An Overview of the WRF-Solar Ensemble Prediction System

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Providing reliable probabilistic solar radiation information is needed to improve management of the uncertainty and variability of solar generation. Thus, guidance on how to develop skillful and accurate ensemble forecasts is essential and it will ultimately contribute to integration of high amounts of solar energy on the grid. A team from the National Renewable Energy Laboratory and the National Center for Atmospheric Research had been collaborating to develop the WRF-Solar ensemble prediction system (WRF-Solar EPS) in the past three years to produce probabilistic solar irradiance forecasts and better predict solar energy by quantifying forecast uncertainty. The WRF-Solar EPS basically generates ensemble members for solar irradiance based on stochastic perturbations to provide intraday and day-ahead probabilistic forecasts. This study will present main research steps in developing the WRF-Solar EPS including: (a) tangent linear analysis for identifying key input variables of six WRF-Solar modules significantly related to predicting of cloud and solar irradiance, (b) combining stochastic perturbation technique with the WRF-Solar model, and (c) ensemble calibration method to decrease error and uncertainty of ensemble-based solar forecasts. The capability of WRF-Solar EPS is now updated to the most recent version of standard WRF model. This presentation will summarize comprehensive results from the evaluation of forecasts against the National Solar Radiation Data Base as well as ground-measured observations. Moreover, we will introduce the user's guide for WRF-Solar EPS (e.g., parameters to configure stochastic perturbations) and future extension of this research.