SOLAR ENERGY TECHNOLOGIES OFFICE
U.S. Department Of Energy

Forecasting Session I: Solar Forecasting 2

Coordinated Ramping Product and Regulation Reserve Procurements Using Probabilistic Solar Power Forecasts

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Project Summary

Objective: Integrate probabilistic short- (2-3 hr ahead) and mid-term (day-ahead) solar power forecasts into operations of two ISOs:

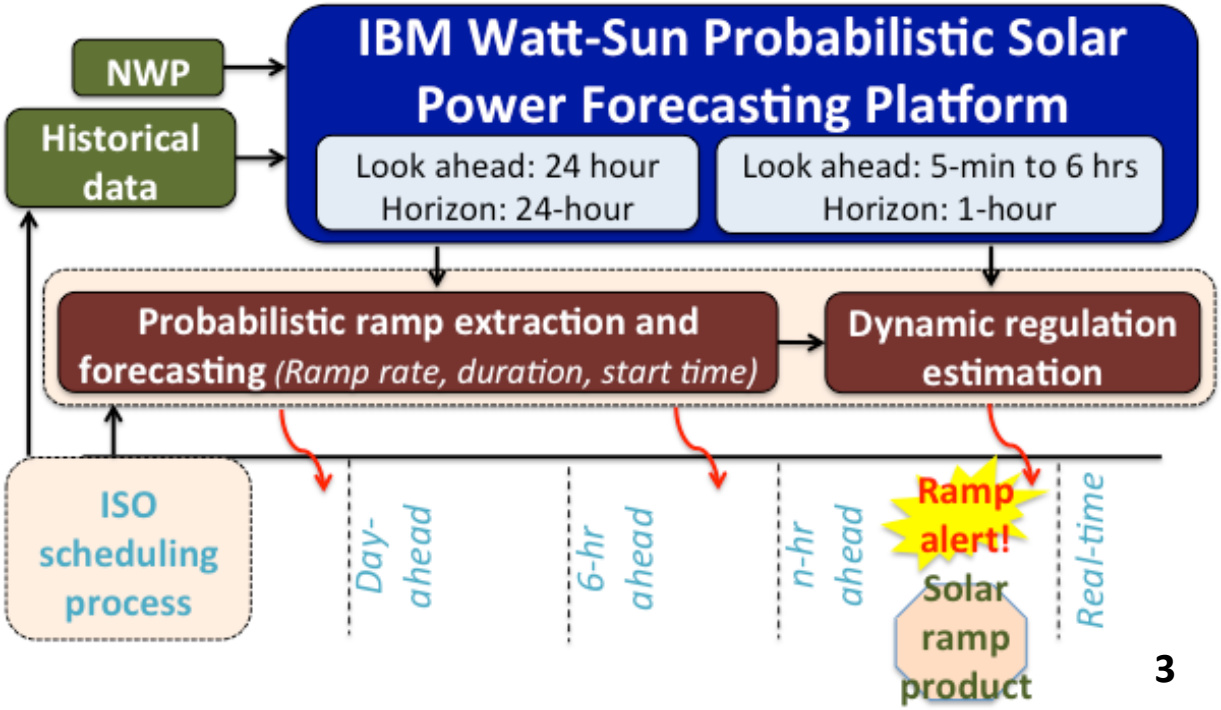
- CAISO & MISO

Approach:

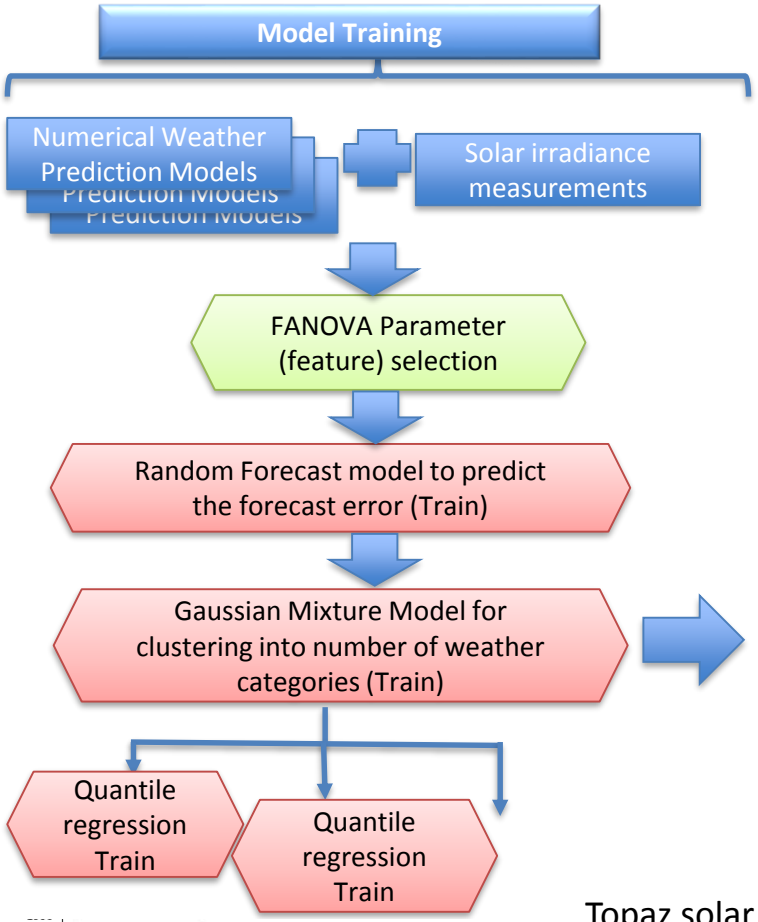
Thrust 1: **Advanced big data-driven "probabilistic" solar power forecasting technology using** IBM Watt-Sun & PAIRS (**Big data** information processing and **machine learning approaches** to blend outputs from multiple models).

Thrust 2: **Integrate probabilistic forecasts** in ISO operations for *ramp product* & *regulation* requirements

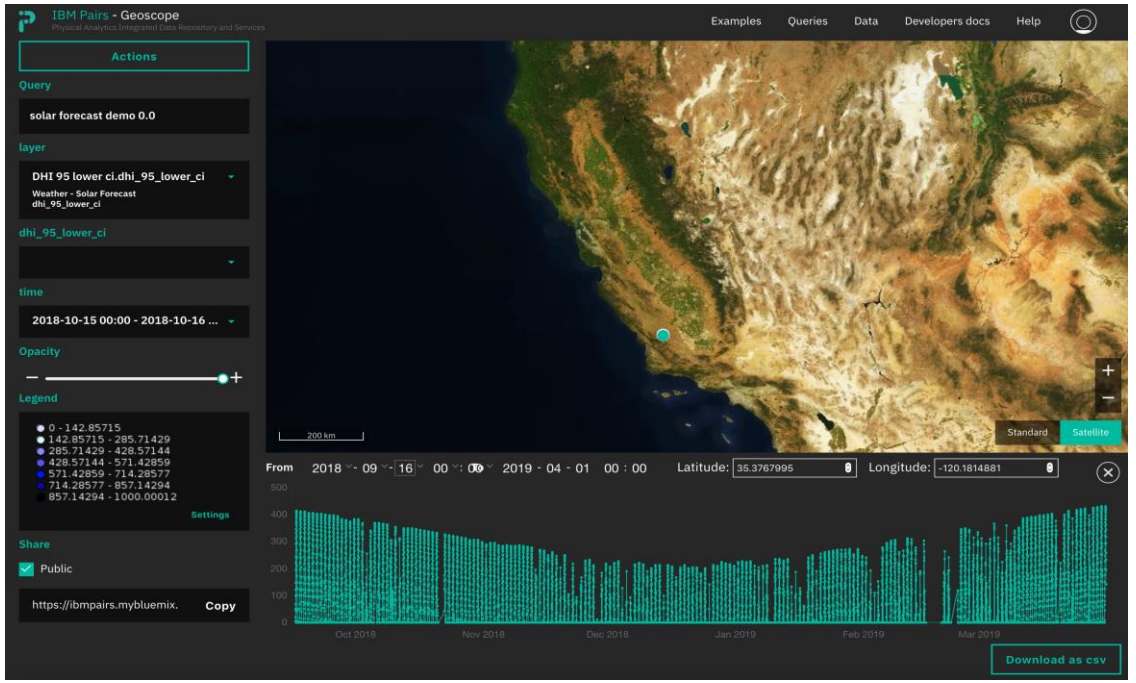
Thrust 3: Provide **situational awareness via visualizations** of probabilistic ramp forecasts & alerts



Thrust 1

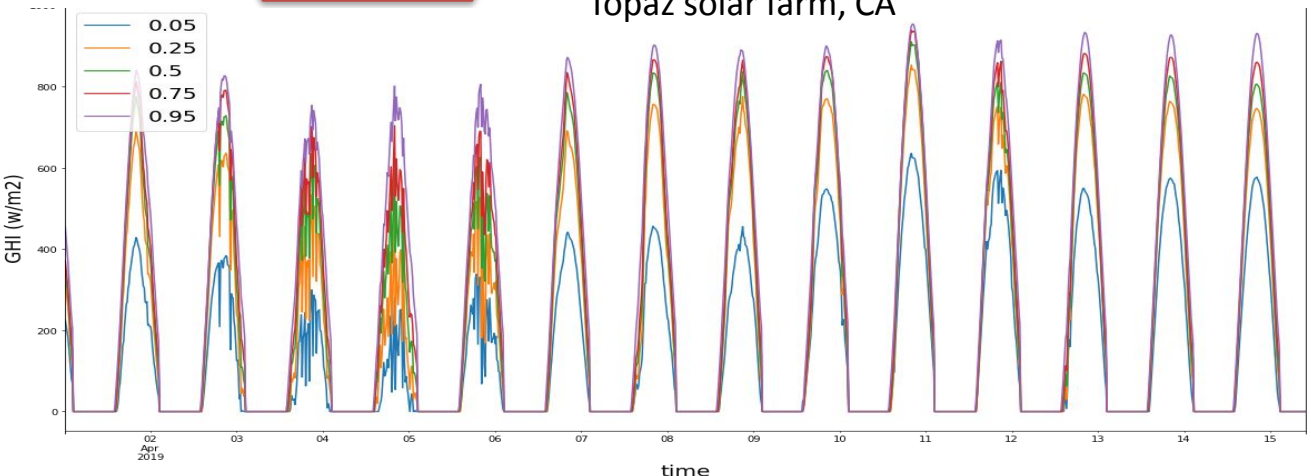


Use trained models and quantile regression for **FORECASTING**



Finding: Distribution is asymmetrical, hence important to have quantile regression techniques

Topaz solar farm, CA



Future work: AI based short term forecast methods using GOES-R, e.g., Generative Adversarial Neural Network

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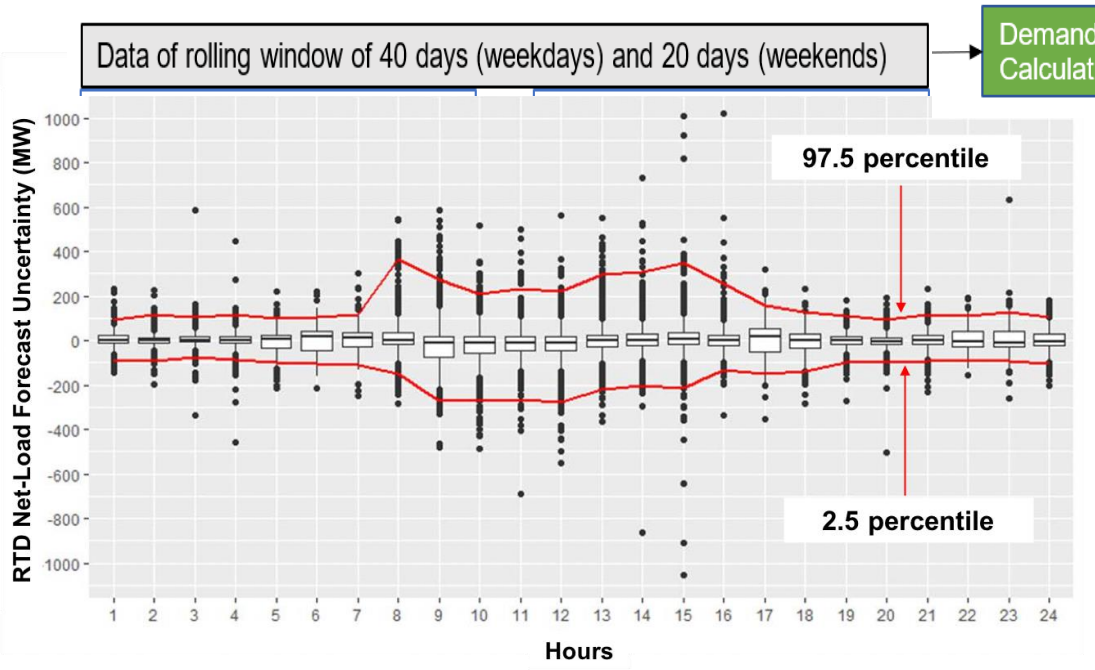
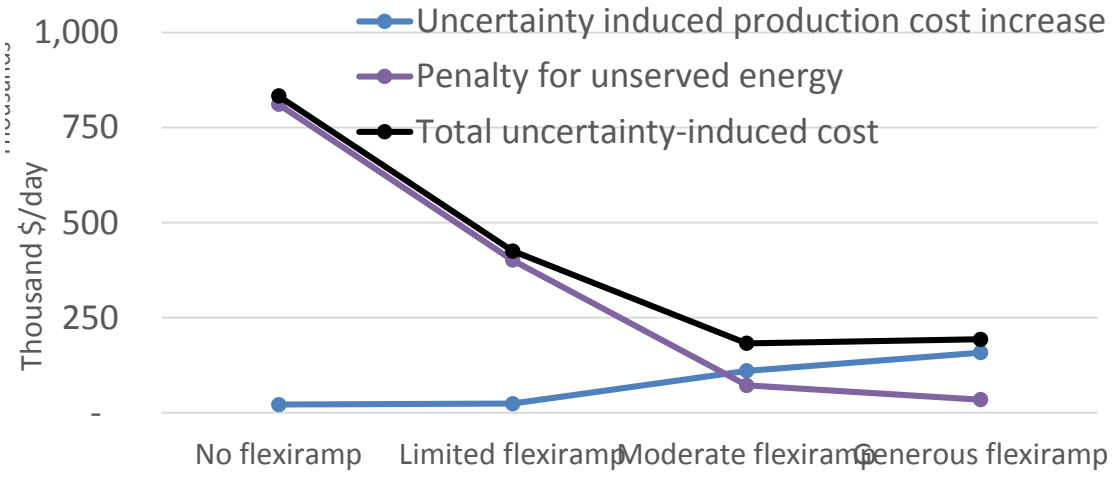
Progress 1: ISO baseline Flexible Ramping Product (FRP) procurement uses historical forecast errors.

Thrust 2



Progress 2: Reliability vs. economics of various FRP levels. (IEEE 118 bus system market simulations)



Ongoing work: Integrate probabilistic forecast into ISO FRP procurement process.

- Estimate probabilistic net-load forecasts from IBM solar forecasts using convolution (considering dependence across sites and components).
- Compare the levels of uncertainty in probabilistic forecasts and histograms of historical error.
- Estimate cost and reliability impacts of probabilistic net-load forecast based FRP procurement under high solar futures (IEEE 118 bus and ~20,000 WECC systems)

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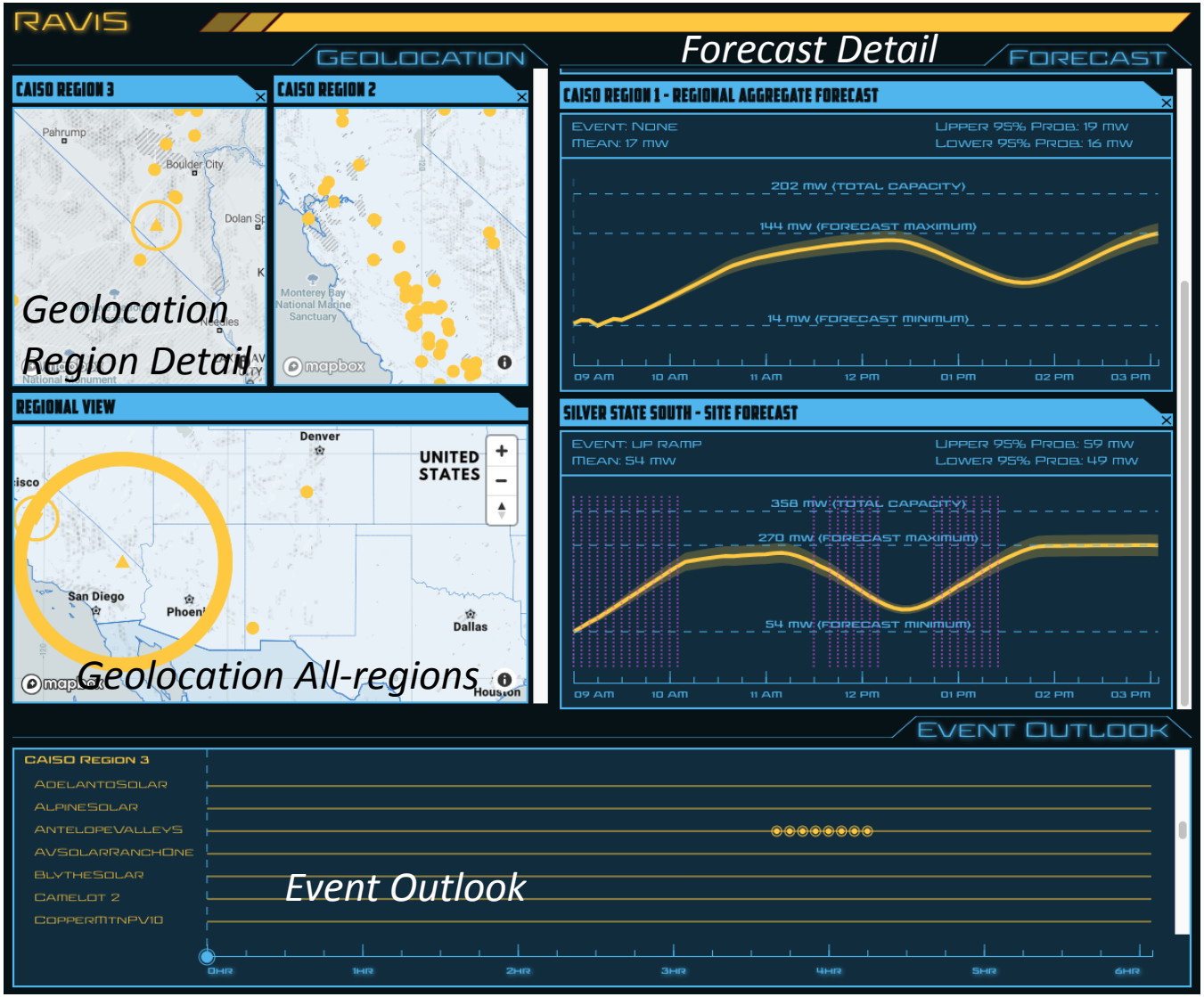
Ramp Visualization for Situational Awareness (RaViS)

Thrust 3



Features:

- Forecast data from IBM integrated
- RaViS refresh rate of 60 seconds
- User interface: Single page web application and open source
- Shows site specific metadata via hover
- Highly flexible and easily configurable

Future work:

- Net-load ramps
- Adaptable to other kinds of events: outage/trip, cyber threats

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