

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

NEAL MANN

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2026-06-15

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

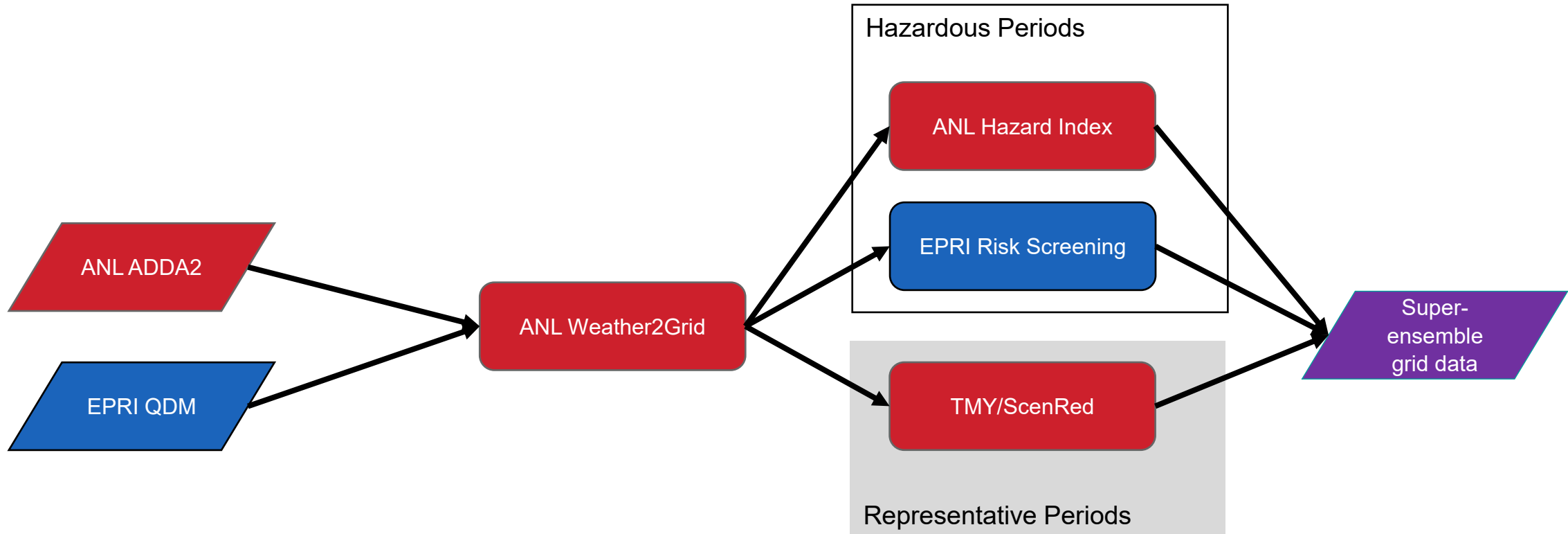
- DOE Office of Electricity, DOE Office of Critical Minerals and Energy Innovation

WEATHER SCENARIOS AND EVENT SELECTION

Weather Scenarios

weather2grid

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)

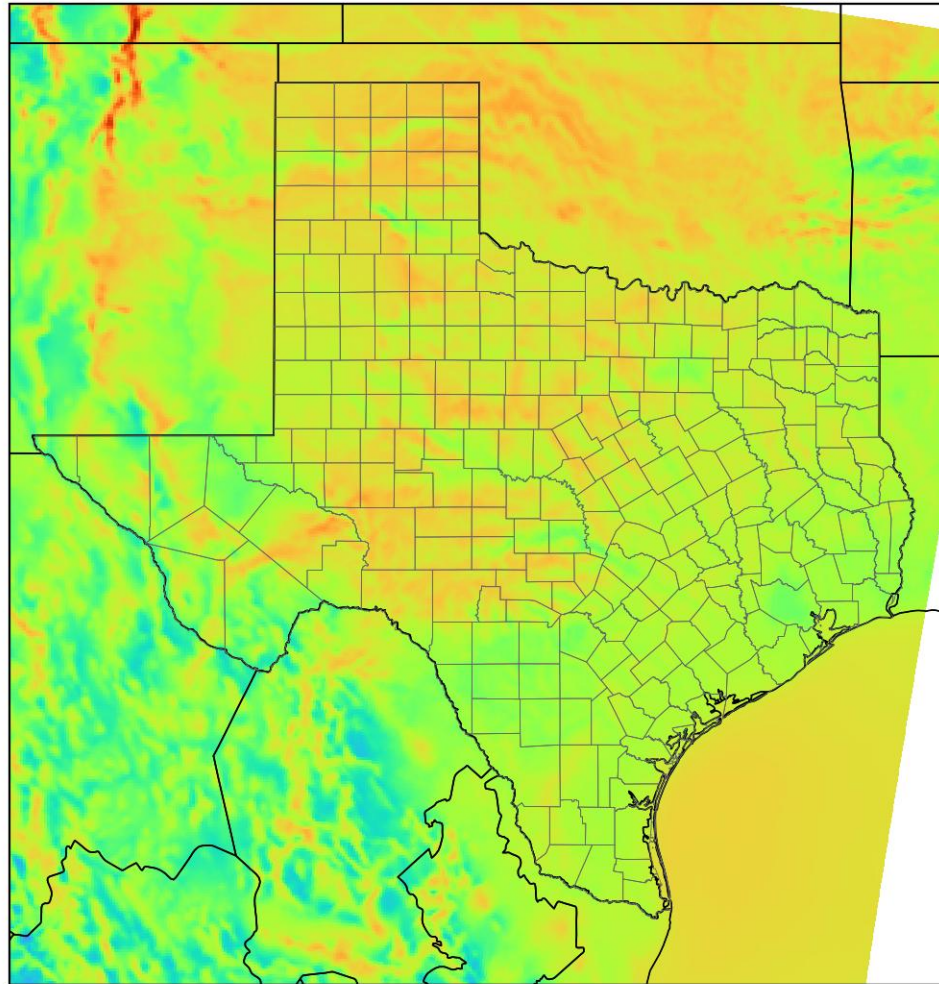
EPRI QDM Shift

- 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)

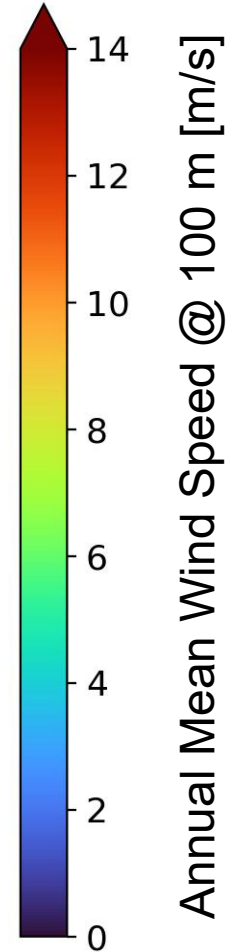
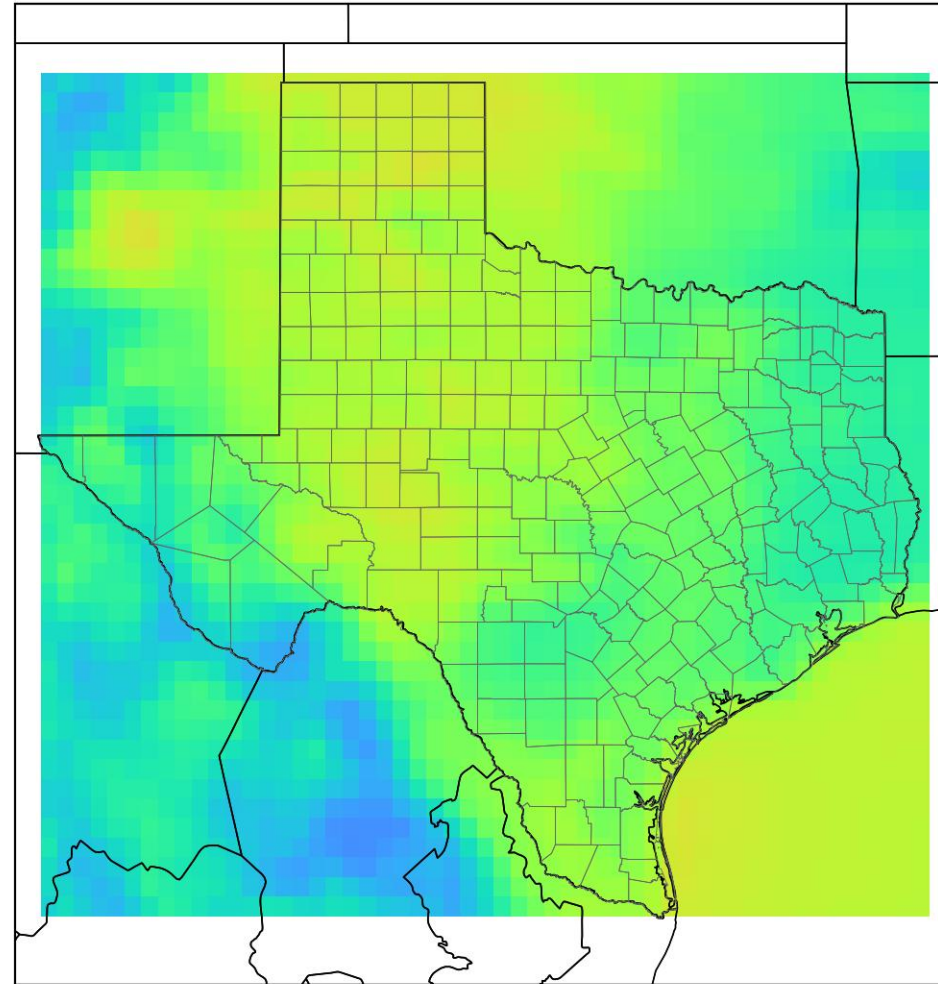
Hypothesis: Leveraging historical+synthetic data and dynamical+statistical methods better characterizes uncertainty and provides more robust assessments

ADDA2 DOWNSCALED WIND SPEEDS ARE HIGHER THAN ERA5...

ADDA2 (Downscaled ERA5)



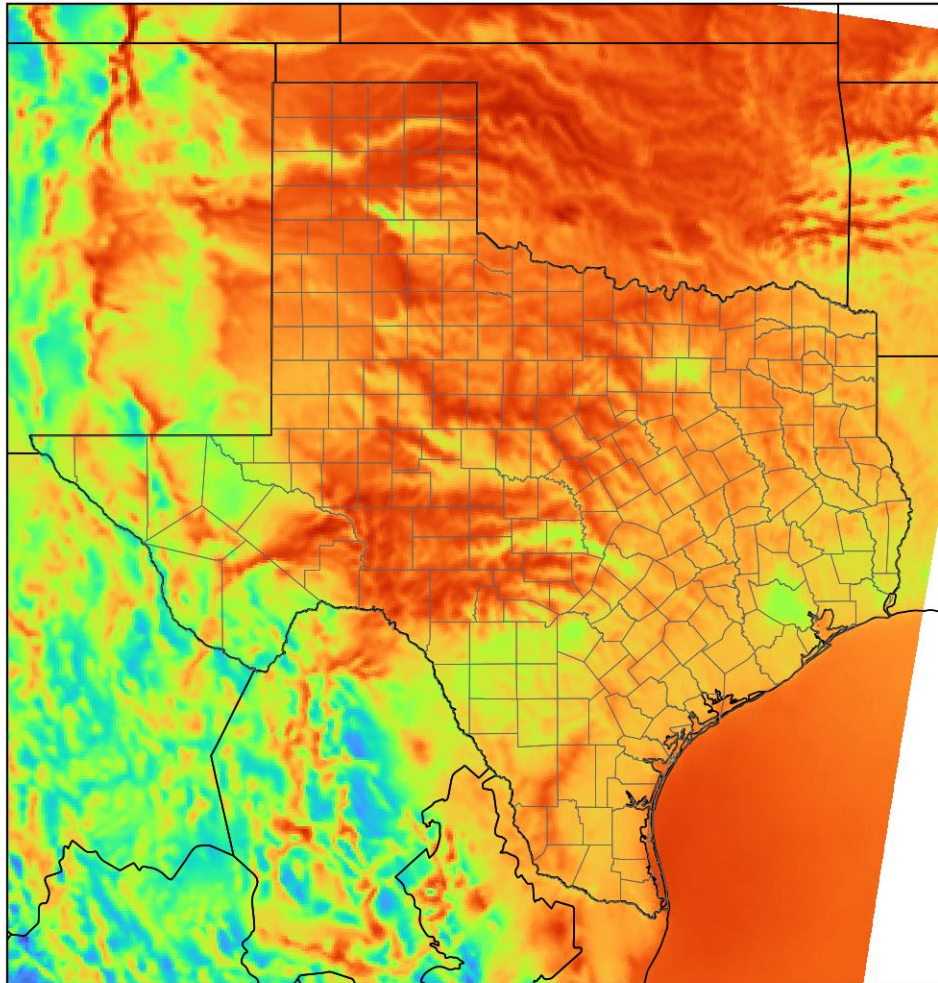
ERA5



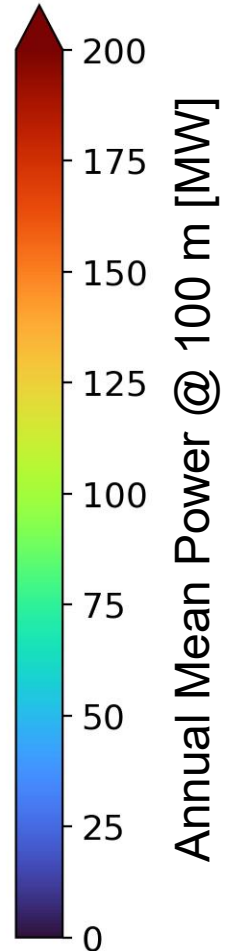
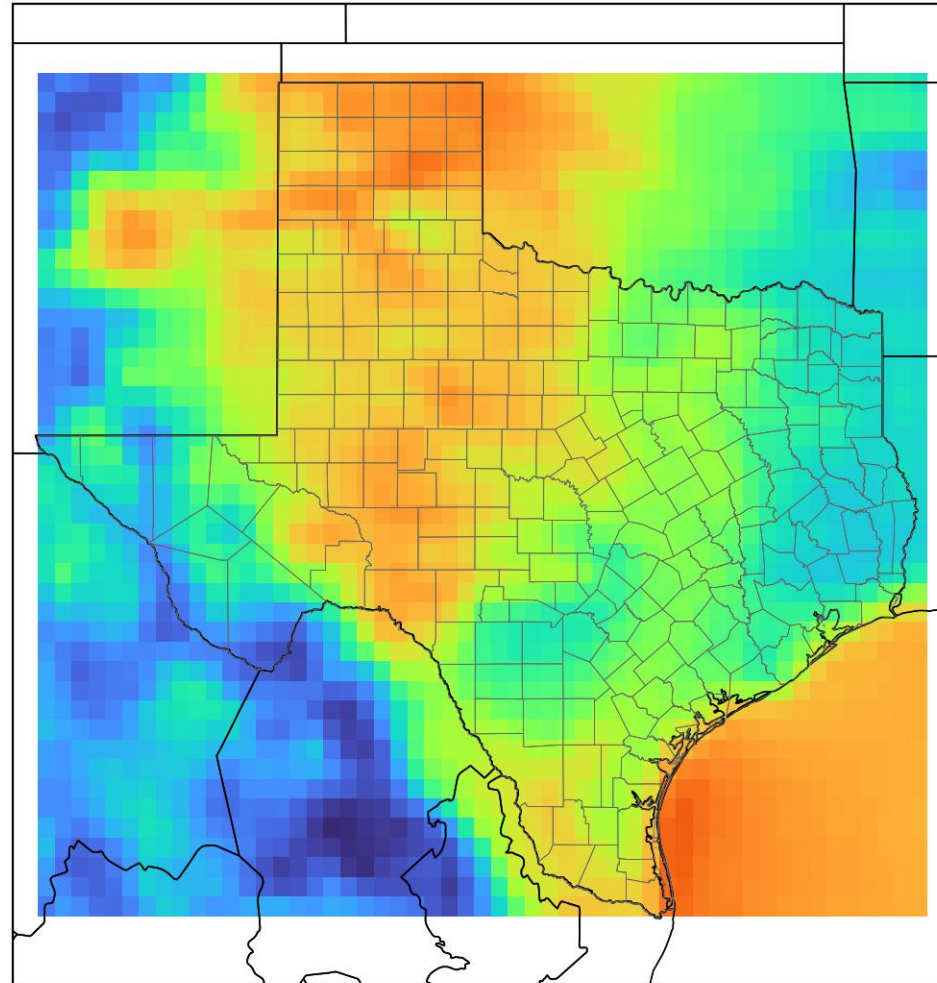
Annual Mean Wind Speed @ 100 m [m/s]

...LEADING TO SIGNIFICANTLY HIGHER GENERATION

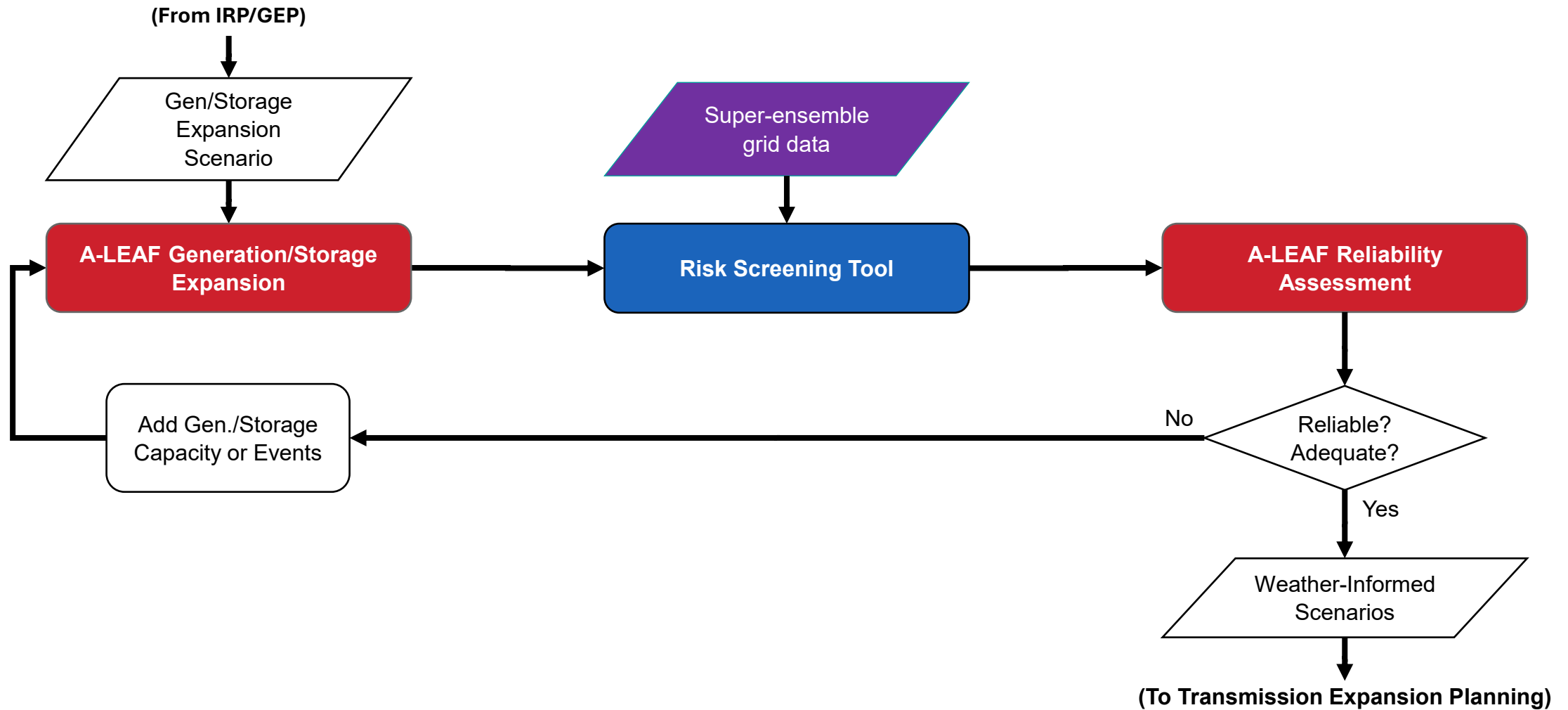
ADDA2 (Downscaled ERA5)



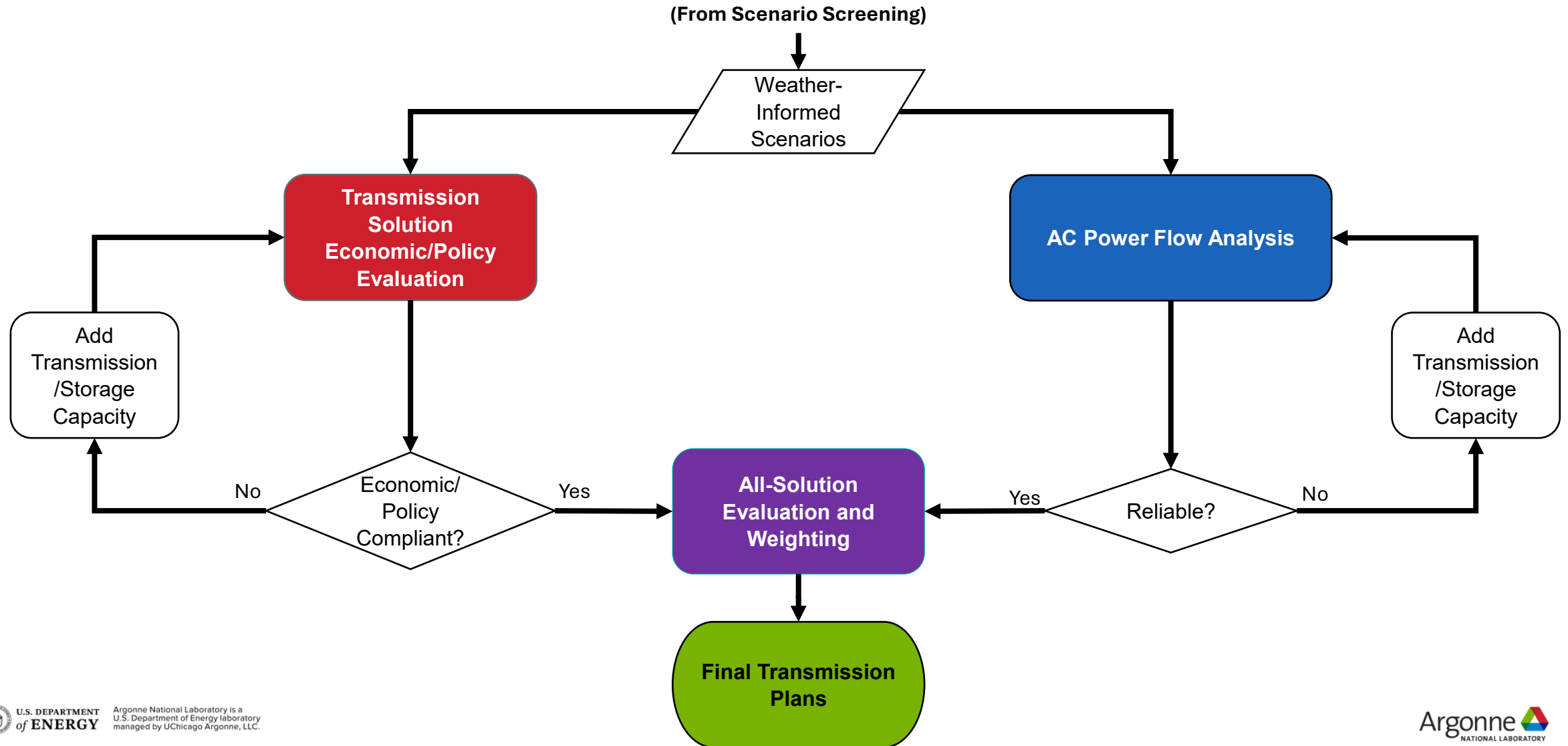
ERA5



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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