COMPARISON OF RAP FORECAST WIND DATA WITH LIDAR MEASUREMENTS IN THE MARYLAND WIND ENERGY AREA

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Wind interacts with or drives most meteorological phenomena, whether steering synoptic weather systems, driving storm evolution through complex circulations, or generating wind power. The accurate determination of the speed and direction of the wind is therefore central to any effort to simulate the atmosphere or predict the weather, as well as any assessments of wind resources in an area. In order to check the National Weather Service's 13-km Rapid Refresh model (RAP), lidar wind measurements from the ocean east of Maryland during July and August 2013 were compared to the RAP 0-hour analyses and 3-hour forecasts for the same times at the same locations in one of the first comparisons of operational model output to offshore wind profiles. The 0-hour analysis is a dynamically balanced initialization state resulting from the data assimilation process, while the 3-hour forecast better reflects the dynamic imbalances and realisms found in the atmosphere. The forecast wind speeds were slower than the observed values, by 1.5 m/s for the 0-hour analysis and 0.8 m/s for the 3-hour forecast, with standard deviations relative to the lidar observations of 2 m/s and 3 m/s, respectively, at a height of 140 m. The 0-hour analysis showed no clear pattern of changing error or bias with increasing height, while the 3-hour forecasts produced values that become both smaller and more variable relative to the lidar observations with increasing height. The decreasing bias in wind speed with increasing forecast hours is indicative of model "spinup", whereby the simulation state evolves from the balanced initialization/analysis state, to an unbalanced forecast state. Proper assessments of wind resources in an area require a thorough understanding of these issues, since model results are often used if there are no detailed profile measurements, as is often the case in initial surveys.

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