

Detection of forecast busts of regional surface solar radiation using ensemble spread with multi numerical weather prediction centers

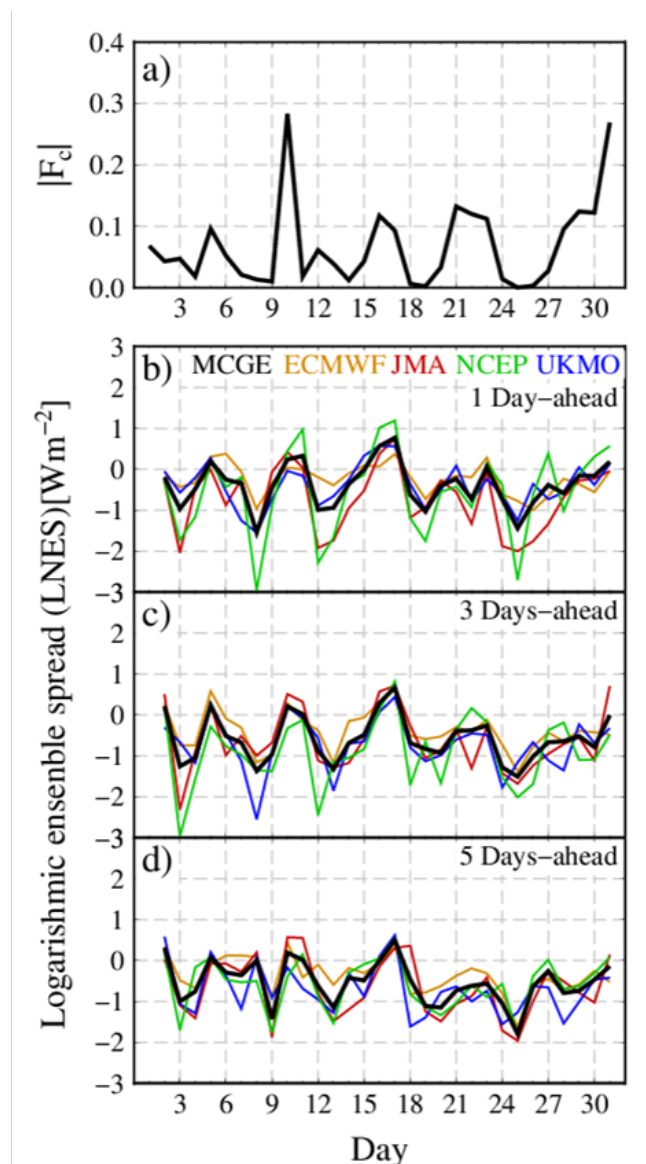
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Energy management using weather forecast of numerical weather prediction (NWP) center is exposed to blackout risks and production of excessive surplus power owing to the large forecast errors (forecast busts) of NWP models. The detection of forecast busts is important for stable electricity provisions. Dispersion of ensemble forecast (ensemble spread: ES) relate to forecast skill. Multi-center grand ensemble (MCGE) has higher forecast skill than single-NWP center ensemble forecast. It is considered that the ES and ES of MCGE (ES_g) can be used as the predictor of the forecast busts. We investigate the detectability of forecast busts on operational regional forecast predicted by Japan Meteorological Agency (JMA-MSM) using lognormal ES (LNES) and ES of MCGE ($LNES_g$) in Kanto Plain, Japan. One- to six-day ahead global forecast at four leading NWP centers (European Centre for Medium-Range Weather Forecasts: ECMWF, Japan Meteorological Agency: JMA, National Centers for Environmental Prediction: NCEP, and Met Office, UKMO) were used to detect of daily surface solar radiation of regional forecast in 2015.

Root mean square error for the ensemble mean of MCGE (EM_g) and 5km regional forecast of JMA-MSM are 27.6 and 28.6 Wm^{-2} for the one-day ahead forecast, respectively. The forecast skill of the EM_g was found to be comparable with that of the JMA-MSM. In October 2015, the correlation between the absolute value of forecast error coefficient ($|Fc|$) on the operational regional forecast and $LNES_g$ for the one-, three-, and five-day ahead forecasts are 0.68, 0.63, and 0.45, respectively (see Figure). The correlation for one- and six-day ahead forecast was found to have statistical significance at ten and seven months, respectively. The $LNES_g$ can be, therefore, a valuable predictor for detection of forecast busts in the regional forecast.

Keywords: Ensemble forecast, Forecast busts, TIGGE, Surface solar radiation



Figure, Time series of F_c in JMA-MSM and ensemble spread in October 2015. (a) $|F_c|$ in JMA-MSM one day-ahead forecast, and (b, c, d) LNES and LNES_g in one (b), three (c), and five (d) day-ahead forecast. Colored thin lines indicate the LNES each NWP centers as shown in the legend. Thick line indicates LNES_g in MCGE.