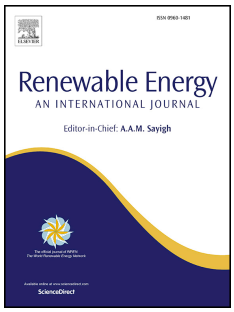
Accepted Manuscript



Resolution of the cloud enhancement problem for one-minute diffuse radiation prediction

Allan R. Starke, Leonardo F.L. Lemos, John Boland, José M. Cardemil, Sergio Colle

PII: S0960-1481(18)30259-3

DOI: 10.1016/j.renene.2018.02.107

Reference: RENE 9838

To appear in: *Renewable Energy*

Received Date: 11 August 2017

Revised Date: 20 February 2018

Accepted Date: 22 February 2018

Please cite this article as: Starke AR, Lemos LFL, Boland J, Cardemil JoséM, Colle S, Resolution of the cloud enhancement problem for one-minute diffuse radiation prediction, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.02.107.

Resolution of the Cloud Enhancement Problem for One-Minute Diffuse Radiation Prediction

Allan R. Starke[1,a)], Leonardo F. L. Lemos[1], John Boland[2], José M. Cardemil[3] and Sergio Colle[1]

[1] *LEPTEN - Laboratory of Energy Conversion Engineering and Energy Technology/Federal University of Santa Catarina (UFSC), Florianópolis, Santa Catarina, Brazil.*
[2]*Centre for Industrial and Applied Mathematics, University of South Australia, Mawson Lakes Boulevard, Mawson Lakes, SA, 5095, Australia*
[3]*Mechanical Engineering Department, Universidad de Chile, Beauchef 851, Santiago, Chile*

[a)]Corresponding author: allan.starke@lepten.ufsc.br,

Abstract:

For design and simulation of solar energy systems, quality information about all components of solar irradiance is crucial. In cases when only global irradiance measurements are available, separation models are a useful method to estimate DNI and diffuse irradiation. Several of such models have been developed since the 1960s, most of them aiming to deliver estimates in hourly resolution. For higher data resolution, such as in minute data, those models are not able to describe fast transient and cloud enhancement phenomena commonly observed in data with smaller time-steps. This paper proposes an adaptation of the BRL separation model, making it capable of delivering more precise irradiance estimates for higher resolution data. Two models result from this adaptation: one for Brazil and other for Australia. The proposed models yield a more precise DNI and diffuse fraction estimates to their respective countries, compared to other separation models commonly used in the technical literature. For example, using the recommended Combined Performance Index (CPI) as a single statistical indicator, the proposed model yields DNI estimates with CPI from 230 to 350 % for Australia, and from 270 to 800 % for Brazil, while the Engerer model, recently recommended as a ‘‘quasi-universal” 1-min separation model, yields DNI estimates with CPI from 500 to 700 % for Australia, and from 600 to 1800 % for Brazil.

Keywords: *Minute global, diffuse and direct irradiance; BRL model; Irradiance separation models; Cloud enhancement*