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Forecasting the variability of solar irradiance using numerical weather prediction

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Temporal solar variability significantly affects the integration of solar energy into the power grid across various time scales. However, current day-ahead forecasting techniques of solar irradiance/power are not able to provide the accuracy which is necessary to characterise its temporal variability at fine spatio-temporal resolution. In this work, temporal solar variability is treated as a standalone phenomenon and modelled directly from the output of numerical weather prediction (NWP). For this purpose, a number of meteorological variables are extracted as predictors from the output of two NWP models, i.e. the Global Forecast System (GFS) of the US National Centers for Environmental Prediction (NCEP) and the Cubic Conformal Atmospheric Model (CCAM) of the CSIRO. Temporal solar variability at several sites across Australia is quantified using 1-min observation data collected by the Bureau of Meteorology. Then, various statistical techniques are adopted to model temporal solar variability from the predictors extracted from the output of the NWPs, and their corresponding performance are compared. In addition, the relative importance of the involved meteorological variables and the effects of clearness on the modelling of solar variability are also explored.