The WIND Toolkit: A National Dataset for Wind Integration Studies

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Regional wind integration studies in the United States require detailed wind power output data at many locations to perform simulations of how the power system will operate under high-penetration scenarios. The wind datasets that serve as inputs into the study must realistically reflect the ramping characteristics, spatial and temporal correlations, and capacity factors of the simulated wind plants, as well as be time synchronized with available load profiles. The Wind Integration National Dataset (WIND) Toolkit described in this article fulfills these requirements as the largest and most complete grid integration dataset publicly available to date. A meteorological dataset, wind power production time series, and simulated forecasts created using the Weather Research and Forecasting Model run on a 2-kilometer grid over the continental United States at a 5-minute resolution is now publicly available for more than 126,000 land-based and offshore wind power production sites. State-of-the-art forecast accuracy was mimicked by reforecasting the years 2007–2013 using industry-standard techniques. Our meteorological and power validation results show that the WIND Toolkit data is satisfactory for wind energy integration studies.