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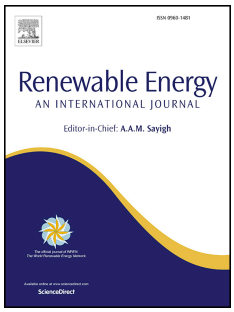

Identifying periods of clear sky direct normal irradiance

M. Larrañeta, M.J. Reno, I. Lillo-Bravo, M.A. Silva-Pérez

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Identifying periods of clear sky direct normal irradiance

Larrañeta, M.[1], Reno, M. J. [2], Lillo-Bravo, I.[3], Silva-Pérez, M.A.[3]

[1] Andalusian Association for Research and Industrial Cooperation (AICIA).

[2] Sandia National Laboratories.

[3] Department of Energy Engineering, University of Seville.

Corresponding author:

Miguel Larrañeta, Andalusian Association for Research and Industrial Cooperation, Camino de los Descubrimientos s/n. 41092, Seville, Spain.

Phone/Fax number: (+34)954487237/ (+34)954487233

E-mail: mlarraneta@gter.es

Abstract

When modeling the effect of the cloud transients in the Direct Normal Insolation (DNI), it is particularly relevant to identify those moments in which there are no clouds between the observer and the sun. In this paper, we present a simple algorithm for offline detection of situations where the sun path to the observer is not obstructed by any cloud. The algorithm is based on the characterization of the relations between the measured and the clear sky curves. The clear sky identification module consists of three evaluation and detection metrics: hourly mean, slope, and line length criterion. All of them rely on the assessment of the measured data against the clear sky generated data. The conjunction of the fulfillment of the three criteria leads to the clear sky hour identification. We validate our algorithm by comparing our results with those obtained from a recently published clear sky detection algorithm that uses high temporal resolution Global Horizontal Irradiation (GHI) as the input. We obtain a 98% agreement when having more than 50 minutes identified as clear.

Keywords

DNI; clear sky; solar radiation models

1 Introduction

There are several alternatives when defining the clear sky condition and the clear sky irradiance [1]. The most common definition is the absence of visible clouds across the entire sky dome and the irradiance occurring these conditions is the clear sky irradiance. In Concentrated Solar Power (CSP) systems it is also interesting to identify periods where there are no visible clouds between the observer (solar field) and the sun although there may be clouds in the rest of the sky dome since DNI is not affected by diffuse radiation scattered by the clouds and plant production will be similar than under clear sky conditions. We use the term “clear sky equivalent DNI” to refer to either DNI during clear sky conditions or DNI during