Geophysical Research Abstracts, Vol. 7, 06299, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06299

THE USE OF DEM TO IMPROVE THE ESTIMATION OF SOLAR IRRADIANCE IN COMPLEX TOPOGRAPHY AREAS

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The solar radiation plays a major role in the energy exchange process between the atmosphere and the earth surface. As a consequence, the spatial distribution of the solar radiation is a key parameter in a wide range of studies related to agriculture, hydrology, ecosystem modeling or renewable energy. Particularly, the development that renewable energy will have in the next years, under the support of the European Union, needs for a reliable estimation of the available solar energy resources. At local scales, the topography is the most important factor in determining the distribution of the solar radiation on the surface. Interpolation techniques have been developed to estimate meteorological variables, as solar radiation, over landscape, but often their usefulness is limited because variables that cause spatial variation (e.g. topography) are not included. The surface orientation and the obstruction due to elevations cause great local differences in insolation which should be taken into account.

In this work we present results corresponding to a simple physical model which estimates the daily solar radiation in complex terrain areas using topographic information obtained from Digital Elevation Models (DEM). The use of these DEM allows taking into account topographical information, such as the slope, elevation, etc. in the

solar radiation estimates. The model can be easily incorporated in a GIS environment, thus helping to a proper design of the solar-based energy production facilities at local scales.

Results were tested against observed global radiation data collected, along the years 2003 and 2004, in 14 radiometric stations located within the Sierra Nevada National Park, in Granada (Southern Spain). The area of study shows a very complex topography, and, as a consequence, the 14 locations cover a wide range of elevation (from 1100 to 1700 m), aspects, slopes and sky view factor. The data were logged in a minute basis and processed to obtain daily integrations. Results shows that a simple interpolation between stations leads to RMSE values of around 50%, while the use of the topographic information leads to RMSE values which ranges from 10% to 15%, depending on the stations.