



Assessment of diffuse radiation models in Azores

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Measured irradiance databases usually consist of global solar radiation data with limited spatial coverage. Hence, solar radiation models have been developed to estimate the diffuse fraction from the measured global irradiation. This information is critical for the assessment of the potential of solar energy technologies; for example, the decision to use photovoltaic systems with tracking system.

The different solar radiation models for this purpose differ on the parameters used as input. The simplest, and most common, are models which use global radiation information only. More sophisticated models require meteorological parameters such as information from clouds, atmospheric turbidity, temperature or precipitable water content. Most of these models comprise correlations with the clearness index, k_t (portion of horizontal extra-terrestrial radiation reaching the Earth's surface) to obtain the diffuse fraction k_d (portion of diffuse component from global radiation).

The applicability of these different models is related to the local atmospheric conditions and its climatic characteristics. The models are not of general validity and can only be applicable to locations where the albedo of the surrounding terrain and the atmospheric contamination by dust are not significantly different from those where the corresponding methods were developed. Thus, models of diffuse fraction exhibit a relevant degree of location dependence: e.g. models developed considering data acquired in Europe are mainly linked to Northern, Central or, more recently, Mediterranean areas. The Azores Archipelago, with its particular climate and cloud cover characteristics, different from mainland Europe, has not yet been considered for the development of testing of such models. The Azorean climate reveals large amounts of cloud cover in its annual cycle, with spatial and temporal variabilities more complex than the common Summer/Winter pattern.

This study explores the applicability of different existing correlation models of diffuse fraction and clearness index or other plain parameters to the Azorean region. Reliable data provided by the Atmospheric Radiation Measurements (ARM) Climate Research Facility from the Graciosa Island deployment of the ARM Mobile Facility (<http://www.arm.gov/sites/amf/grw>) was used to perform the analysis. Model results showed a tendency to underestimate higher values of diffuse radiation. From the performance results of the correlation models reviewed it was clear that there is room for improvement.