



## **A preliminary study on short-term predictability of solar surface irradiance over Italian Peninsula for photovoltaic energy production**

Christian Lanconelli, Tony Christian Landi, Boyan Petkov, Angelo Lupi, Mauro Mazzola, Vito Vitale, Paolo Bonasoni, Maurizio Busetto, Paolo Cristofanelli, Piero Malguzzi, Andrea Buzzi, Monica Campanelli, Stefano Dietrich, Stefano Federico, Claudia Roberta Calidonna, and Anna Maria Sempreviva

Institute of the Atmospheric Sciences and Climate, National Research Councils, Italy (c.lanconelli@isac.cnr.it)

Global horizontal broadband solar irradiance (GHI) is measured at many sites over the Italian Peninsula. In the framework of several projects led by the Institute of Atmospheric Sciences and Climate (ISAC CNR), one-minute based long-term radiation measurements have been carried out at urban site of Bologna (44.31N 11.21E) and at the rural site San Pietro Capofiume (44.39N 11.37E) in Northern Italy (2007-ongoing). In addition, since June 2013, radiation data have been collected at Lecce (40.03N 18.12E) and Lamezia Terme (38.08N 16.02E) in Southern Italy (I-AMICA project). For these sites, ancillary observations, such as longwave down-welling and the major meteorological parameters are available with the same temporal resolution. At Bologna, diffuse (DHI) and direct (DNI) irradiance are collected with different instruments. Moreover, a high sensitive shadow-band all-sky camera and sun-photometer are co-located with the GHI observation, allowing a complete monitoring of the parameters affecting the surface solar radiation. In addition, continuous measurements of GHI performed by the pyranometer network of the Italian Military Air Force at lower time resolution (up to ten minutes) and of the European Skynet Radiometer network (ESR) have been considered.

Predictions of GHI on various time horizon relevant for the energy production (i.e. <1h, 3-6h, 24h), have been assessed by following different approaches. It was found that GHI can be predicted within  $\pm 5\%$  from 2 to 6 hours ahead, by applying chaotic time series algorithms. State-of-the-art numerical weather prediction GHI forecast (i.e. BOLAM/MOLOCH, RAMS, WRF), will be compared with observations mentioned above, and with satellite retrieval of GHI operationally obtained from MSG imagery. Moreover, off-line radiative transfer (i.e. SBDART, RSTAR) as well as parametric models, have been implemented for selected case studies to resolve the DNI and DHI.

Preliminary results – achieved by using WRF simulations - show that the model is able to reproduce the observed values of GHI ( $r_2 \sim 0.95$ ) during fair weather, even if a slightly overestimate (i.e. less than 10%) of daily maximum remains.