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On the dependence of the topographic parameters estimates on the DEMs resolution: influence on solar radiation estimates

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The topography is the most important factor in determining the local distribution of the solar radiation on the surface. The variability of the elevation, the surface orientation and the obstruction due to elevations cause great local differences in insolation and, as a consequence, in the climate. Interpolation techniques have been developed to estimate the solar radiation over flat landscape, but often their usefulness is limited in complex-topography areas because the surface orientation and the obstruction due to elevations cause great local differences in insolation which these techniques do not account for. An alternative way in complex-topography areas is the use of GIS-based solar radiation models, as the “Solar Analyst”. The “Solar Analyst” is a spatially distributed solar radiation model, which provides solar radiation estimates taking into account the topographic parameters (slope, aspect and elevation). These parameters are derived from DEM in a GIS environment, and, therefore, are dependent on the DEM resolution. In this work we present an analysis of the dependence and sensibility of the “Solar Analyst” daily global radiation estimates on changes in the topographic parameters. To this end, these parameters were derived using several DEM with resolution ranging from 20 to 100 m, and the corresponding solar radiation estimates where compared against each other. The analysis was carried for an area located in the Sierra Nevada National Park (Granada), and the model was run for seasonally representative days. Results show, overall, that the difference between the solar radiation estimates increases when the topographic complexity increases, particularly, the difference is especially important where the terrain curvature (slope’s gradient) is great.