

Wenpeng Yu¹, Yilu Liu^{1,2}, Lin Zhu³, Evangelos Farantatos³

¹ The University of Tennessee, Knoxville ² Oak Ridge National Laboratory

³ Electric Power Research Institute

Introduction

- Fast and accurate source location is of importance for forced oscillation mitigation in interconnected power grids.
- A dissipating potential-based method is proposed to locate the source of forced oscillation:
 - creates virtual transmission lines according to the monitored buses' location,
 - estimate the virtual dissipating energy flow with partial system observation.
 - dissipating potential is calculated to locate the exciting source.
- Conclusion:** The developed method is tested with an actual forced oscillation event in EI and the IEEE test case of 179-bus WECC system sustained oscillations. The test results demonstrate the effectiveness of the tool in forced oscillation source location.

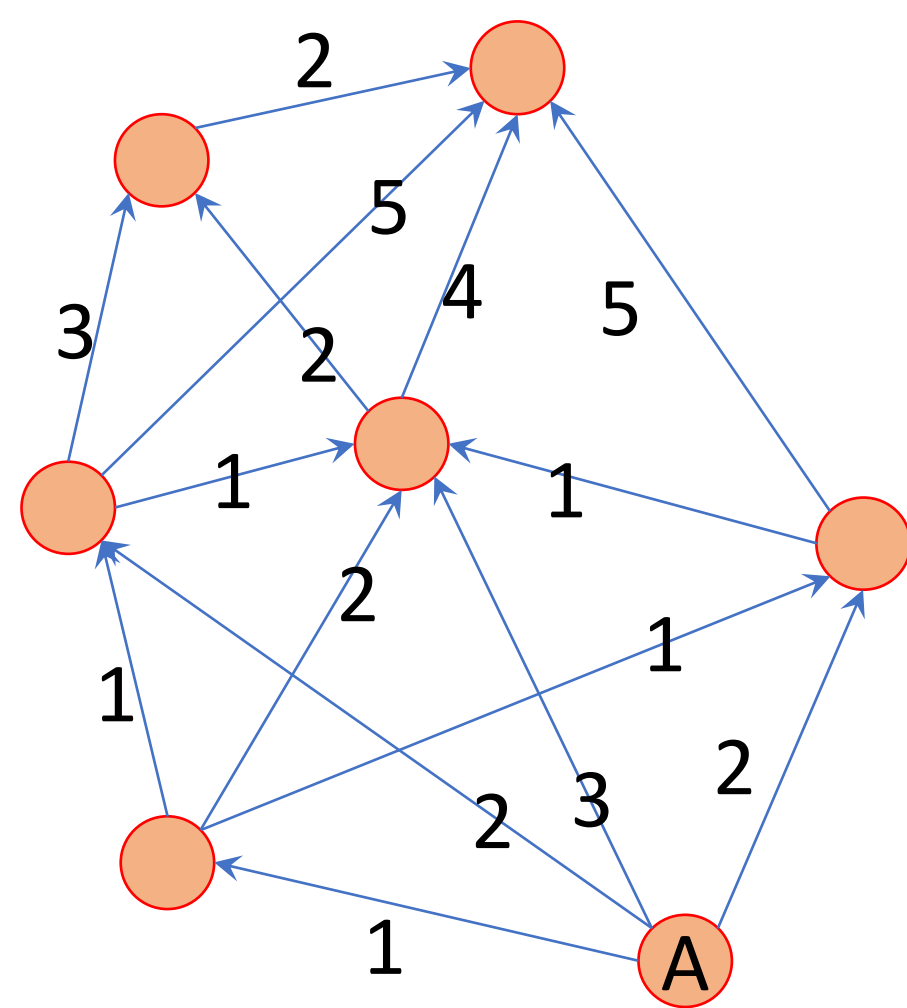
Dissipating Potential based source location algorithm

$$DE = \int (2\pi\Delta P_{ij}\Delta f_i dt + \Delta Q_{ij}d(\Delta \ln V_i))$$

Dissipating energy flow method requires real-time topology and full observation.

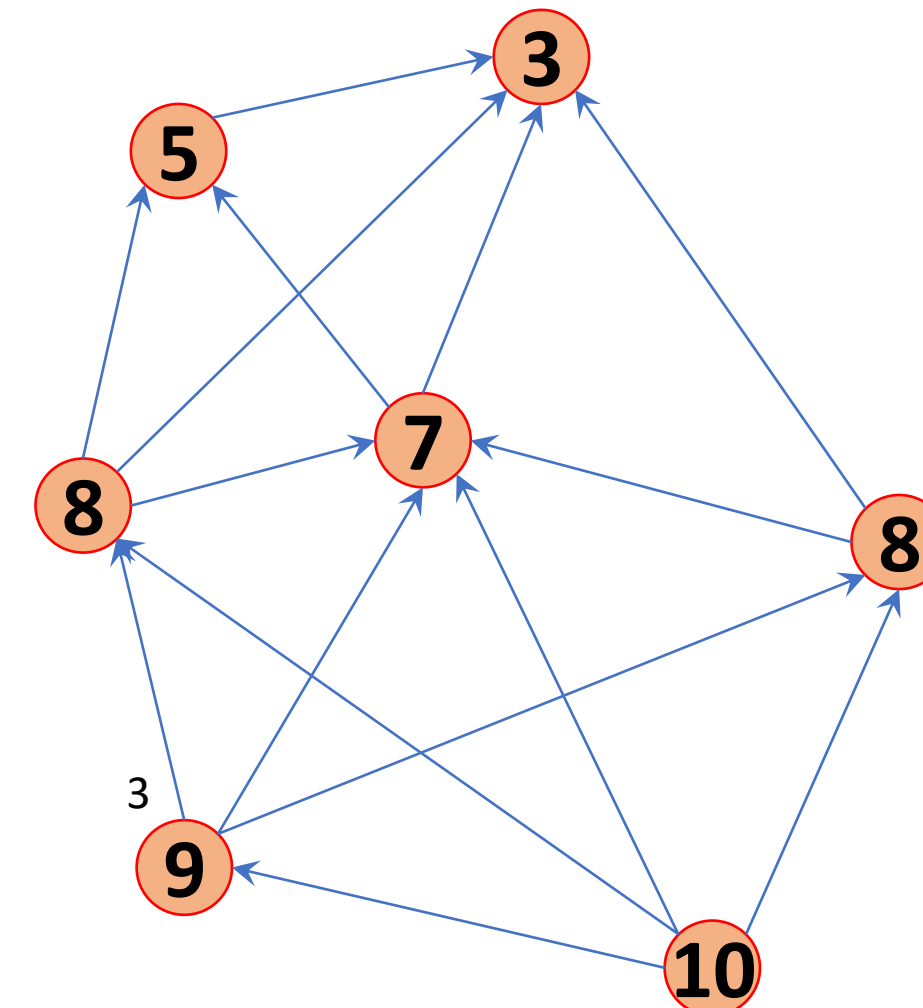
$$DE_{ij} \approx \sum(\Delta A_i - \Delta A_j)\Delta f_i$$

Dissipating energy flow **estimation** does NOT require topology or grid full observation.



$$DP_i - DP_j \approx DE_{ij}$$

Find a **best** set of **potential** to fit the energy flow;

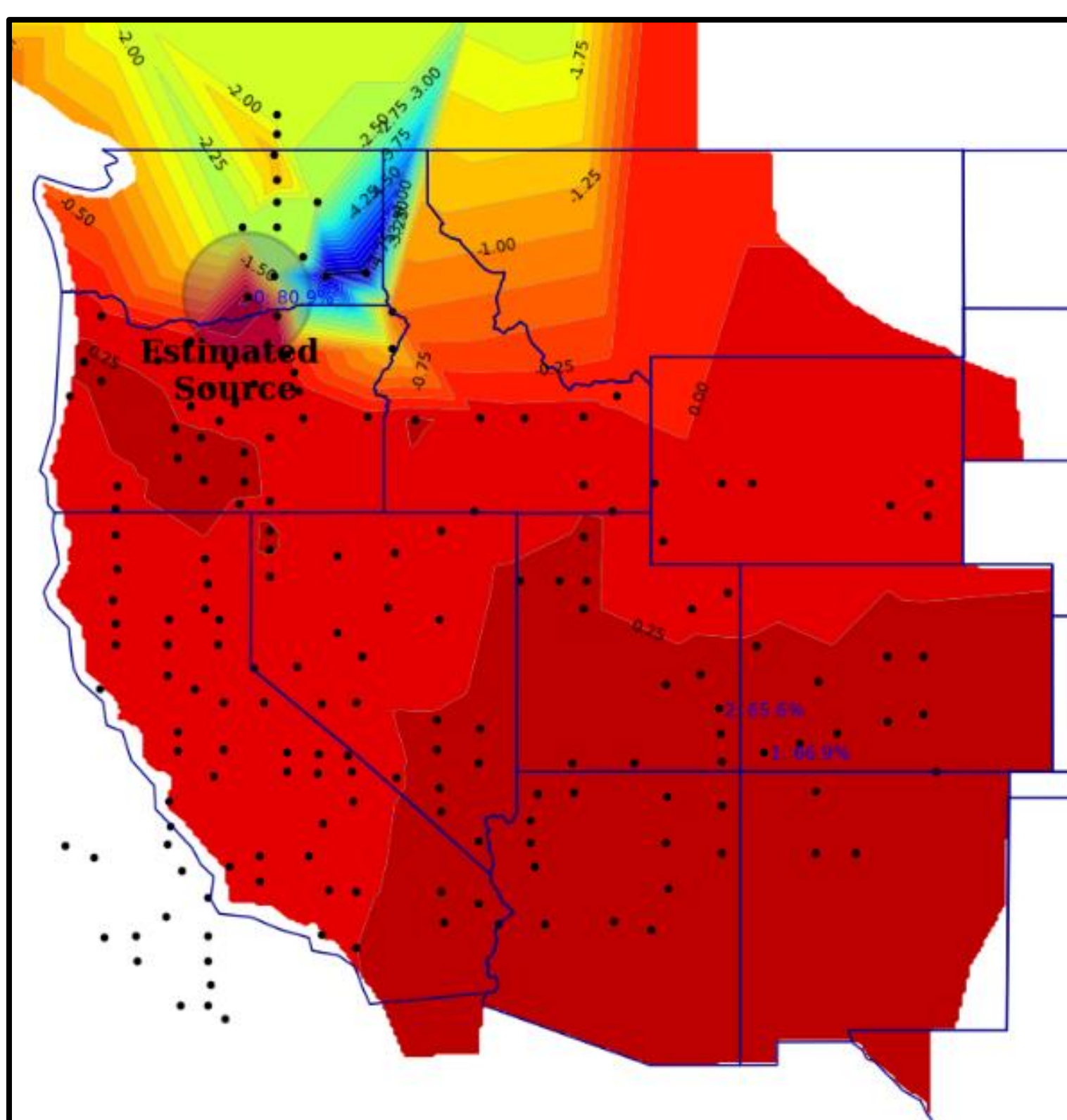


Estimated Dissipating Energy flow

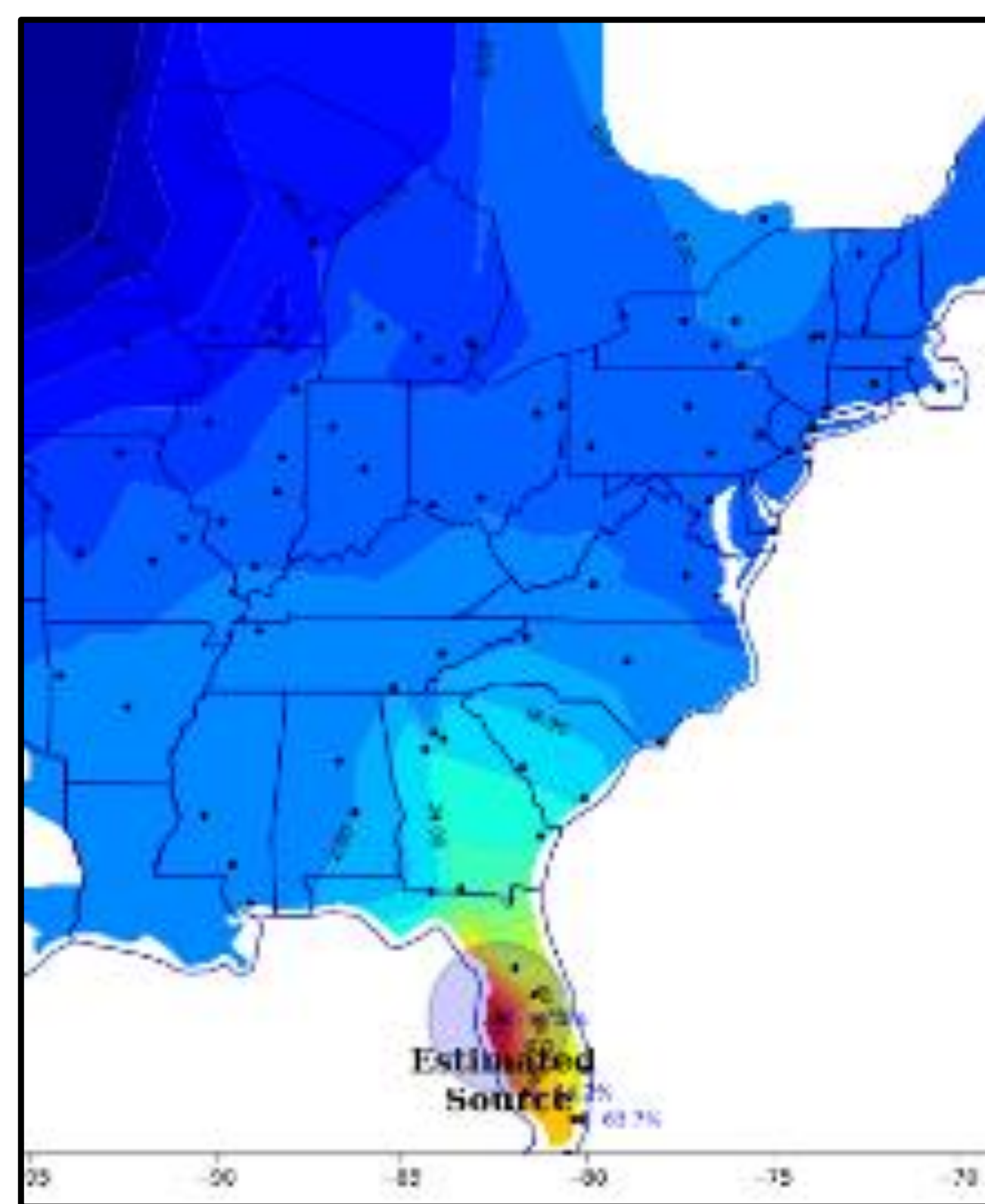
Estimated Dissipating Energy Potential

Estimate dissipating potential according to estimated dissipating energy flow.

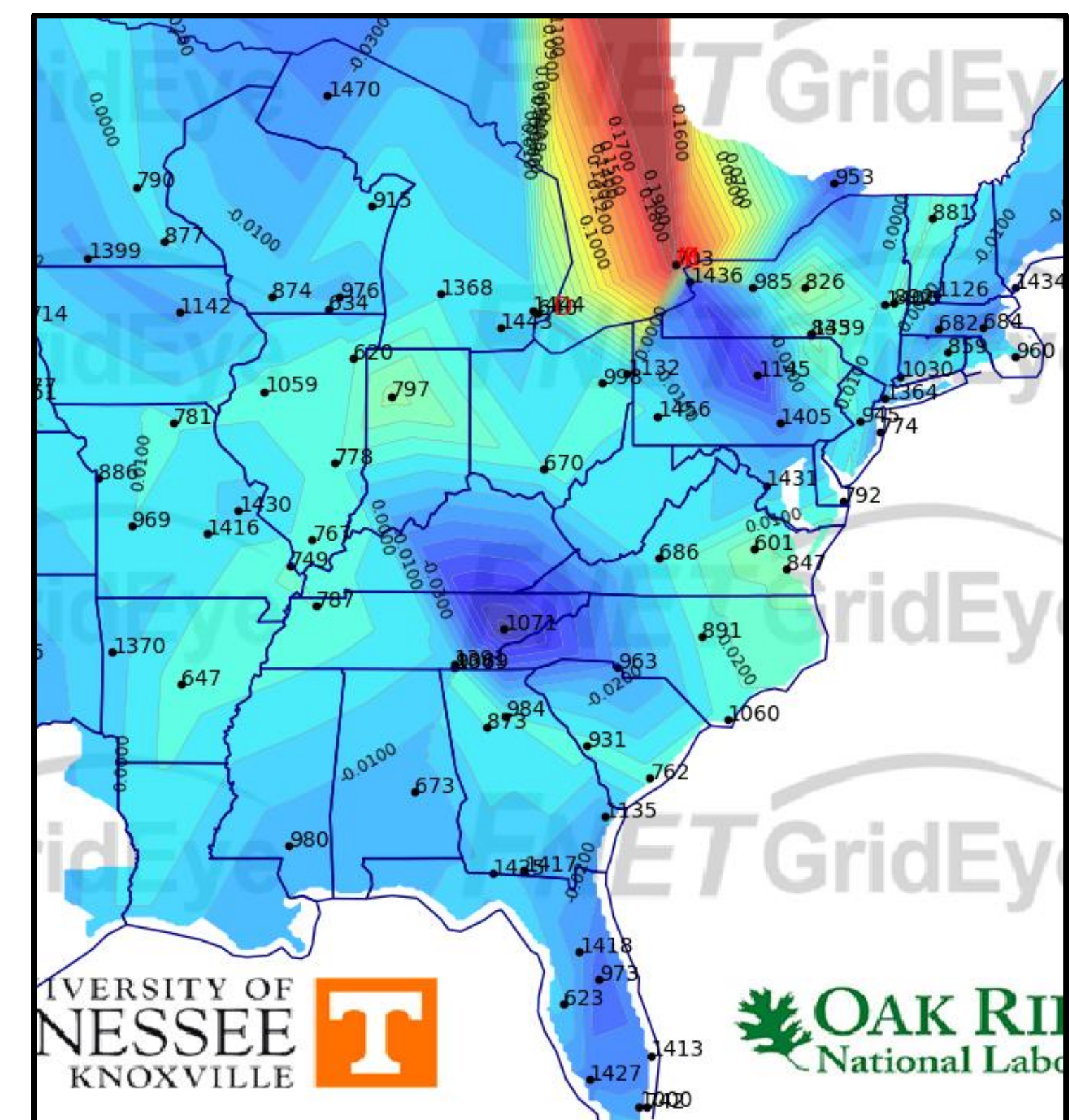
Testing with Simulation Case and Real Forced Oscillation Cases



WECC 240-bus Simulation Case



10/11/2019 EI forced oscillation event



04/2020 EI forced oscillation event

