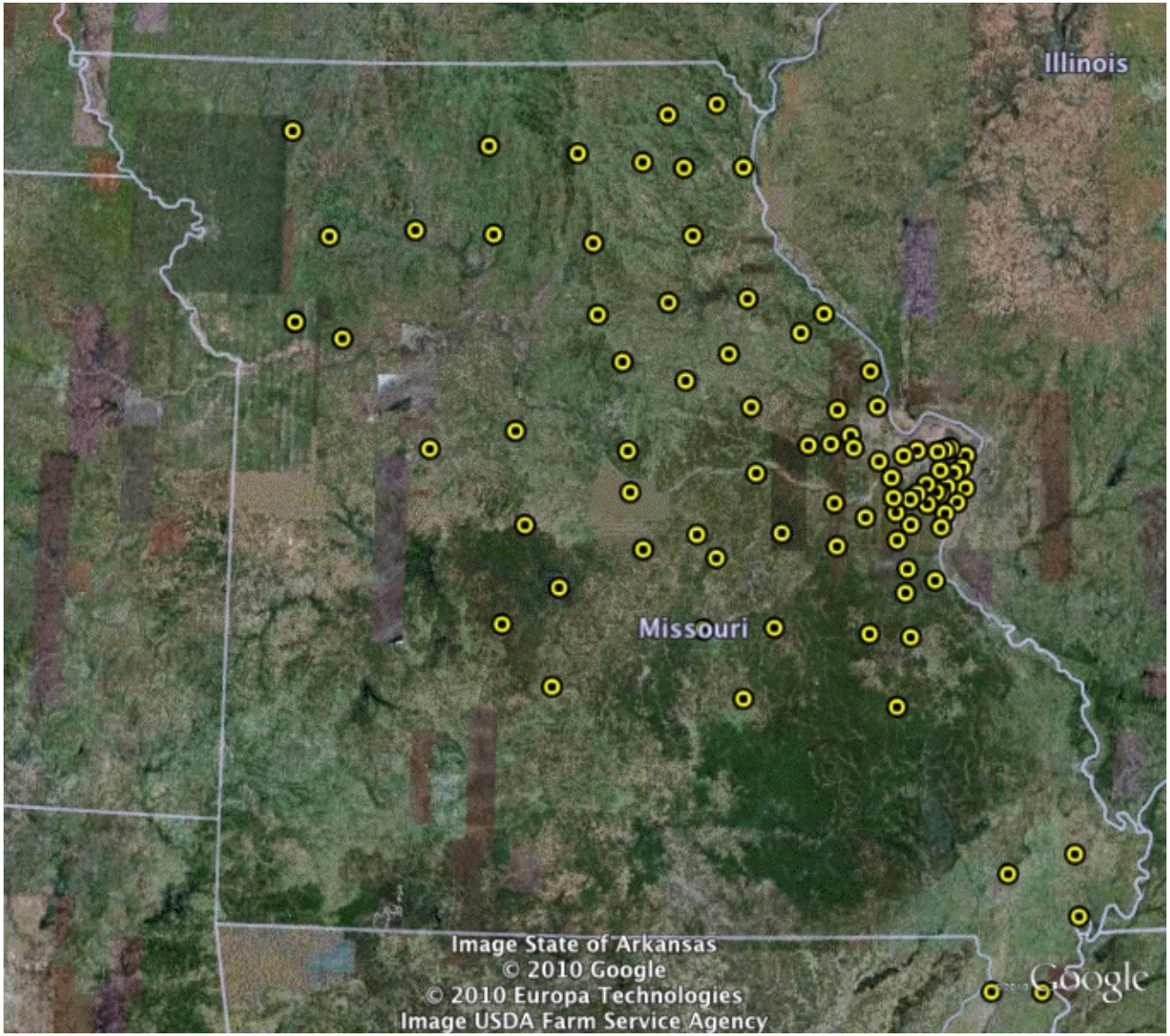

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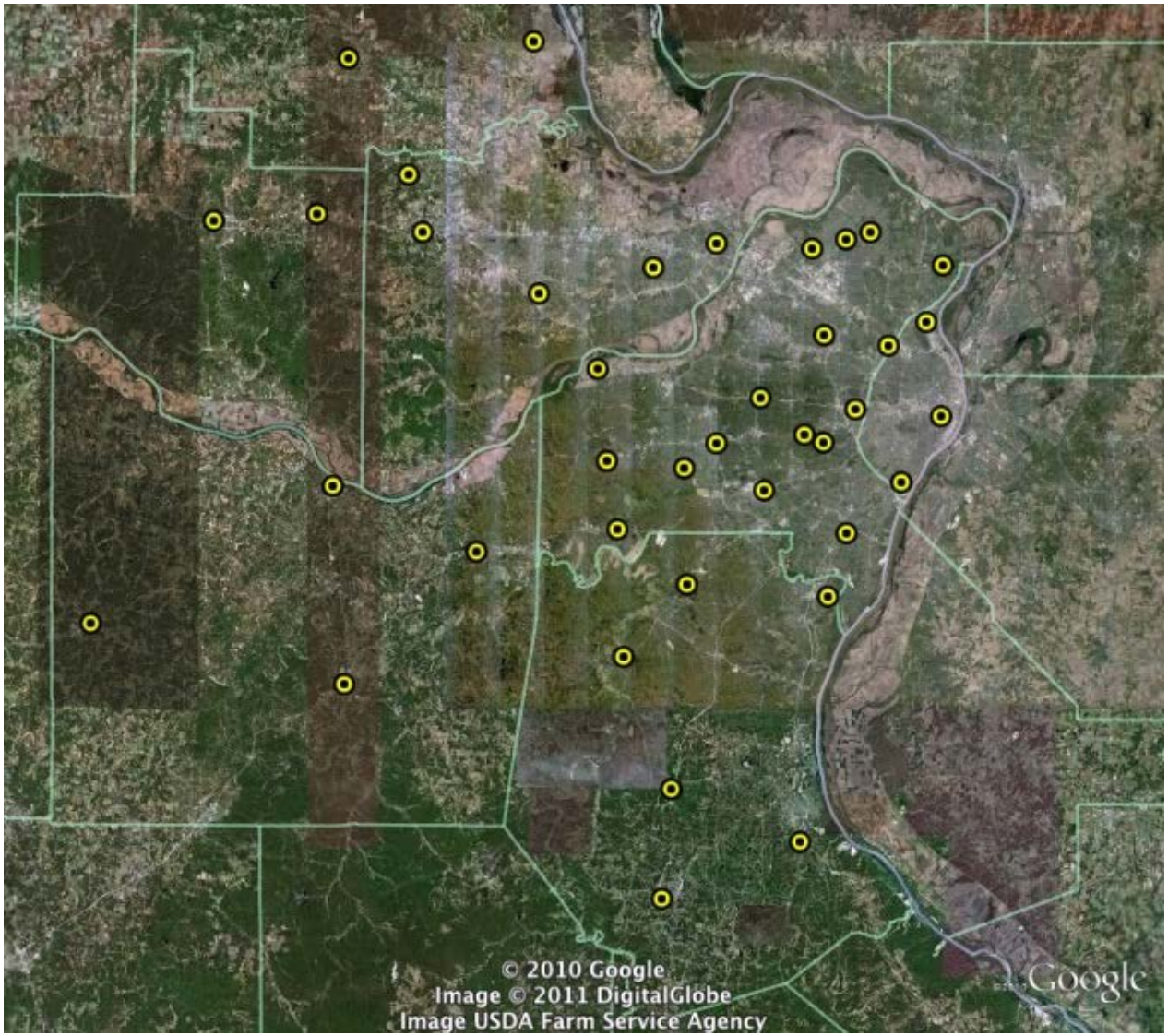

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- We have two radiosondes to probe the vertical structure of the atmosphere.

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- How does QuantumWeather® make these forecasts?
  - We get surface observations once a minute
  - Surface data at each site is transmitted to AmerenMissouri and then to SLU.
  - Upper air data by AmerenMissouri and Saint Louis University

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- How does QuantumWeather® make these forecasts?
  - Data is quality controlled every 5 minutes and quality assurance tests 10 minutes
  - Maintenance and calibration on all sensors done once a year or when a failure occurs

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- QuantumWeather® feeds this higher spatial and temporal resolution data into a numerical weather prediction model that has been tuned for our customers needs
  - Ameren needs wind and sleet/freezing rain forecasts
  - The threat posed is seasonally dependent and adjusted seasonally.

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- How much improvement in forecast quality does the addition of the mesonet data provide?
  - Subject of on going research
    - Rigorously comparing twice daily model forecasts with and without mesonet data against observations over an entire year
    - Rigorously comparing selected day
      - Days with significant weather
      - Days without significant weather

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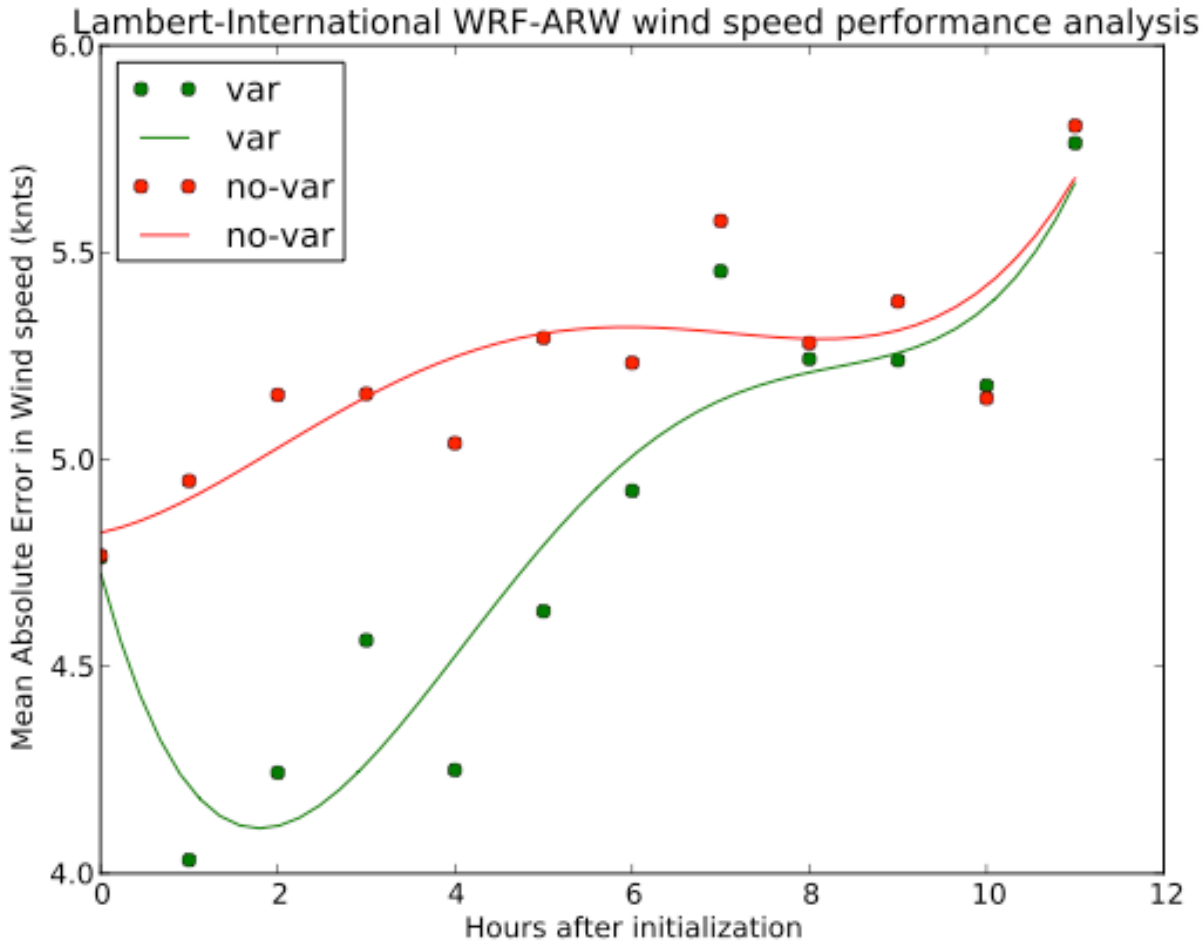

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- How does QuantumWeather® make these forecasts?
  - Data ingest, QC and QA is automated and part of the QuantumWeather patent suite
  - An automated process that is part of the patent suite prepares all of this data for model input and for analysis before, during and after “events”
  - Analysis plots give the forecaster a better picture of the event as it unfolds

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- You might be saying to yourself at this point: “Ok, I get that Saint Louis University’s meteorologists and their models are good. What good does that do me as a utility operator?”

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- The answer to this question is that we combine other kinds of data with the meteorology to create an integrated view.
- By combining the analysis from the model, the mesonet data, the location and health of vegetation, and the location of AmerenMissouri's above ground assets present a picture of how, when and where a particular weather event will impact AmerenMissouri.

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- Further AmerenMissouri has a much better picture of what assets were affected by the weather event.
  - Knowing that the highest wind speed or greatest accumulations of ice occurred at precise locations makes the job of determining the cause and location of the problem easier.
  - Driving around at night in the rain looking for a downed power line is not high on my “bucket list”

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- Currently QuantumWeather does not overlay weather and vegetation data on top of the location of AmerenMissouri assets.
  - Forecasts are available in several formats:
    - GoogleEarth
    - IDV
  - Vegetation, land cover and land use data is available in several formats.

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- The location of AmerenMissouri assets has not been available until just recently.
- Integration of AmerenMissouri assets and other data has just begun.
- How the integration of the meteorology, land use and cover, and AmerenMissouri assets is done is still an open question
- Requires close cooperation with the team from AmerenMIssouri

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- As an example of how QuantumWeather works:
  - 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.
  - AmerenMissouri trusted QuantumWeather Forecasters.

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- AmerenMissouri committed nearly all of it's resources to southern Missouri before the storm began.
- AmerenMissouri had the right resources and crews on site as the ice began to accumulate.
- AmerenMissouri was able to restore power to it's customers before neighboring Utility companies were able to arrive on site.

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- "The Forecasts 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 there 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