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# 1 Estimates of Clear-Sky Solar Irradiances over Nigeria

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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.

11 The biases in the  $E_{bn}$  estimates with NASA datasets across Nigeria (11 to 25 %) are of similar  
12 magnitudes with NASA observations with ground measurements. The estimates show persistent  
13 negative biases that increased from tropical savannah to semi-arid climate zones ( -8 to -24 % ).  
14 The bias in the  $E_d$  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  
16 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  
18 response of  $E_{bn}$  to water vapour absorption and aerosol extinction signals is mostly active in  
19 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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## 25 **1. Introduction**

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

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