2026 ESIG Integrating Economic and Reliability Models for Power Systems Planning Workshop

Enhancing Weather-Informed Transmission Planning: Augmenting Workflows with Multiple Hazardous Events

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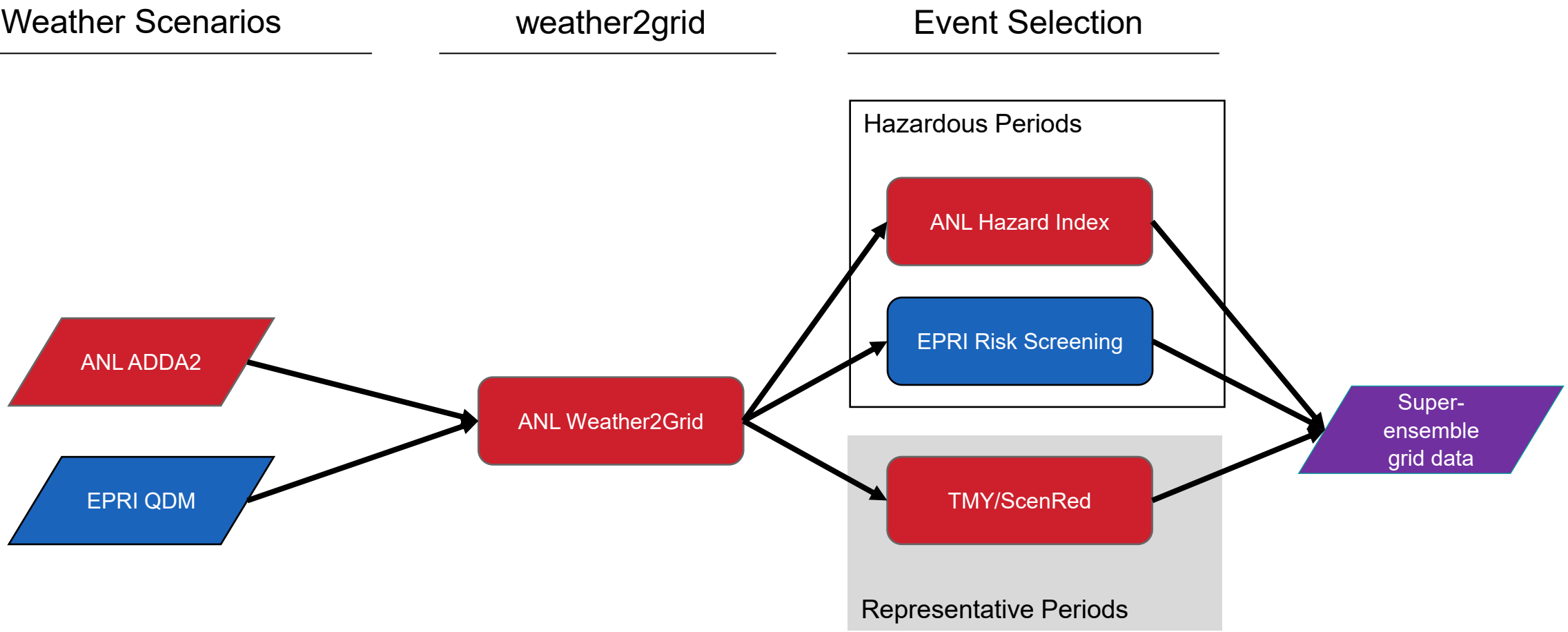
PROJECT OVERVIEW

- **Objectives**
  - Identify extreme weather scenarios across multiple historical and synthetic datasets
  - Create a more robust weather-resilient transmission planning process
  - Demonstrate the economic and reliability benefits of the new planning process
- **Team**
  - ANL: Todd Levin (PI), Connor Aghili, Seolhee Cho, Chunyong Jung, Jonghwan Kwon, Neal Mann, David Sehloff, Jiali Wang
  - EPRI: Katie Brennan, Caroline Draxl, Francisco Ralston Fonseca, Jing Peng, Eric Swanger, Eknath Vittal
- **Funding and Support**
  - DOE Office of Electricity, DOE Office of Critical Minerals and Energy Innovation

WEATHER SCENARIOS AND EVENT SELECTION



WE'RE CREATING A SUPER-ENSEMBLE FROM THREE WEATHER DATASETS

ANL ADDA2

- Argonne Downscaled Data Archive, Version 2 (ADDA2)
- Dynamical spatiotemporal downscaling
- ERA5/GCM→WRF, North America, 0.036° (≈4 km), hourly (convection permitting)
- 80 weather year scenarios (historical and synthetic)

EPRI QDM Shift

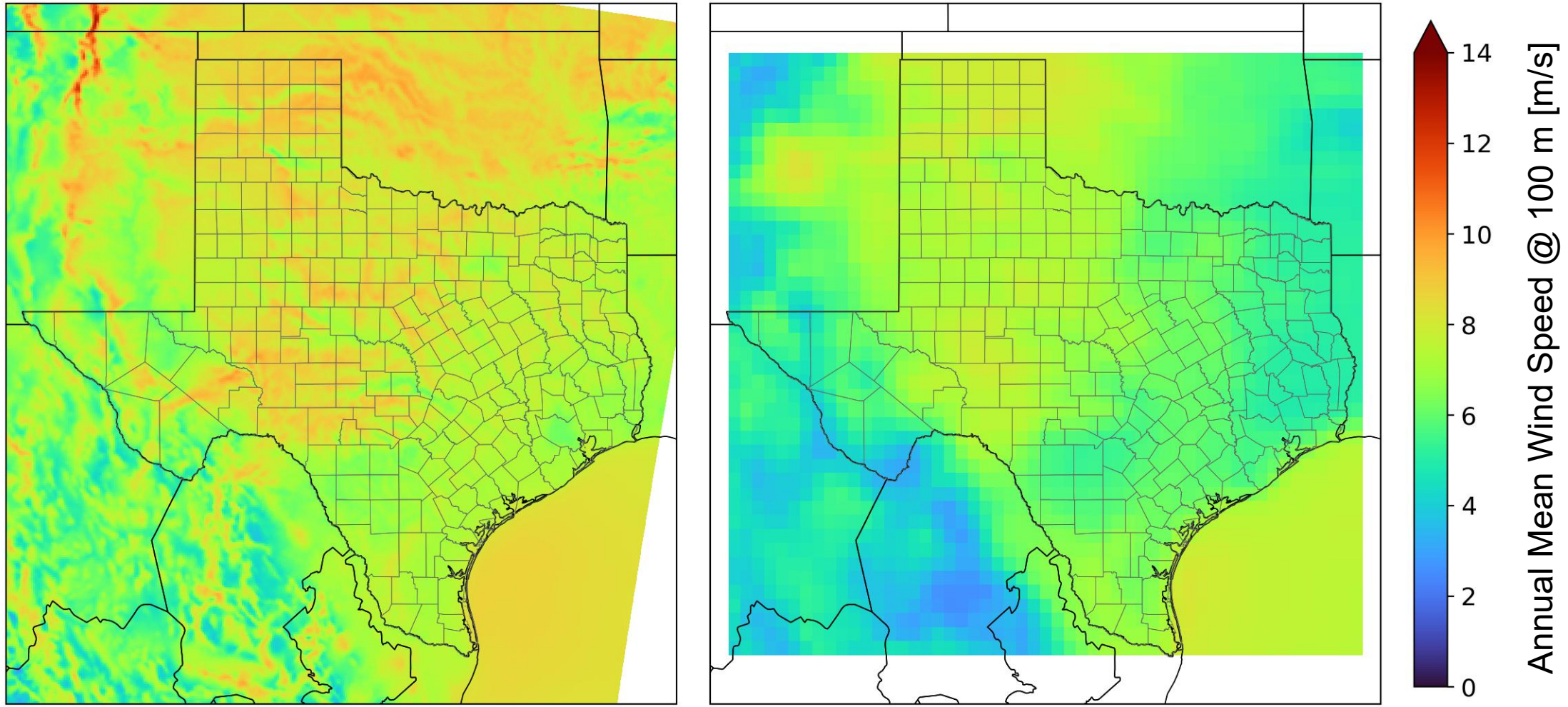
- EPRI Quantile Delta Mapping (QDM)
- Statistical temporal downscaling
- ERA5→GCM QDM, North America, 0.25° (≈28 km), hourly
- 130+ weather year scenarios (historical and synthetic)

Hypothesis: Leveraging historical+synthetic data and dynamical+statistical methods better characterizes uncertainty and provides more robust assessments

ADDA2 DOWNSCALED WIND SPEEDS ARE HIGHER THAN ERA5…

ADDA2 (Downscaled ERA5)

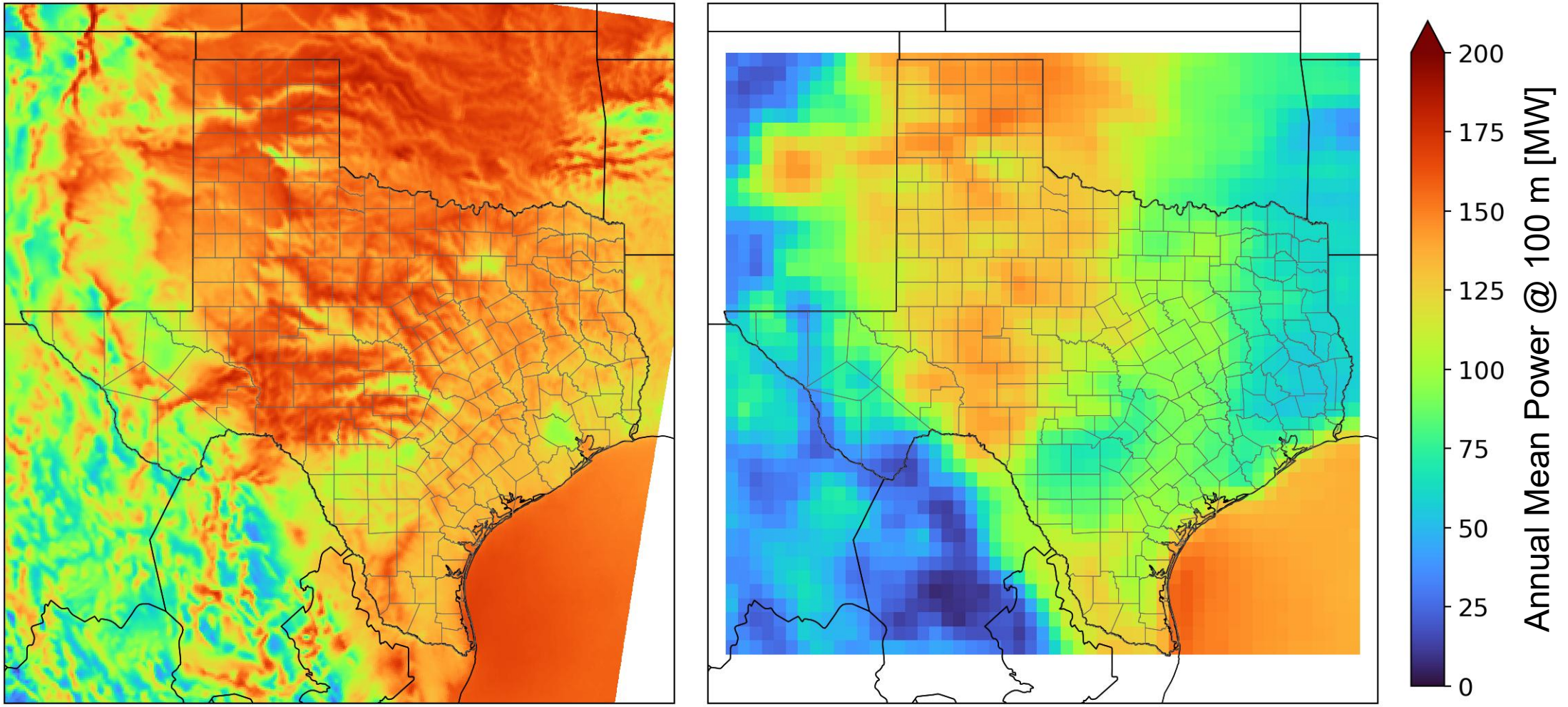
ERA5



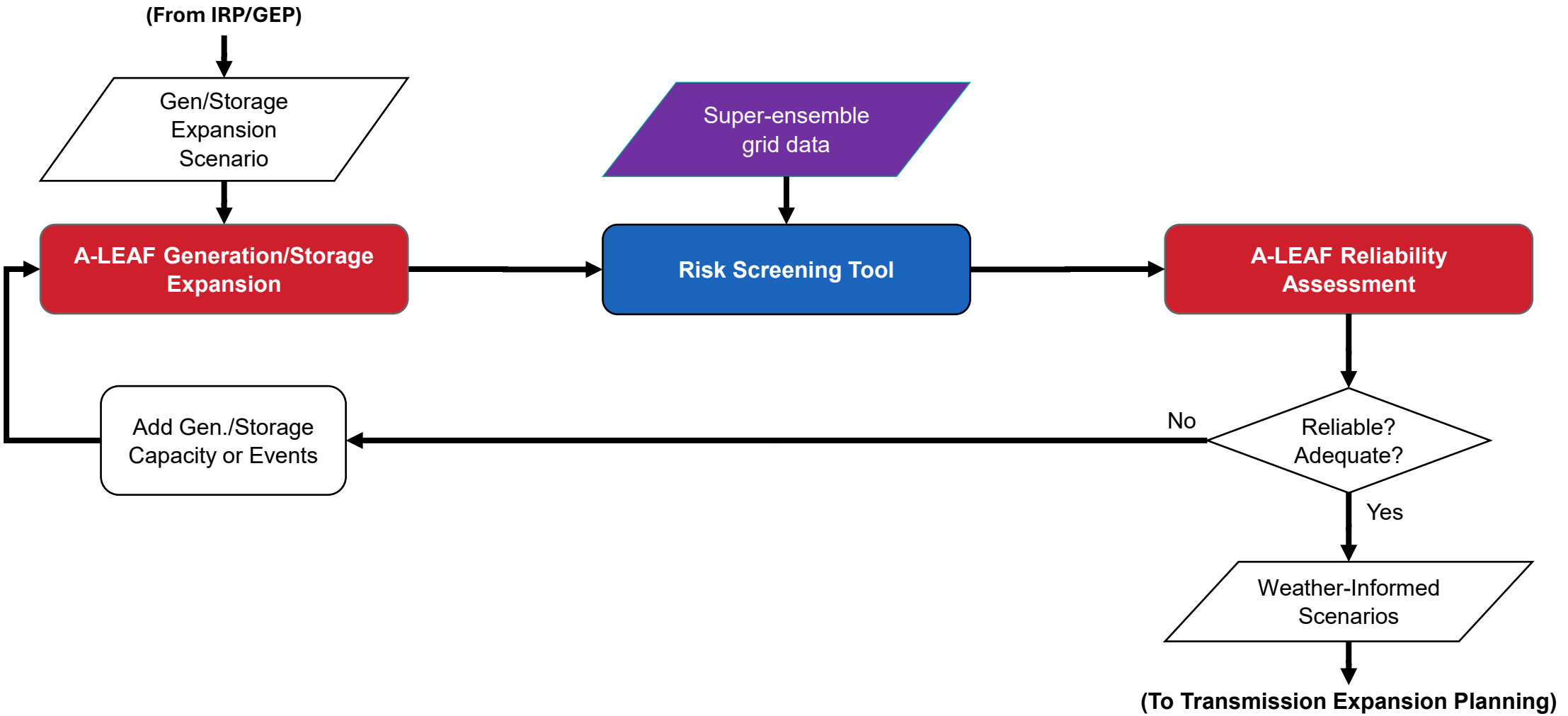
…LEADING TO SIGNIFICANTLY HIGHER GENERATION

ADDA2 (Downscaled ERA5)

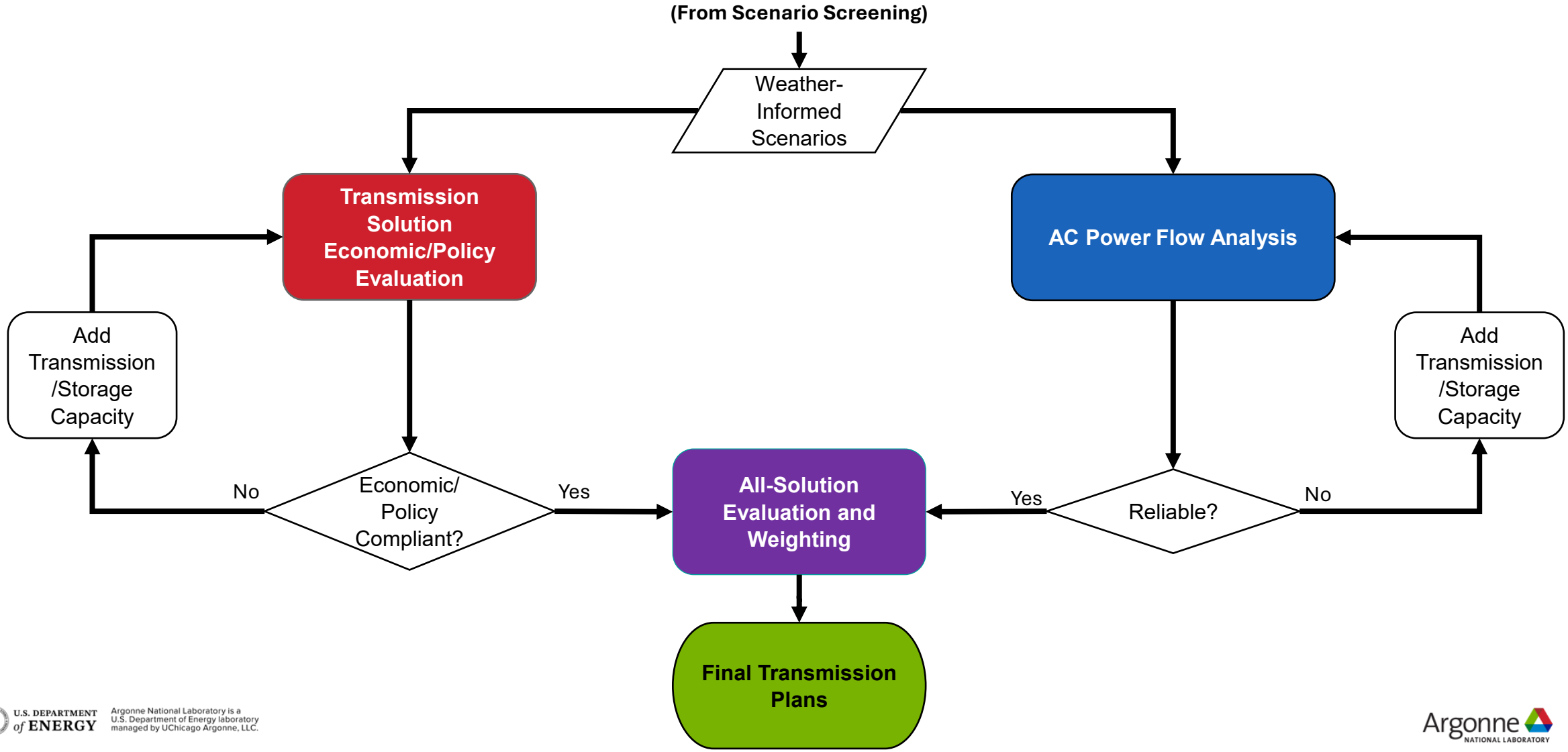
ERA5



OUTAGE SCENARIOS AND SCREENING



EXTREME WEATHER-INFORMED TRANSMISSION EXPANSION PLANNING



PROGRESS AND FUTURE WORK

- Created or extracted ≈3 TB of weather data so far
- Converted 40 initial scenario years into grid data
- RiSC: reconfigured to ERCOT counties, identified initial hazardous periods
- Validated synthetic 7k bus ERCOT system model power flows in A-LEAF
- In progress
  - Screening weather scenarios with ANL Hazard Index methods
  - Enhanced validation of load and generation models
  - Transmission expansion simulations

NOTICES

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QUESTIONS?

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