

## Wind Power Potential Variability in the Middle East

\*Chak Man Andrew Yip<sup>1</sup>, Udaya B Gunturu<sup>1</sup>, Georgiy L Stenchikov<sup>1</sup>

### 1. KAUST

Variability in power generation would affect the reliability and energy efficiency of the power grid. Power generation planning and operation scheduling span various time-scales. These range from day-of-economic-dispatch, where real-time pricing and emergency occur, day-ahead for bidding and scheduling, to months for operational planning and maintenance, and years for systems planning.

To improve reliability, variability in power generation should be understood and better characterized. The conventional approach is to characterize a bulk wind power density variability using a coefficient of variability that is not time interval-specific.

This study aims to characterize the wind power variability at various time-scales of power operations to illustrate its effects across the Middle East via spectral analysis and clustering. Using a high-resolution dataset obtained from a local area model simulation, this study showcases how aggregate variability may impact operation, and informs the planning of large-scale wind power integration in the Middle East in light of the scarcity of observational data.

Keywords: Wind Energy, Middle East, Spectral Analysis, Clustering