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Interannual variability of solar energy generation in Australia

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Australia has an abundant solar energy resource that is likely to be used for energy generation on a large scale. Variable sources of electricity generation require knowledge of the nature of their variability at all time scales. This study examines the effect that El Nino Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD) have on solar radiation in Australia, in order to establish the role for seasonal forecasting of solar power. Calendar years are classified into their ENSO state using a sea surface temperature index. The ERA-Interim and NCEP reanalysis products are then used to estimate the effect of ENSO on global horizontal solar irradiance over the continent. A bootstrap technique is used to obtain confidence regions for the effect in both winter and summer. The main impact of ENSO occurs during winter over a large part of eastern Australia. Little impact was observed over the continent during summer. A similar analysis is conducted for the Indian Ocean Dipole (IOD) to ensure that the observed ENSO effect is not a manifestation of the IOD. This study indicates that the ENSO phenomenon may account for solar energy changes of more than 10% in some locations on a seasonal basis. We show that the solar radiation analysis is directly applicable to solar energy yield. Knowledge of this variability may influence the location of large solar generation plants. Also, there is a potential to predict solar energy a few months ahead by means of seasonal forecasting systems, which would help to assist with planning for electricity grid.