Estimation of the diffuse component of solar irradiation in Uruguay

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Recent efforts towards solar resource assesment in Uruguay have been related to measuring [1,2] or modelling [3,4] global horizontal irradiance. At most locations only global irradiance is measured and, in order to estimate global irradiation on tilted surfaces and direct normal irradiation, a reliable method for the separation of its diffuse and direct components is required. Several more or less "universal" models have been proposed [5-7] which relate the clearness index (and sometimes auxiliary variables) with the diffuse fraction. Most of them are based on ground data from a few specific sites. Since the diffuse fraction is expected to depend on the local details of the atmospheric composition, these models must be tested against real data to see how they perform under specific climatic conditions at a given location.

In 2010, our group initiated a project that aims to continuously monitor the global and diffuse components of solar irradiance at several sites in the country. In this work, we consider global and diffuse irradiance data from two sites of different characteristics: one of them (Montevideo) is a urban site and the other one (Salto) is a rural site located 500 km North from the first. At Montevideo, global and diffuse irradiance are being measured continuously since march 2011 using a Delta-T SPN1 radiometer with no moving parts. At the other site at Salto, we use a series of seven years of global and diffuse irradiance obtained by the local Meteorological Service using two Kipp & Zonen CMP-11 radiometers, one of them equipped with a shadowband. These data are used to compare the performance of several universal correlations. We also develop our own local correlation on an hourly, daily and daily monthly average basis and test it against a set of independent data. The best performing correlations for the urban site are used to estimate daily global irradiation on an inclined plane from both the isotropic and HD methods and the results are compared to our own measurements, in order to evaluate the importance of the methodology at the end-product level. Based on the previous considerations, a set of tools for estimating global irradiance on tilted planes in Uruguay is recommended.

References:

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