

Relation between photovoltaic power generation and synoptic weather regimes in La Reunion

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The Reunion Island is a French overseas department located 800 km east of Madagascar in the Indian Ocean. Due to the complex topography of the island, the Reunion climate presents a strong variability at different space and time scales, many local phenomena (land-sea breeze, orographic convection...) interacting with large scale phenomena (trade winds). As photovoltaic (PV) energy is a fast growing energy in La Reunion, there is considerable interest in improving PV power generation forecasting, from very short term (a few minutes or a few hours) to medium term (a few days). In this study we investigate an approach that consists in linking typical daily profiles of PV power generation with large scale weather regimes. As a first step, we adopt a bottom-up approach. We use 10 minutes PV power generation time series measured at 8 sites in La Reunion over the period 01/05/2008-30/04/2010. At each site, daily PV power generation profiles are classified into a small number of classes using statistical methods. This automatic classification enables to distinguish several typical daily profiles at each site as for example: full capacity factor, weak capacity factor, weak capacity factor in the afternoon... As each class is expected to be highly dependant on the sensible weather (clear sky, cloudy, clouds developing in the afternoon...), we then look at the anomaly fields of different meteorological variables (solar radiation, 500hPa vertical velocity, mean sea level pressure) associated with those classes using the NCEP reanalysis with 36 km spatial resolution. In some cases, evidence that local PV power generation profiles can be related to large scale phenomena is highlighted. We then investigate the opposite approach. We start by classifying the atmospheric variables into classes and then look at the PV power generation profiles associated with those large scale classes. Then we try to establish relationships between large scale classes and different features of the daily PV power generation profiles (mean profile, variability...). Finally we discuss the suitability of this approach in an operational context.