EMS Annual Meeting Abstracts
Vol. 11, EMS2014-576, 2014
14th EMS / 10th ECAC

Satellite-based solar irradiance and photovoltaic (PV) production forecasting on Reunion Tropical Island

Jordi Badosa (1), Martial Haeffelin (2), Elke Lorenz (3), Genevieve Seze (1), Natacha Kalecinski (1), and Jean Mathorel (1)

(1) Laboratoire de Météorologie Dynamique, Palaiseau, France, (2) Institut Pierre Simon Laplace, Palaiseau, France, (3) University of Oldenburg

Intraday forecast of solar irradiance and photovoltaic (PV) production is needed to manage solar plants and other energy sources necessary to cover consumption demand in a given region. Satellite-based forecasting methods, such as cloud motion vector techniques, are seen the most appropriate for this forecast horizon.
In this work, we focus on the particular need for intraday solar irradiance forecast on Reunion Island (Southwest of the Indian Ocean basin) at high spatial and temporal resolution. Reunion, located in the Southwest of the Indian Ocean basin (21ºS, 55.5ºE), is about 60 km wide and has a complex orography, with two high altitude summits (3070 m and 2560 m) separated by a 1500 m plateau. Despite its small size, it currently counts on more than 200 MW of PV installations mainly medium-small plants distributed along the coast, which can supply up to about 30% of the instantaneous electricity demand.
Previous studies based on ground solar irradiance measurements have shown that hourly change in clear-sky index highly dis-correlates after about 10 kilometres of distance on the island, due to its complex relief and the ruling atmospheric dynamics,.
Main clouds around Reunion are often broken clouds (trade cumuli type), which develop and fastly dissipate and tend to radically change or disappear as they approach to Reunion. On the island, orographic clouds systematically develop on the windward mountain regions and, in many cases, they spread off towards the coastal parts (sometime during late morning or early afternoon), thus dramatically affecting PV production. Being able to anticipate whether the orographic clouds will spread off or not is a major challenge for PV production forecasters.
For the above-described cases, which conform the majority of situations on Reunion Island, cloud motion vectors techniques are probably not applicable in the same way as in mid latitudes. However, advection of large cloud structures (typically deep convective clouds) also affect Reunion (although much less frequently) and they are more persistent and in principle easier to track.
The work examines cloudy scenarios as observed with Meteosat-7 geostationary satellite. Existing and new developed satellite-based methodologies for solar irradiance forecasting on Reunion are tested and first results are presented.