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Multi-objective global sensitivity analysis of the WRF model parameters

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Tuning model parameters to match model simulations with observations can be an effective way to enhance the performance of numerical weather prediction (NWP) models such as Weather Research and Forecasting (WRF) model. However, this is a very complicated process as a typical NWP model involves many model parameters and many output variables. One must take a multi-objective approach to ensure all of the major simulated model outputs are satisfactory. This talk presents the results of an investigation of multi-objective parameter sensitivity analysis of the WRF model to different model outputs, including conventional surface meteorological variables such as precipitation, surface temperature, humidity and wind speed, as well as atmospheric variables such as total precipitable water, cloud cover, boundary layer height and outgoing long radiation at the top of the atmosphere. The goal of this study is to identify the most important parameters that affect the predictive skill of short-range meteorological forecasts by the WRF model. The study was performed over the Greater Beijing Region of China. A total of 23 adjustable parameters from seven different physical parameterization schemes were considered. Using a multi-objective global sensitivity analysis method, we examined the WRF model parameter sensitivities to the 5-day simulations of the aforementioned model outputs. The results show that parameter sensitivities vary with different model outputs. But three to four of the parameters are shown to be sensitive to all model outputs considered. The sensitivity results from this research can be the basis for future model parameter optimization of the WRF model.