Operational Evaluation of a Mesoscale Weather and Outage Prediction Service for Electric Utility Operations

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Goals

- **Meteorological analysis**
  - Characterize key historical events that impact utility operations
  - Use AWS/WeatherBug observing stations, wrangled reports and public data to evaluate past forecasts and events
  - Analyze data to tune and improve modeling

- **Impacts Analysis**
  - Characterize how key historical events from the utility's perspective
  - Use ConEd damage data, outage reports, etc. to evaluate past events

- **Uncertainty quantification**
  - Methods for handling and parameterizing uncertainty need to be developed

Outputs

- **Forecast initiation and tuning**
  - Historical perspective
  - Tailored weather visualizations available via a web browser, including
  - Historical data used for retrospective analysis, forecast verification
  - Data also used to calibrate outage prediction model and other sensor data
  - Model initialization will be improved as a future enhancement via three-dimension variational data assimilation of near-real-time data

Use of AWS/WeatherBug Mesonet

- More than 400 stations in 2km model domain that covers extended ConEd service territory – close sampling to model resolution
- Primary data include temperature, relative humidity, wind speed and direction, rainfall at 5-minute intervals
- Quality data used for damage assessment during severe weather
- Historical data used for retrospective analysis, forecast verification and tuning
- Data also used to calibrate outage prediction model and other sensor data

Verification of the Weather Model

- Focus on the ConEd Westchester County, NY service territory
- Compare weather model results with measurements from WeatherBug stations
- Analyze observations and identify any issues with measurements and sensors
- Use typical methods (e.g., RMSE to compare 84-hour WRF-ARW and NAM results with observations
- Create contingency tables to evaluate rainfall results within substation service territories

Web-Based Dissemination

- Customized visualizations with ConEd infrastructure overlays
- Choice of geographic views of service territory
- Forecast plots and interactive tables at specific locations
- Alerts for outage and snow conditions with additional visualizations
- 84-hour forecast at hourly resolution and 24-hour forecasts at 10- or 20-minute resolution

Example Operational Forecast – 07 October 2009 Wind Event

- Wind Forecast for Service Territory
  - Probability with Value
- Forecast and Outage Prediction Initiated with Data from 0900 UTC on 07 October 2009 (~12 hours lead time)
- Prediction of Number of Repair Jobs per Substation Area

Coupled Weather & Damage Modelling

- **Damage**
  - Custom modeling for predictions of outages
  - A damage forecast model at the one substation level is developed using data generated from the ConEd operational service territory and fusion of various data sources to see historical data, sensor data, and operational model data to build a diagnostic model
  - Critical input is damage/disconnect data from ConEd that feeds into the wind model
  - Wind damage module simulates realistic displacement, short-circuiting, etc.
  - Outage spatial-temporal modeling to enable predictions of outage

Example Daily Rainfall Substation Statistics for October 2009 within 2 of Each WeatherBug Station and Each Timing of the Observed Event

- Probability of Number of Predicted Repair Jobs per Substation Area
  - Probability of Number of Predicted Repair Jobs per Substation Area
  - Probability with Value

See Related Presentations (Poster 521 Probability and Statistics; J11.3 Energy; J6.1 Socio-Economic)