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Accurate short term forecasts are essential for the integration of large amounts of wind power onto the electric grid. Large changes in wind speed tend to cause large changes in wind power production. Determining the most effective locations for observations to predict these short term high impact events is important to improving the short them forecast of wind speed and subsequently power production.

An ensemble sensitivity analysis technique has been developed to quantitatively determine the impact of a set of initial conditions on a predicted forecast metric. This method is an attractive approach to computing variable-based sensitivities since it does not require an adjoint model. In this study, a 48-member Weather Research and Forecast model ensemble is run over a 40-day period at a resolution of 4 km. Observations from rawinsondes, aircraft, and surface altimeter settings were assimilated every 6 hours using the square root ensemble Kalman filter (EnKF) with perturbed boundary conditions from the Rapid Update Cycle model. Other surface observations were used for evaluation purposes in the EnKF.

To examine the impact of the initial conditions on the 0- to 6-hour forecast of 80-meter winds for use in wind power forecasts, a set of initial condition parameters for different levels and variables were used to compute sensitivity values for the average wind speed over a targeted region near an existing wind farm. The region centered over Tehachapi Pass is located between the central valley and the Mojave Desert in south central California. The study focuses on sensitivity values during the warm season when the prevailing low level flow is from the northwest. Areas of high sensitivity values indicate that a small change in the initial conditions can be correlated to a large change of wind speed over the target region. These areas are ideal locations for additional observations to improve the short-term forecast of wind speed over the target region.

Preliminary results show that the magnitude of the wind speed within the target region is sensitive to wind speed and stability-related parameters on the upstream side (central valley) of the pass at the lowest levels with strongest sensitivity gradients located over small regions due to the terrain induced flow. At 1.5 km and 3 km above mean sea level, the results are more diffuse over the region. Significant sensitivities were also found to the pressure gradient at several locations both upstream and downstream of the pass.