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The Wind Forecast Improvement Project 2 (WFIP2)

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The Wind Forecast Improvement Project 2 (WFIP2) is a public-private partnership effort led by the U.S. Department of Energy (DOE) and National Oceanic and Atmospheric Administration (NOAA). The goals of this project are twofold: first, to increase understanding of atmospheric processes that affect wind and wind power forecasts in regions of complex terrain, and second, to incorporate this increased understanding into foundational weather forecast models to improve wind power forecasts. The project team includes Vaisala, who is developing decision-support tools to provide uncertainty information to industry agents and operators.

This presentation will provide an overview of the project. The project includes a field campaign in the Columbia River Gorge, a region of the country affected by the Pacific Ocean, Cascade Mountains, and the Gorge, which was conducted October 2015 through March 2017. Special observations, including many vertical profiles from wind profiling radars, sodars, and lidars, as well as radiation observations were collected. Instruments were deployed in a nested configuration to investigate phenomena across a range of spatial scales. This data set is available for public use, and the project team has used it for model verification and assimilation (of some, not all, observations). The Columbia River Gorge hosts approximately 5 GW of installed wind power capacity, and is subject to many phenomena that complicate forecasting, including mountain wakes, marine pushes, cold pools, and gravity waves. Wind plant owners in the region shared confidential meteorological observations with project partners.

The NOAA hourly updating, 13-km Rapid Refresh (RAP) and the 3-km High Resolution Rapid Refresh (HRRR) numerical weather prediction models, and aspects of these models that have been targeted for improvements, will be discussed. These areas include in the boundary layer scheme's treatment of local and non-local mixing, the representation of clouds, and a wind farm parameterization. Special effort has been made to introduce scale-aware adaptive physics, which can be applied to any model resolution.

This presentation will discuss preliminary results including changes in RAP and HRRR forecast skill for turbine-height wind speeds and direction under specific weather regimes and as a function of diurnal cycle. A new technique to detect boundary layer height will be presented, as will an analysis of the uncertainty of lidar measurements of wind speed and direction. The spatial variability of winds will also be illustrated.