Chen, X., X. Huang, Y. Cai, H. Shen, and J. Lu, 2020: Intra-day forecast of ground horizontal irradiance using long short-term memory network (LSTM). *J. Meteor. Soc. Japan*, **98**, https://doi.org/10.2151/jmsj.2020-048.

Plain Language Summary: Accurate forecast of ground horizontal irradiance (GHI) is one of the key issues for power grid managements with large penetration of solar energy. A challenge for solar forecasting is to forecast the solar irradiance with a lead time of 1-8 hours, termed as intra-day forecast. This study investigated a machine-learning algorithm, Long Short-Term Memory (LSTM) model, to predict the GHI in 1-8 hours. The results show that, for a 1-4 hour lead time, the LSTM model can predict GHIs better than random-forest forecast (another machine-learning algorithm), and numerical weather forecast by the Weather Research and Forecasting (WRF) model. The LSTM model performs better in fall and winter than in spring and summer, and better under clear-sky conditions than under cloudy conditions. Using adjacent information from the reanalysis as extra inputs can further improve the forecast performance.

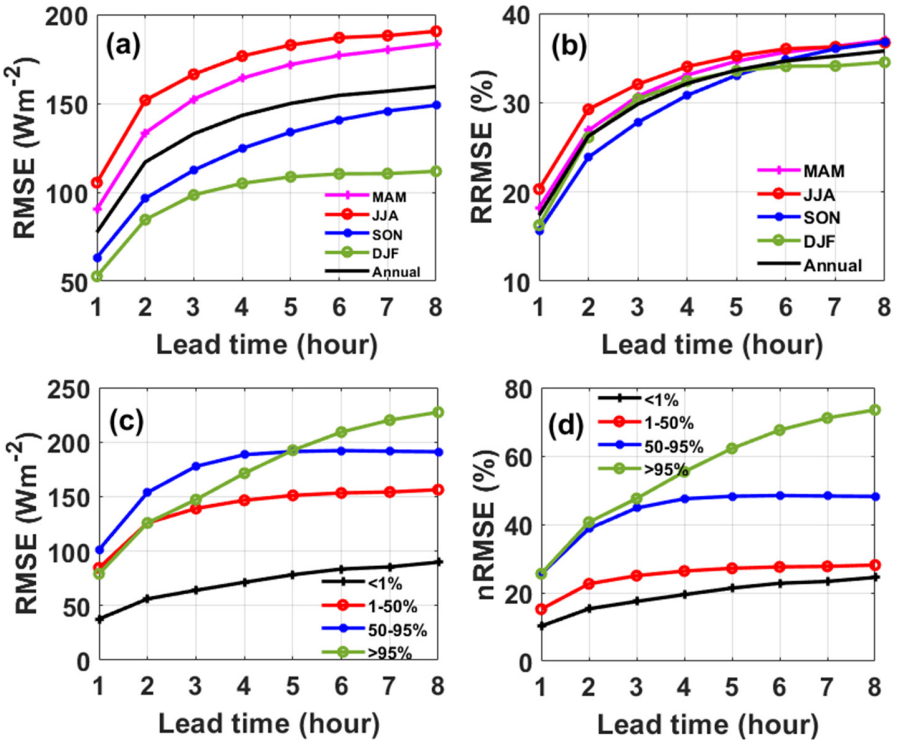

Figure 1. Sensitivity of the root-mean square error (RMSE) of the predicted GHIs compared to the observed GHIs in 2014 and normalized RMSE (nRMSE) to seasons (a and b), to cloud fraction (c and d).

- Implementing a machine-learning based intra-day solar irradiance forecast model.
- For a lead time up to four hours, the predicted GHIs have normalized RMSEs at 18.4~33.0%, better than the performance of numerical weather prediction.
- Optimal configurations of the machine-learning model are explored.