EMS Annual Meeting Abstracts
Vol. 11, EMS2014-249, 2014
14th EMS / 10th ECAC
© Author(s) 2014

Analysis of results from the COST ES1002 DNI inter-comparison based on cloud detection from all-sky cameras

Maria Christina Kotti (1), Laurent Vuilleumier (2), Andreas Kazantzidis (1), Mathias Hauser (2), and Panagotis Tzoumanikas (1)

(1) Laboratory of Atmospheric Physics, Department of Physics, University of Patras, Patras, Greece (akaza@upatras.gr), (2) Federal Office of Meteorology and Climatology MeteoSwiss, Payerne, Switzerland

DNI is affected strongly by clouds covering the sun. As a result, DNI exhibits higher spatial and temporal variability than global irradiance (GHI) and complicates solar power plants operation. Nine instruments' performance of two types was analyzed with respect to the status of the cloud cover using data from an all-sky camera. The first type (IRR, RSI, RSP instruments) used a rotating shadowband, while the second type of instruments (DELTA) used seven sensors and a shading pattern. The dataset consisted of 1-min values of diffuse (DHI), DNI and GHI irradiance. The measurements took place at the Federal Office of Meteorology and Climatology MeteoSwiss, Payerne, for the time period 16.06.2012–16.09.2013 and were taken in the frame of the inter-comparison of the European COST ES1002 WIRE Action.
All-sky camera was chosen after being compared to similar cloud cover data series obtained from an algorithm based on long-wave irradiance from a collocated pyrgeometer and from ceilometer data. The 5-min sky-camera data were interpolated to create 1-min data in order to correspond to the given solar irradiance data. Based on cloud coverage and its rate of change, three significant classes were determined: a) Low cloudiness with low rate of change, b) high cloudiness with low rate of change and c) broken clouds of all rate of change. It was found that the most pronounced differences among the tested instruments and the collocated radiometers occurred either under scatted cloudiness after rain events, or when the sun was not fully obscured by broken clouds conditions. A multi-color criterion was applied on sky images to improve the accuracy in detection of broken and overcast clouds under high solar zenith angles and an automatic cloud classification scheme was developed. The differences on direct, diffuse and global irradiance were also analyzed taking into account cloud coverage and type.