



Integrating Climate Information in Power Grid Reliability Studies; The Case of Extreme Events

Nathalie Voisin

AGCI workshop on Navigating the Clean Energy

Transition in a Changing Climate

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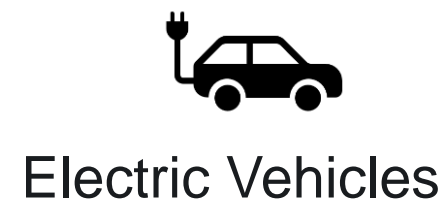
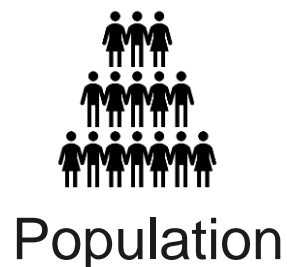
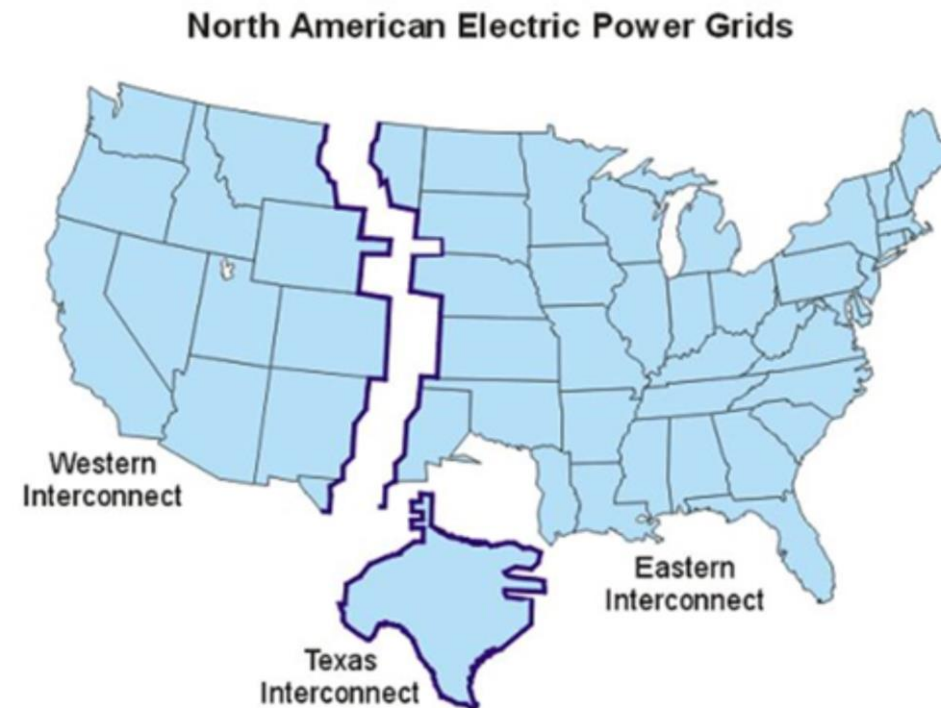


PNNL is operated by Battelle for the U.S. Department of Energy



Three interconnects across the continental US

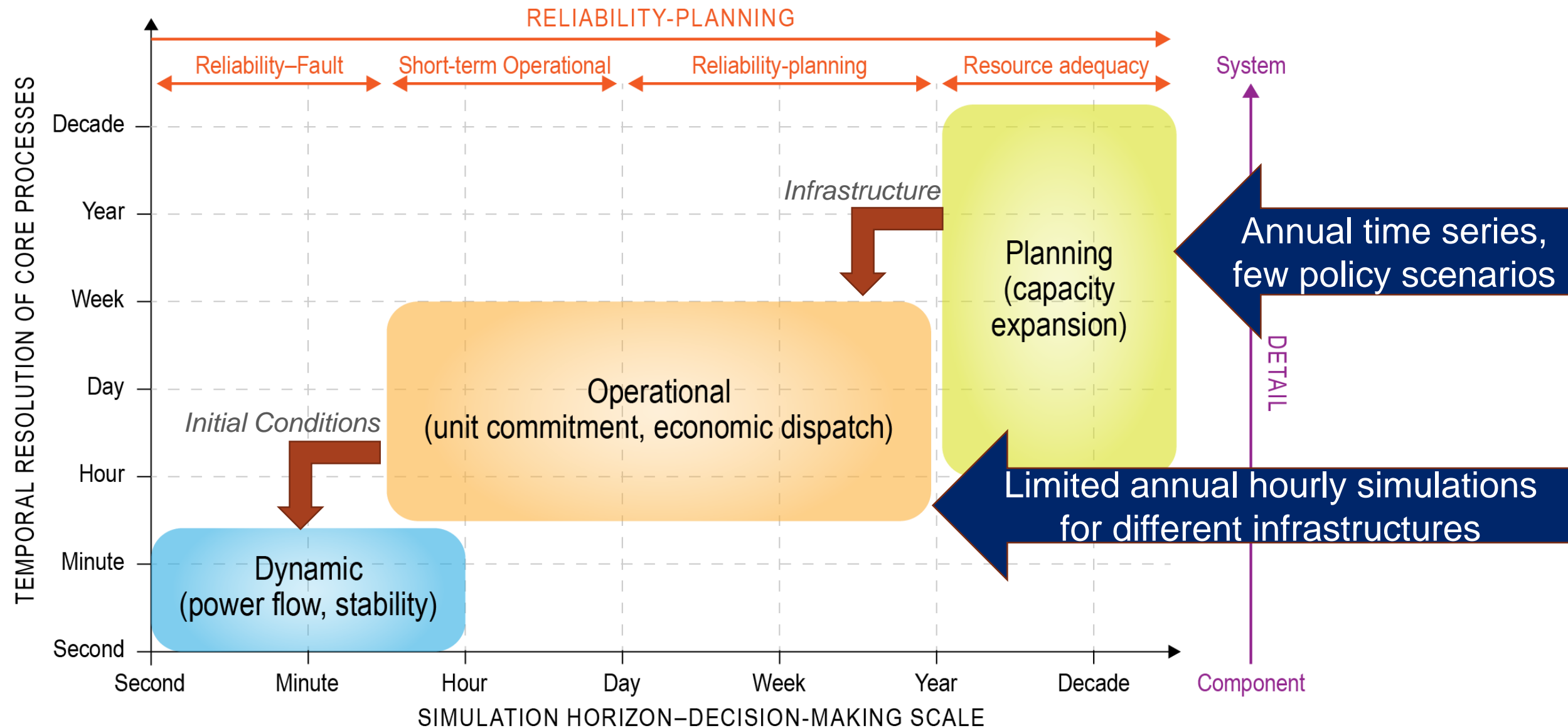
Power grids are dynamics in both their operations and long term planning, responsive to a range of drivers



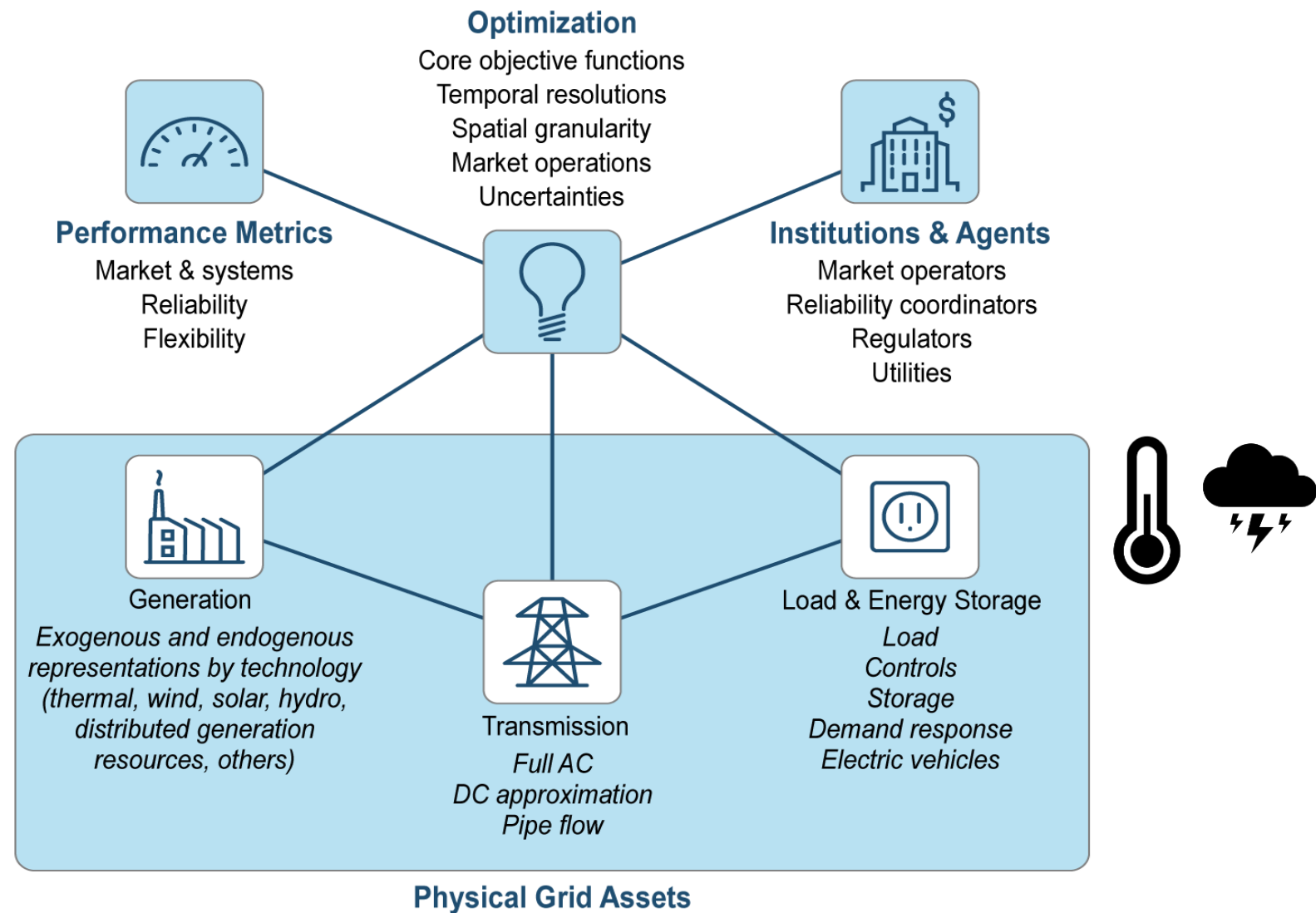
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Multiple Bulk Power System Models Used for Power System Reliability Studies



Physical assets are connected through the grid

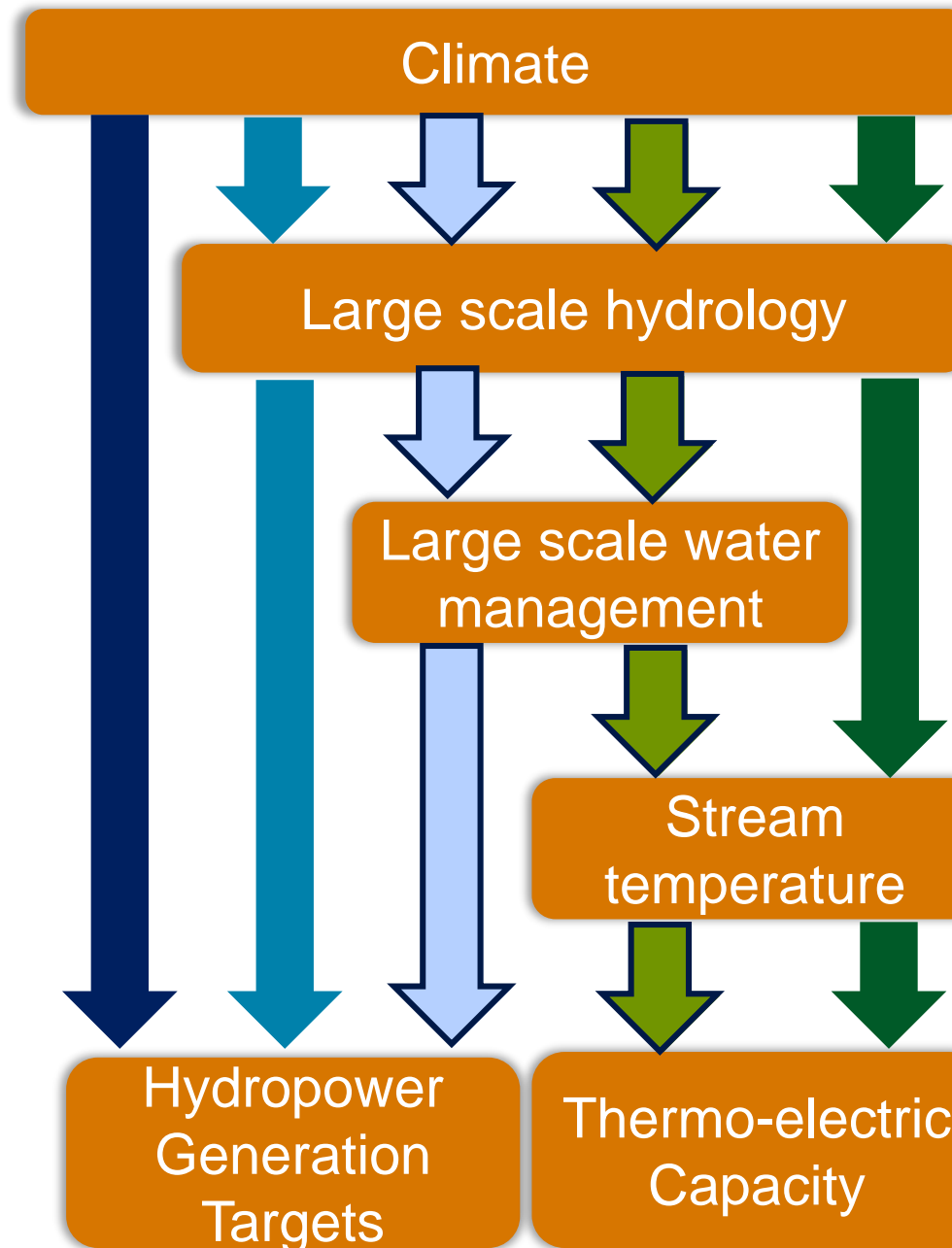
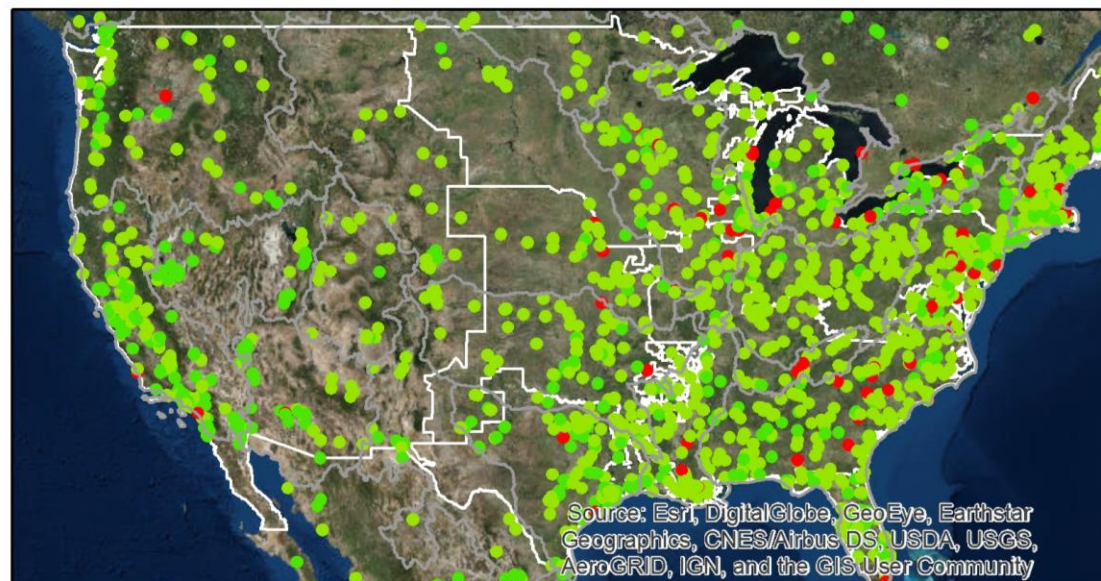
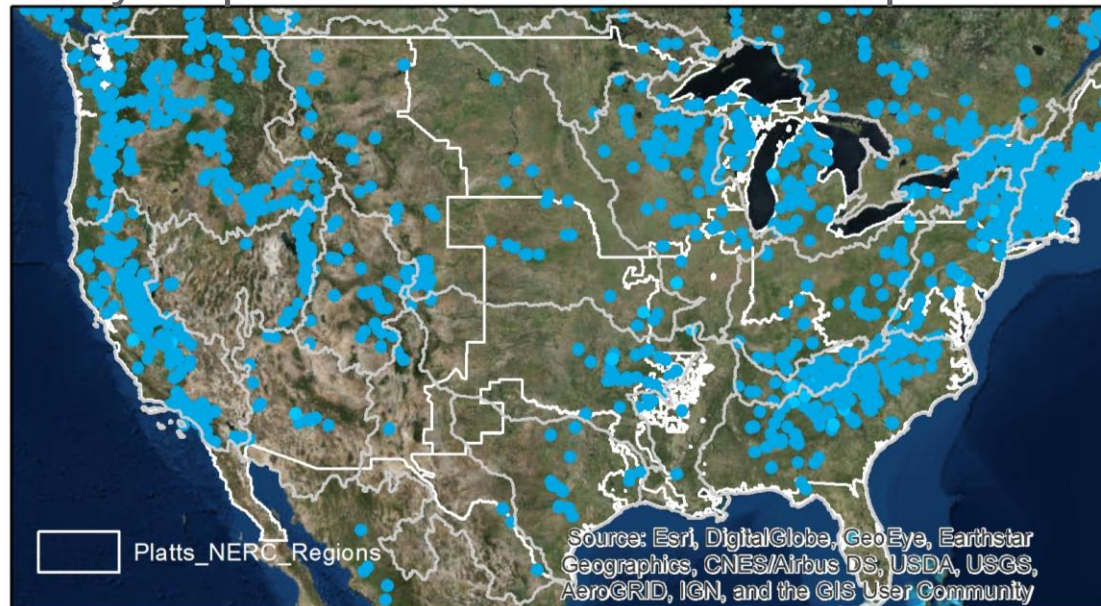


Power grids connect 1000s of generators through transmission lines to meet the electricity demand at all times.

The reliability cost of climate is only known after running a power system model

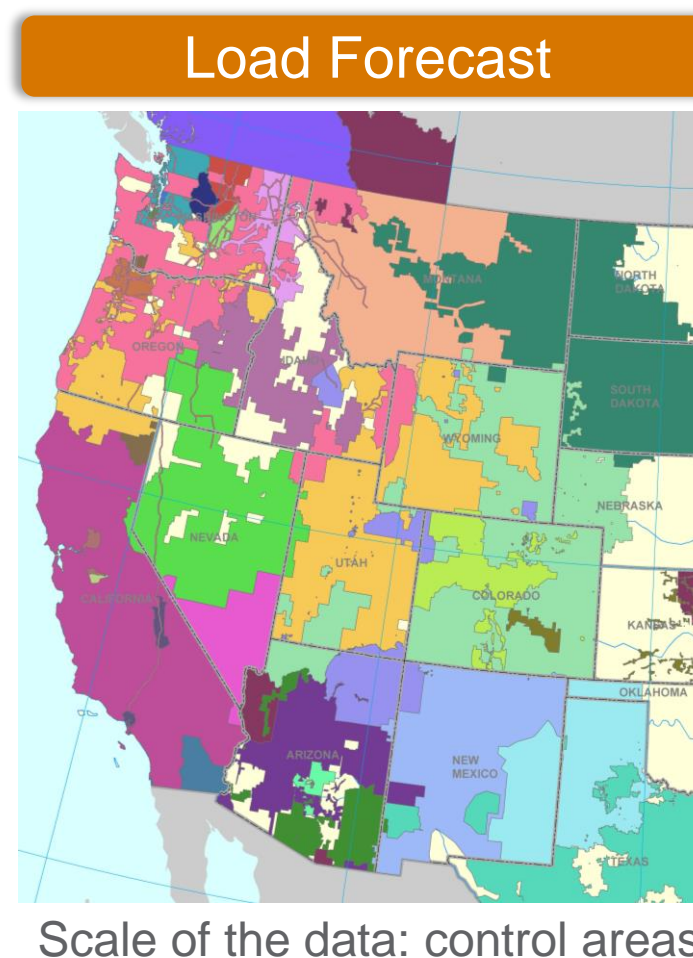
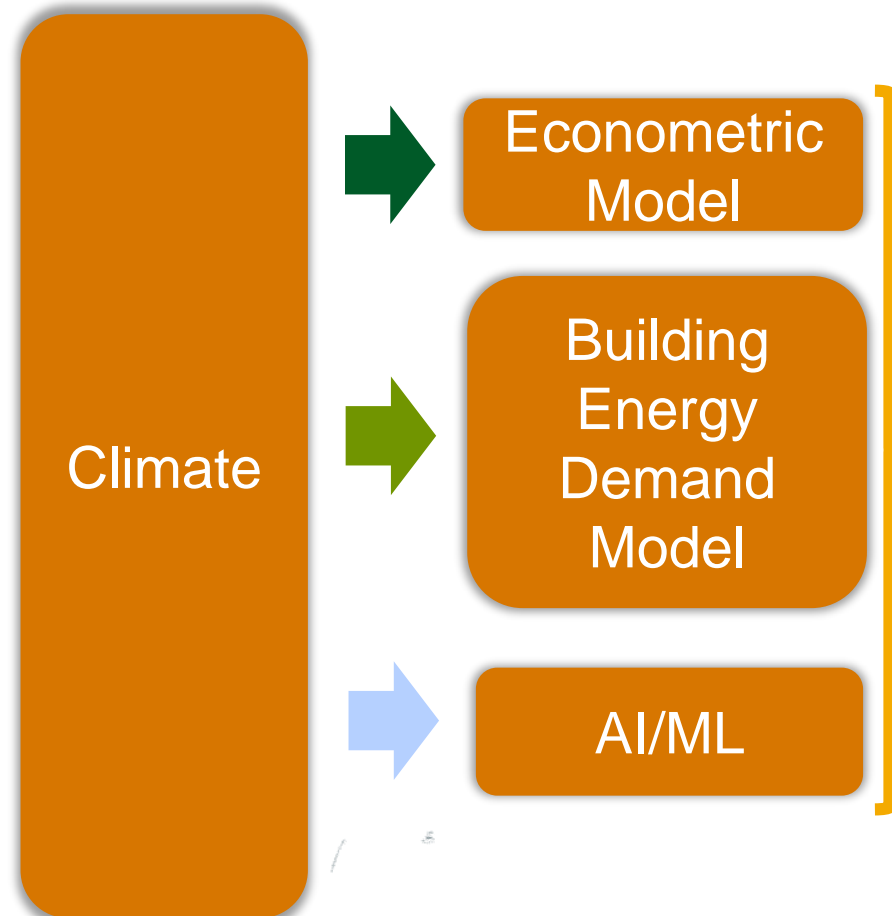
Linking water and power systems: implication of multisystem dynamics on water-dependent generators

Hydropower and thermoelectric plants



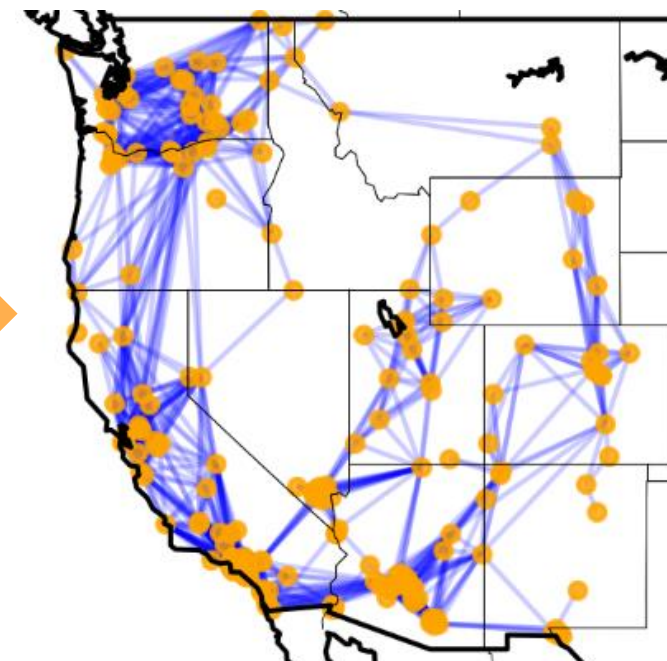
In a drought study, important to constrain monthly and weekly water availability but the hourly dispatch is decided by the power system model

Challenges for representing the impact of heat waves on load and power grid operations



Same Scale

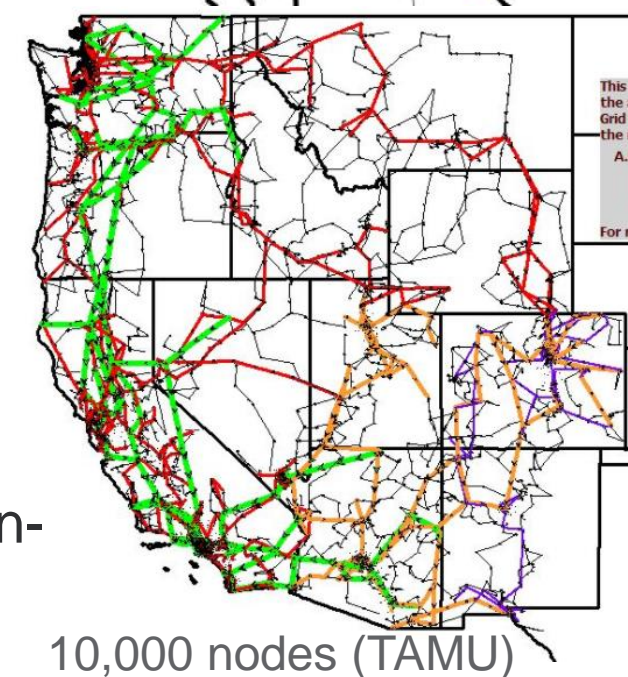
GO 250 nodes



Area to node mapping



Ability to represent the intensity-duration-extent of the event?



Conclusions

- The governance of physical assets is multi-scale, spanning from the asset management itself, control area, to hydrometeorological and environmental management scales.
- While the climate community needs to derive the right datasets for informing power system models, power system models topologies and optimization schemes also need to be challenged for their ability to represent extreme events

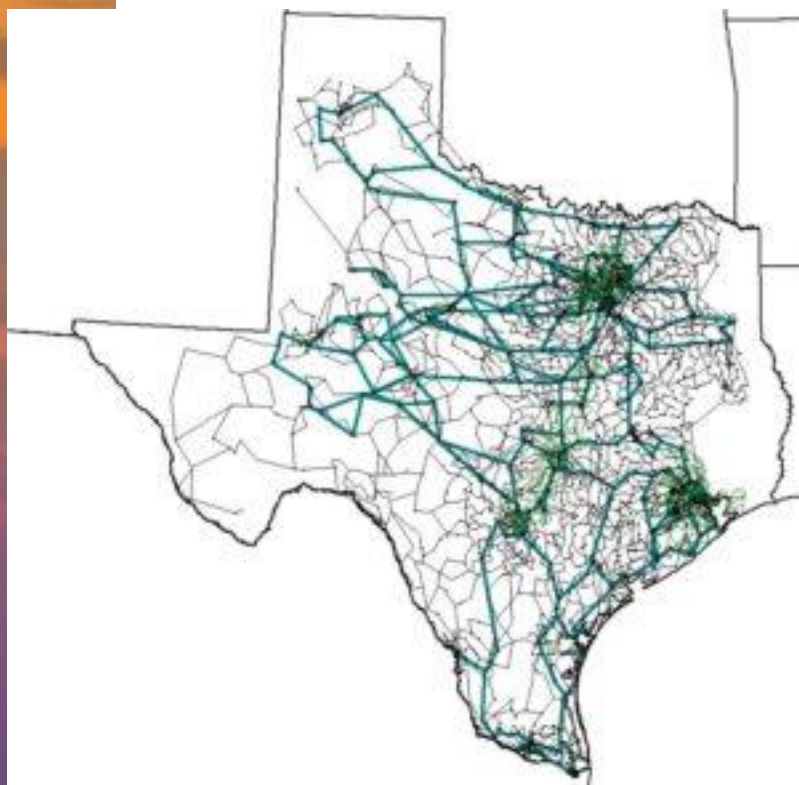
Thank you

Nathalie.Voisin@pnnl.gov



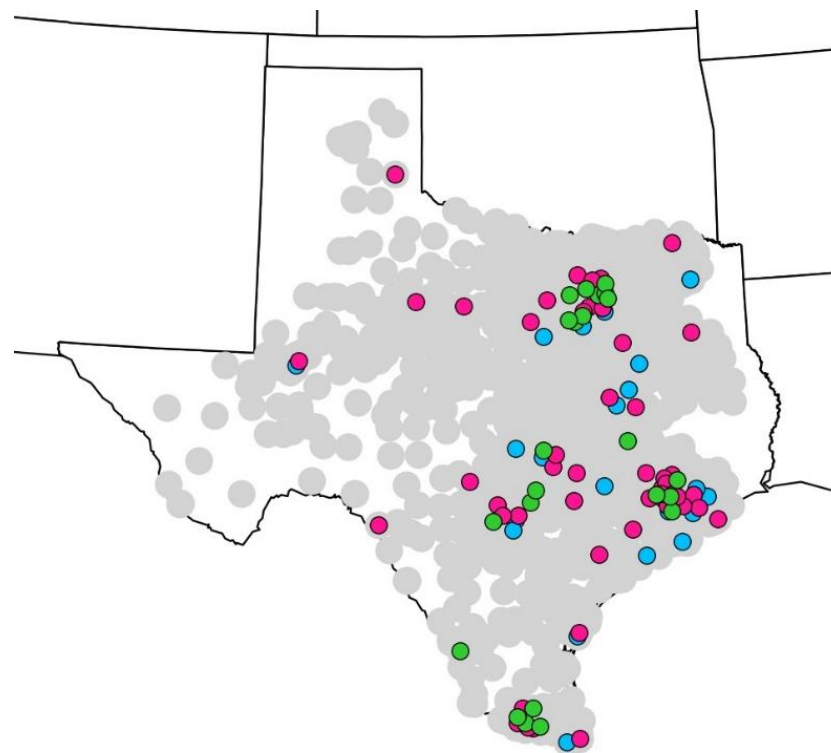
Designing natural extreme events

2,000 nodes (TAMU)

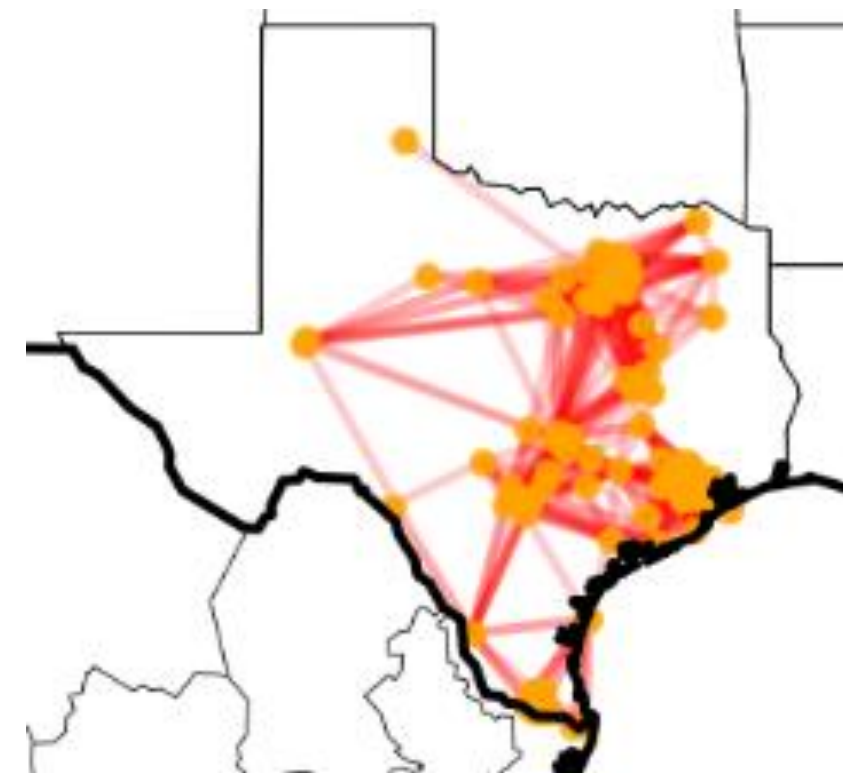


Original TAMU Network

100 nodes



100 nodes

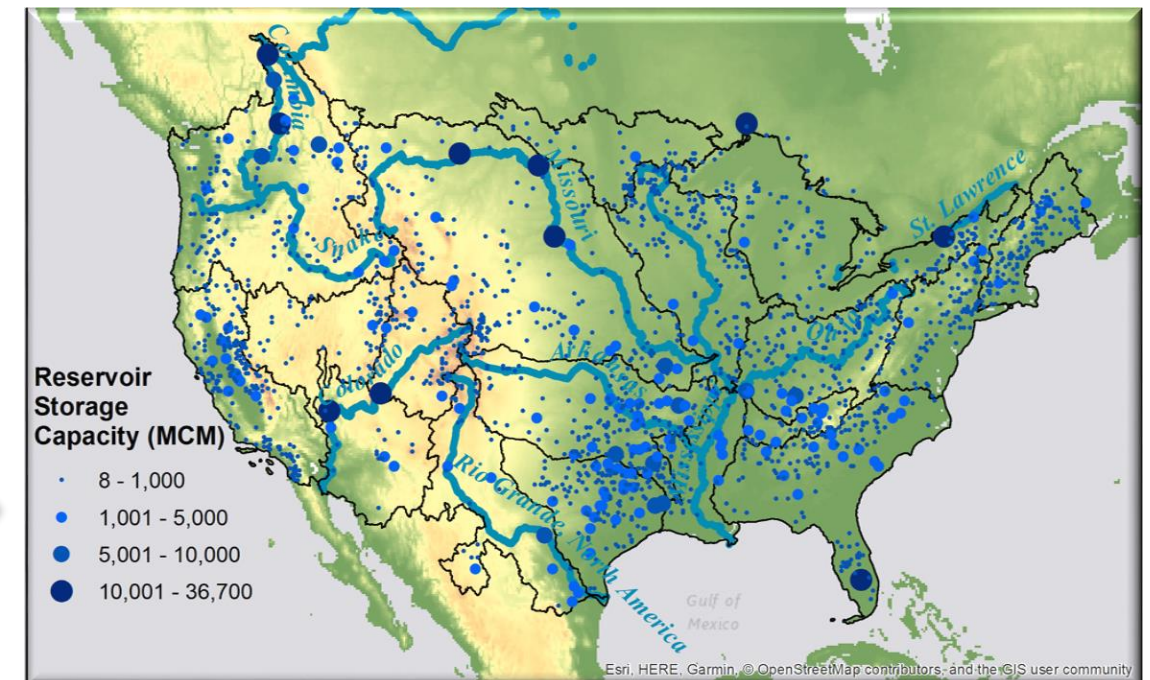
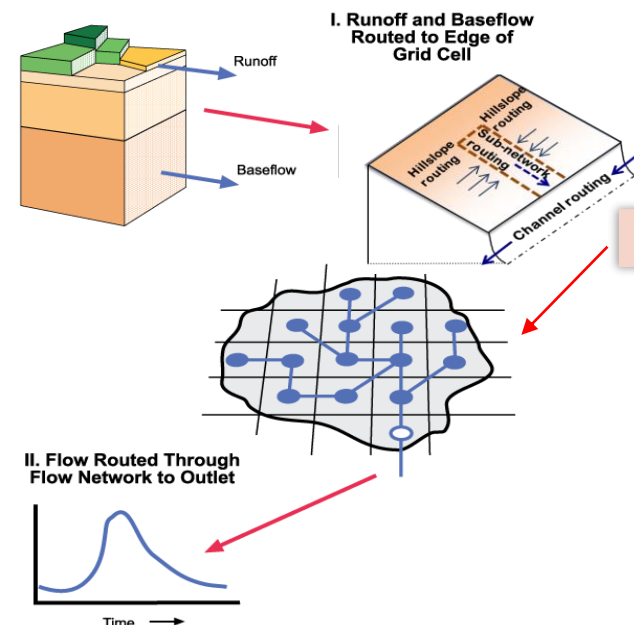


New synthetic network: **nodes** and **transmission**

A large-scale water management model to transition to the power grid scale

Climate
Hydrology

River Transport Model



- 1840 dams with significant reservoir storage
- 18 large river basins
- 10 x 10 miles spatial resolution
- Seasonal operations for flood control, water supply and irrigation

