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Estimates of clear-sky solar irradiances over Nigeria

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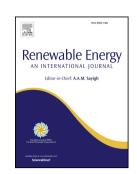
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#### ACCEPTED MANUSCRIPT

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### 5 Abstract

- 6 This study attempts to circumvent the problem of paucity of input data required in climatology
- 7 mapping of clear-sky solar irradiance in Nigeria by computing beam normal  $(E_{bn})$  and diffuse
- 8  $(E_d)$  irradiances using a high performance broadband radiative model in the country climate
- 9 zones. Air temperature, relative humidity and global datasets of ozone thickness and angstrom
- 10 turbidity were used as input parameters.
- The biases in the  $E_{bn}$  estimates with NASA datasets across Nigeria (11 to 25 %) are of similar
- magnitudes with NASA observations with ground measurements. The estimates show persistent
- negative biases that increased from tropical savannah to semi-arid climate zones (-8 to -24 %).
- 14 The bias in the E<sub>d</sub> estimates is only of similar magnitude with NASA in semi-arid climate zone
- 15 (10 %). The  $E_d$  estimates show persistent negative biases that increase from semi-arid to tropical
- savannah across Nigeria (-7 to -54 %). Also, the estimates in each climate zone correspond to the
- 17 expected climatology of water vapour, aerosol turbidity and absolute optical mass. Lastly, the
- response of  $E_{bn}$  to water vapour absorption and aerosol extinction signals is mostly active in
- monsoon zone while the response to the signals by  $E_d$  are active in all the zones.
- 20 **Key words**: beam normal irradiance; clear-sky diffuse irradiance; broadband radiative model;
- 21 Aerosol; water vapour; climate zone.
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#### 1. Introduction

- Solar radiations reaching the earth's surface are usually classified as clear-sky or all sky
- solar irradiance. Clear-sky solar irradiance is the solar radiation that reaches the earth's
- surface in the absence of clouds while all sky solar irradiance includes the contribution of

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