Analysis of Solar Radiation Models and Three-Dimensional Modelling Of Irradiance

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Introduction

- The paper analyses different models for hourly solar radiation data

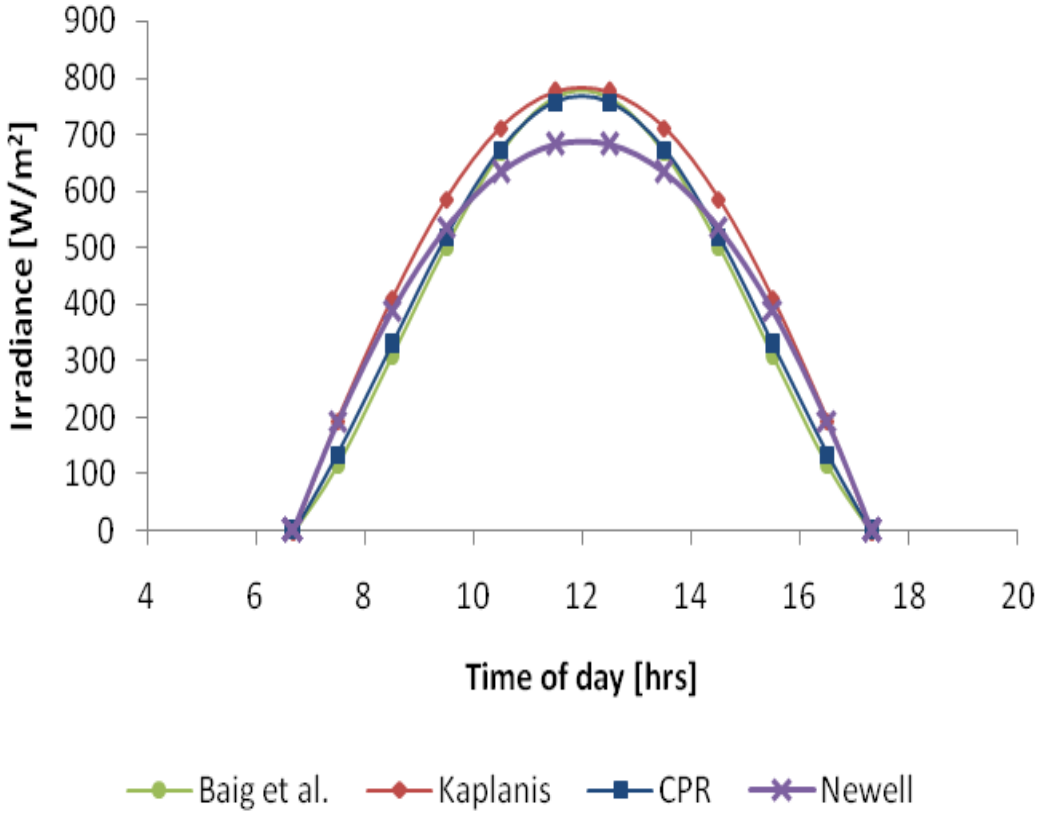
- The models include:
  - Collares-Pereira and Rabl model
  - Baig et al. model
  - Newell model
  - Kaplanis model

- The models were compared using data from different locations

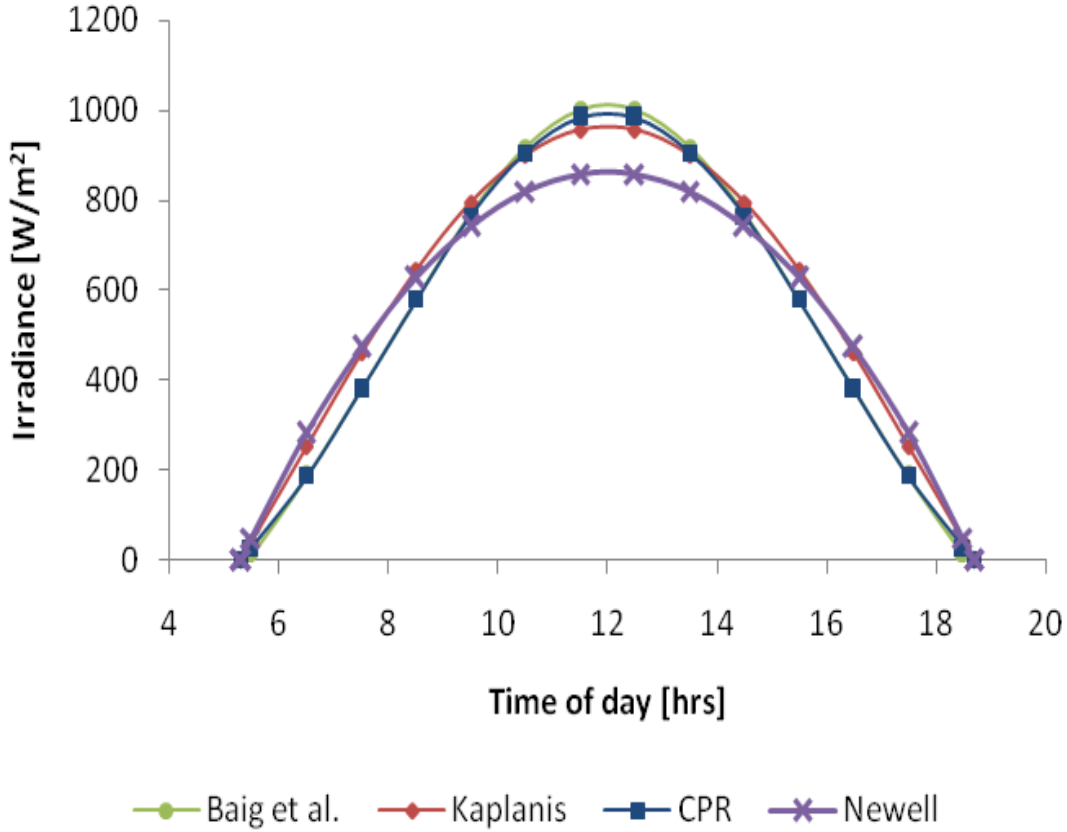
Introduction …

- The results presented using two- and three-dimensional (2D and 3D) graphs
- Validation based on measured solar radiation data for only Windhoek as an example
- ***Collares-Pereira and Rabl (CPR)*** model tends to give more accurate results when validated
- The models have been based on the assumption of clears sky as depicted in the smoothness of the plots.
- The most important inputs to the models are the latitude (ϕ) and the monthly mean daily radiation (H) data for the location.

Results – 2D

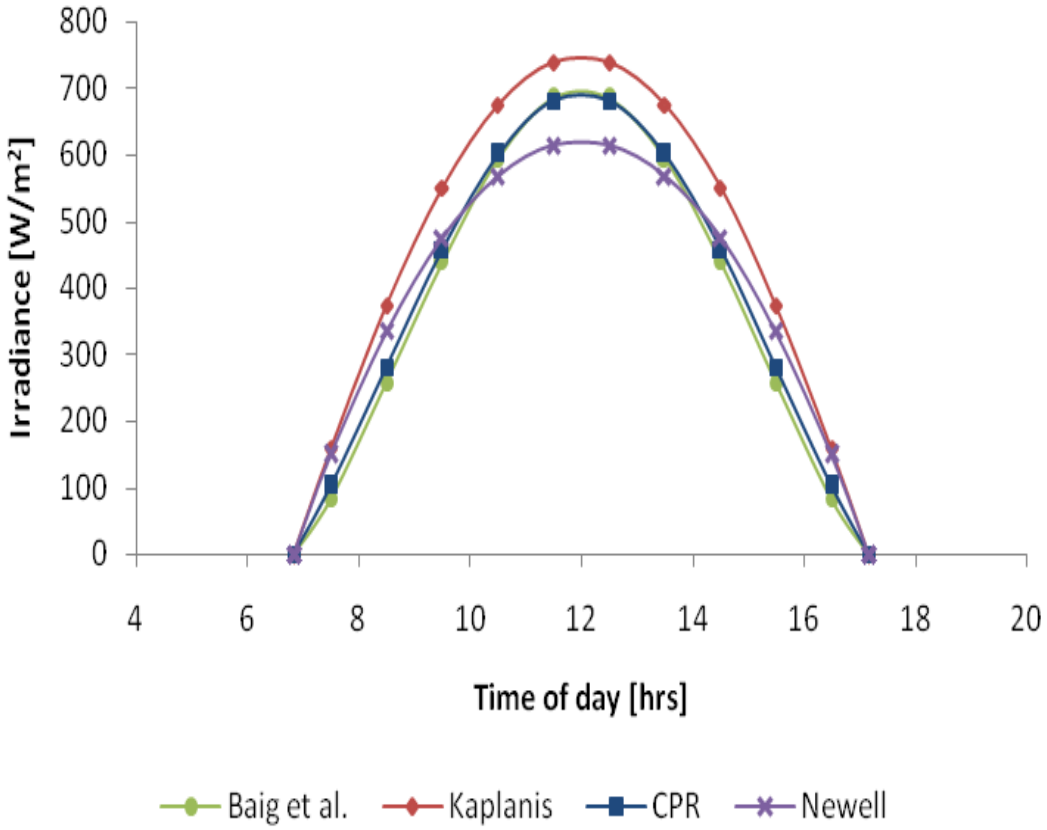


Windhoek 21st June

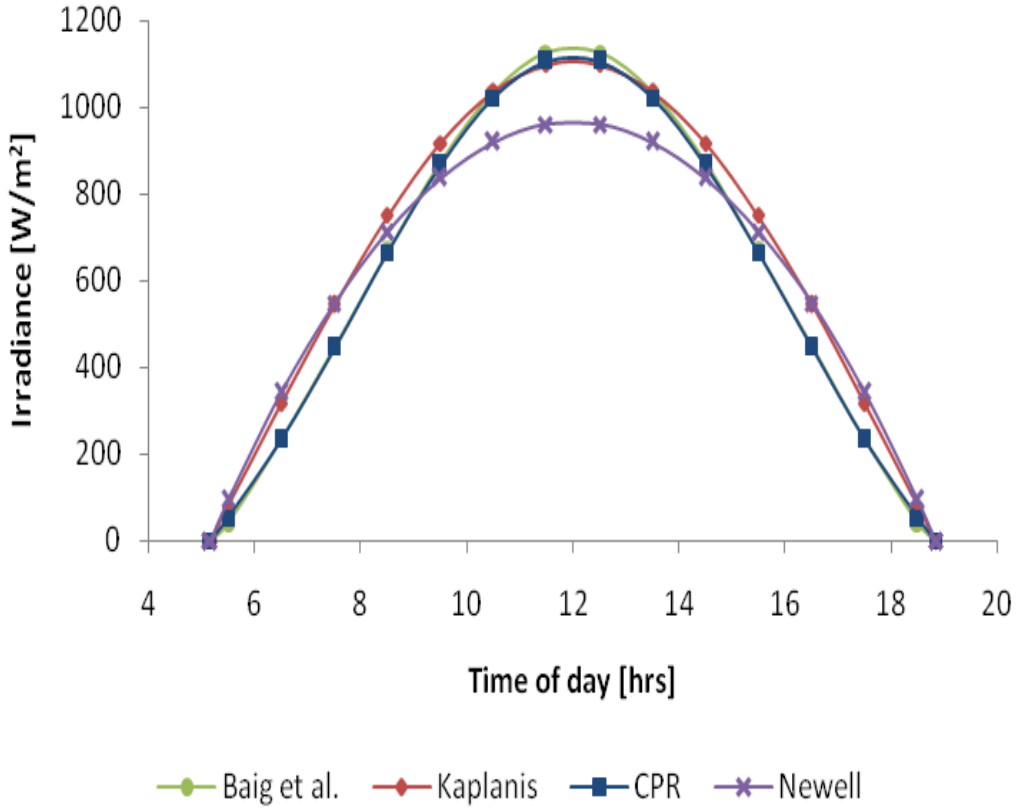


Windhoek 21st December

Results – 2D ...

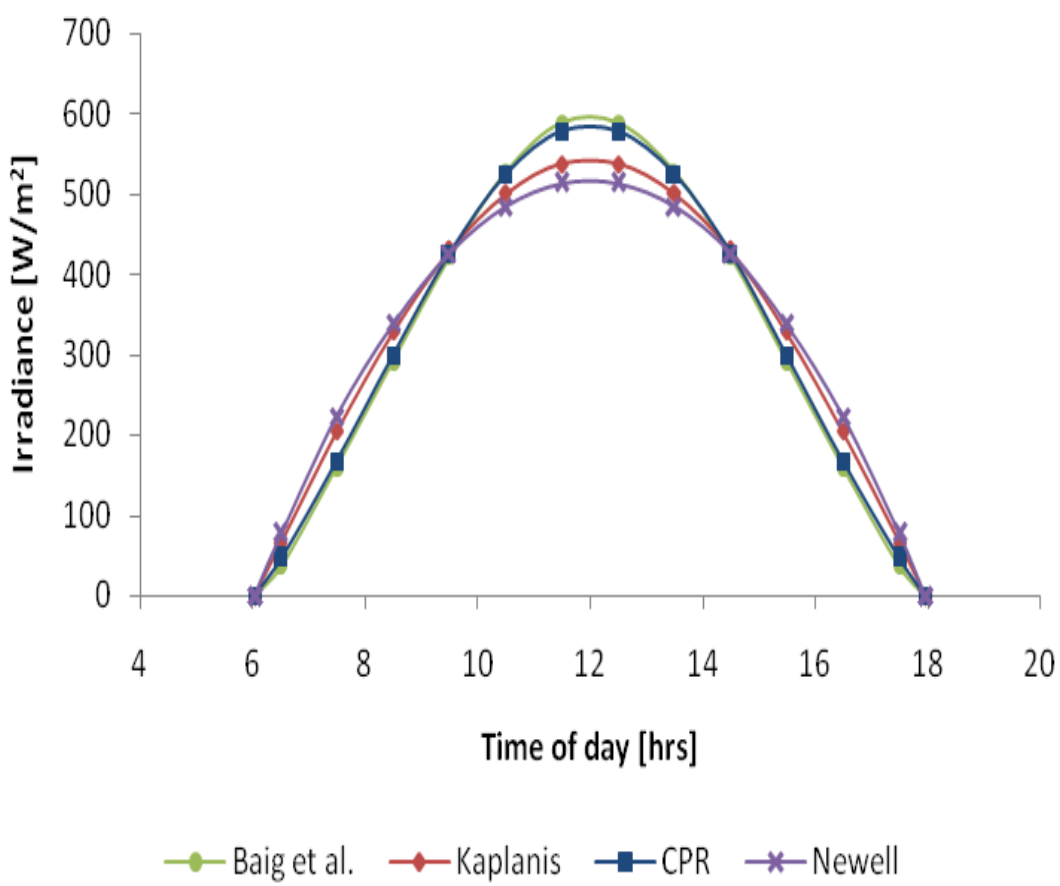


Keetmanshoop 21st June

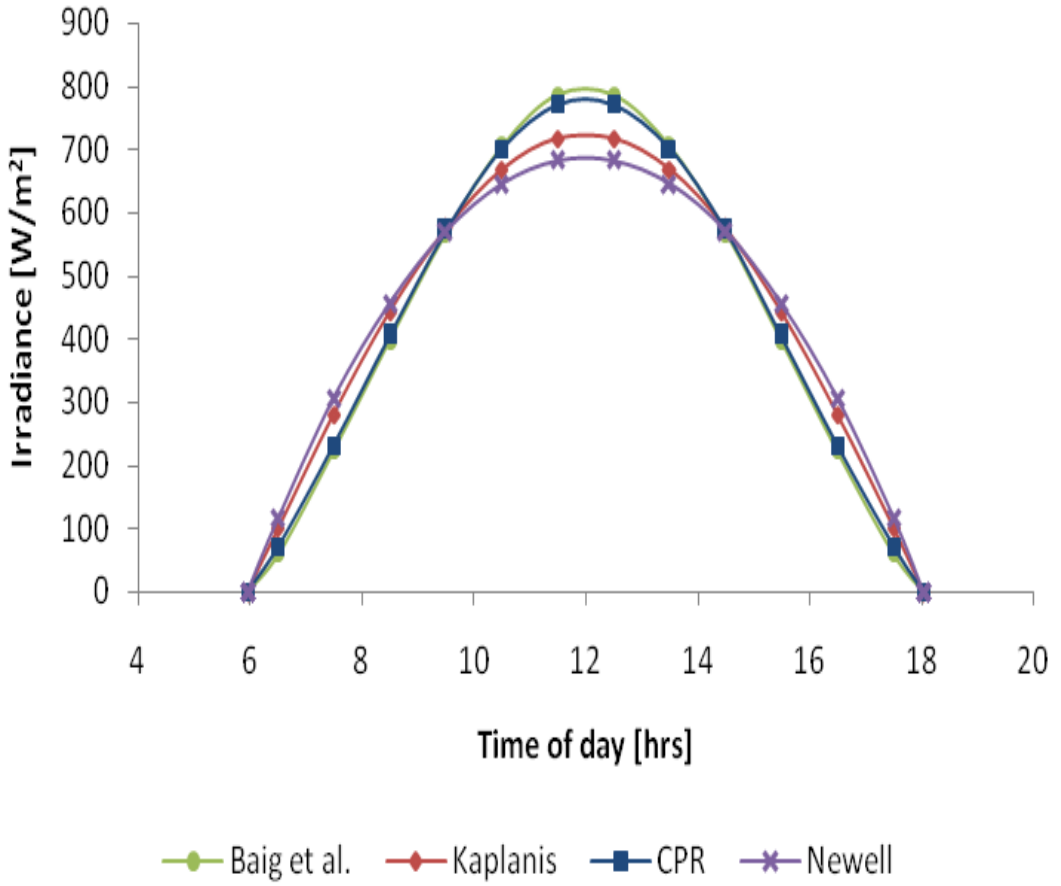


Keetmanshoop 21st December

Results – 2D ...

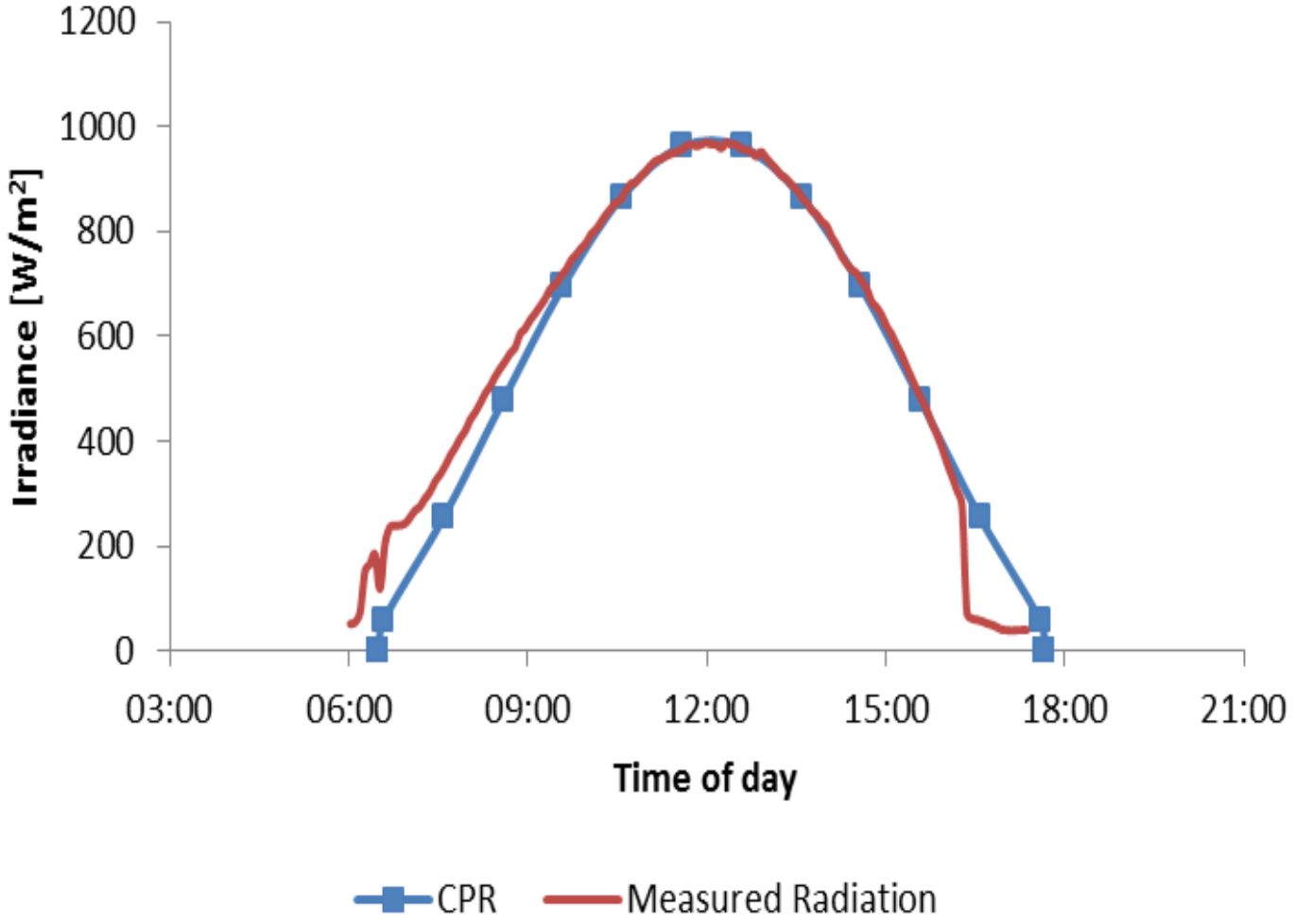


Kampala 21st June



Kampala 21st December

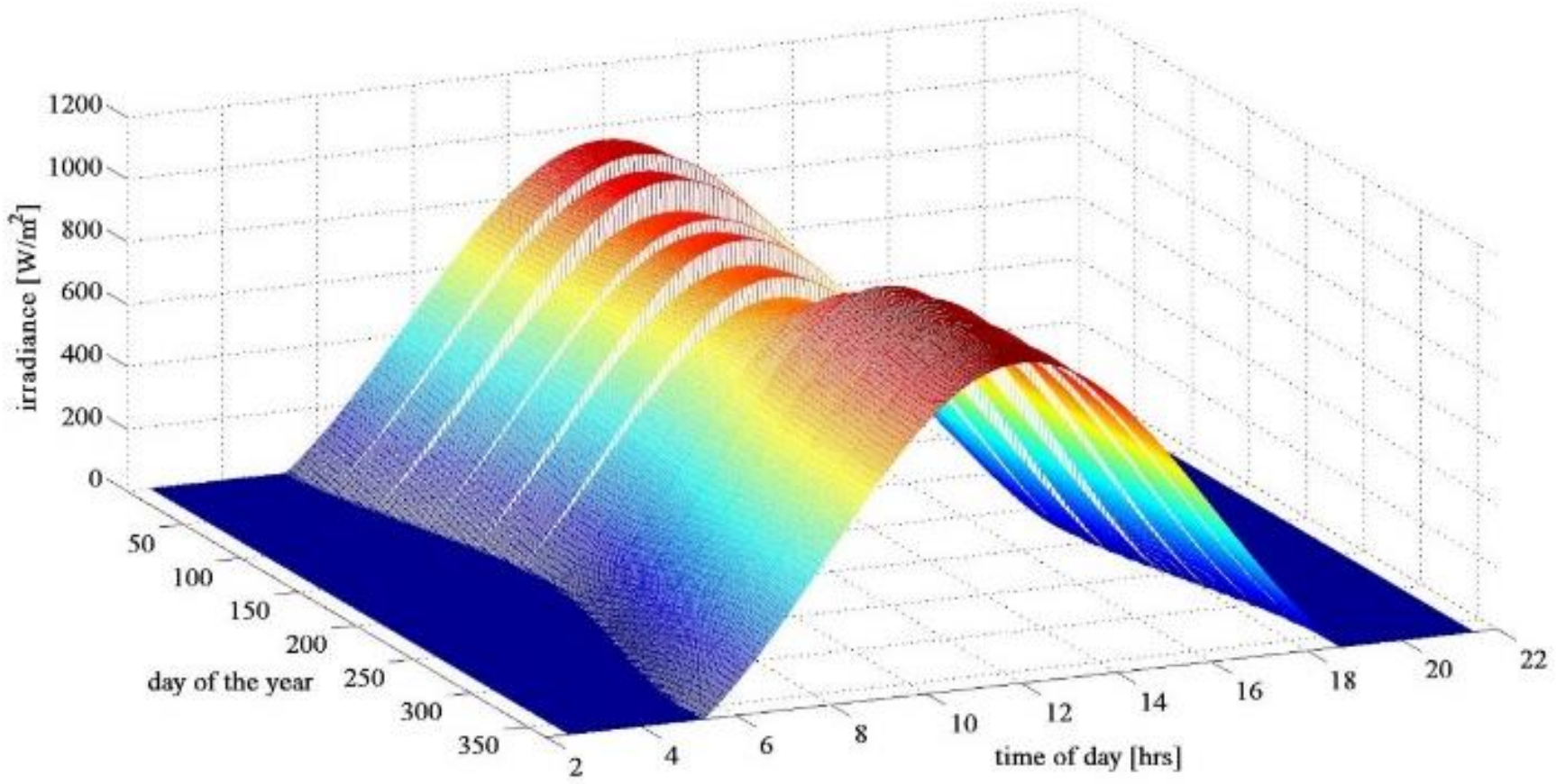
Results – *Example of validated data from Windhoek*



Results – 3D

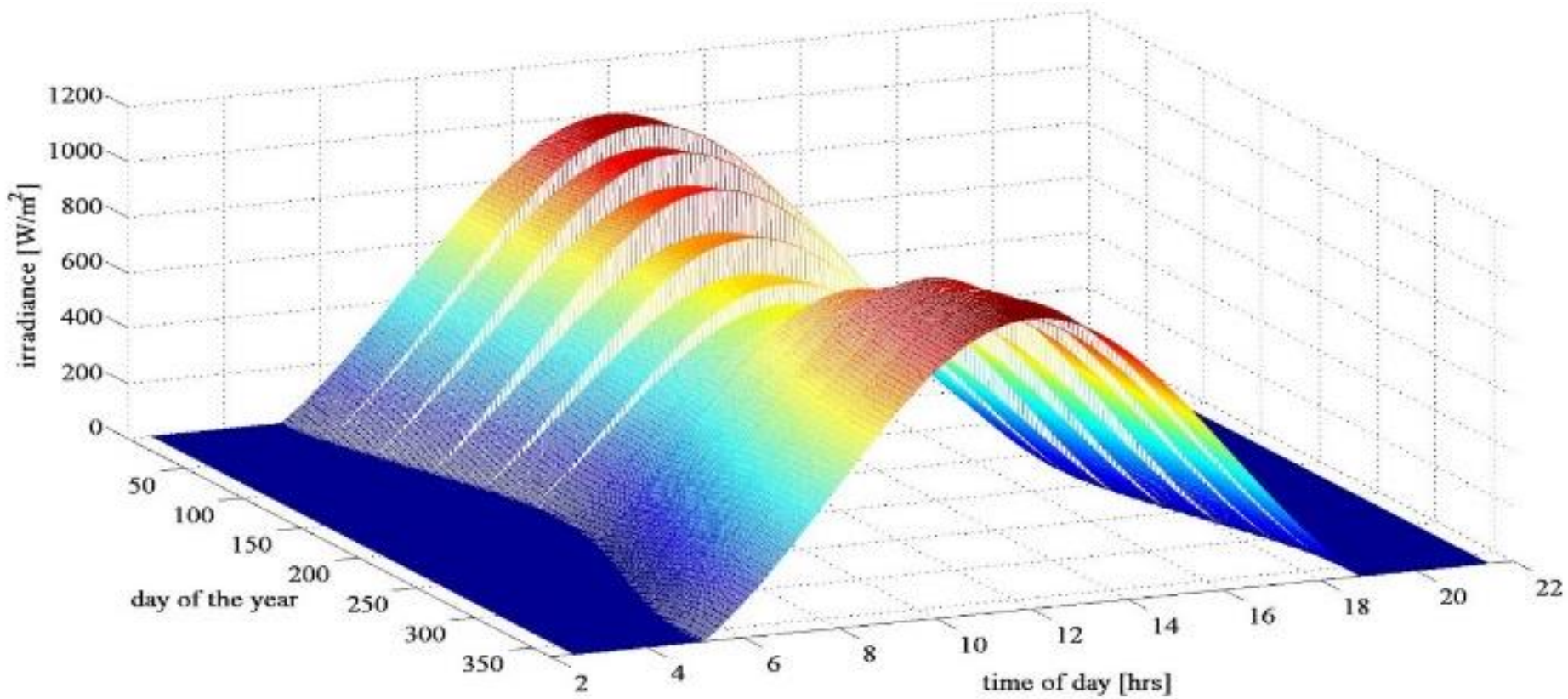
- Three-dimensional (3D) models of solar radiation were developed with the aim to show the variation of solar radiation with another changing parameter (i.e., seasonal and latitude).
- The plots give hourly radiation versus latitude (ϕ) and hours of the day

Results – 3D …..



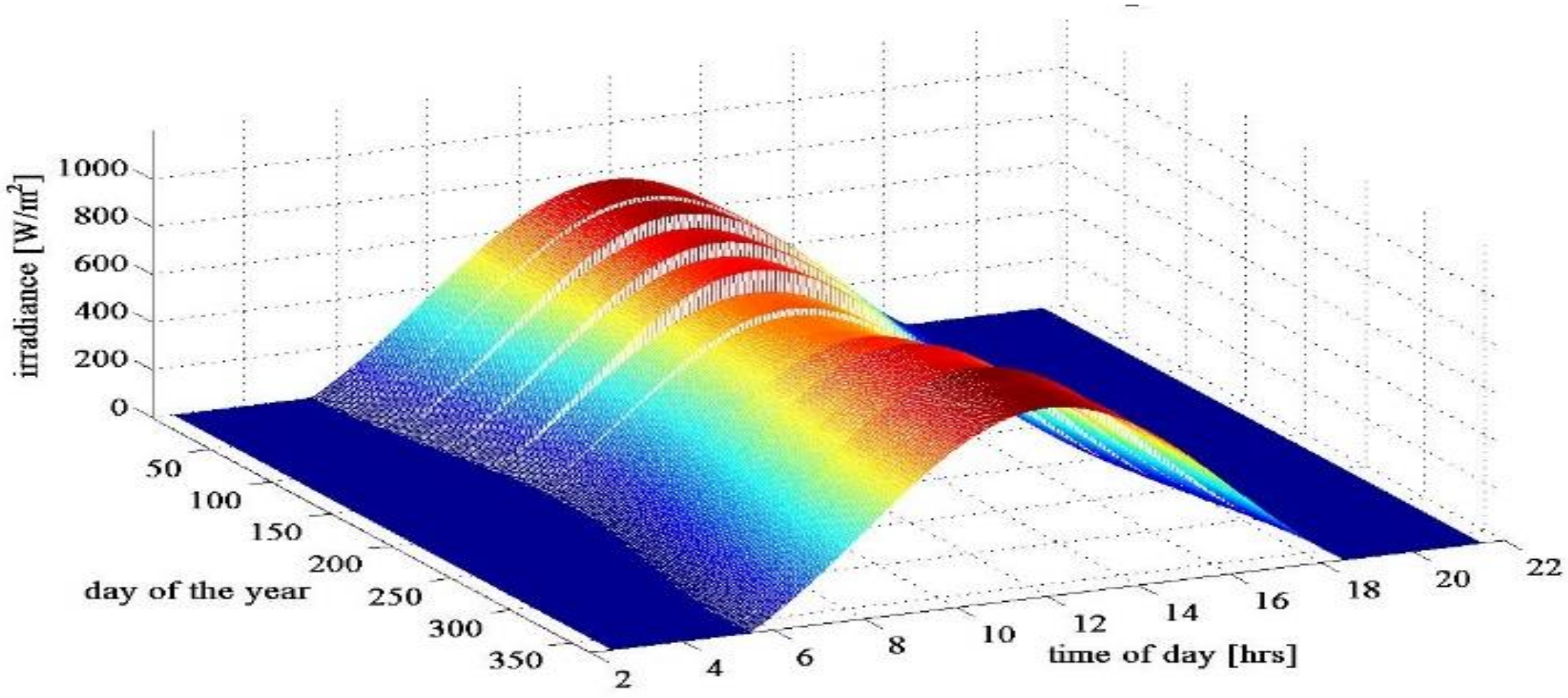
Seasonal variation of solar radiation in Windhoek

Results – 3D …..



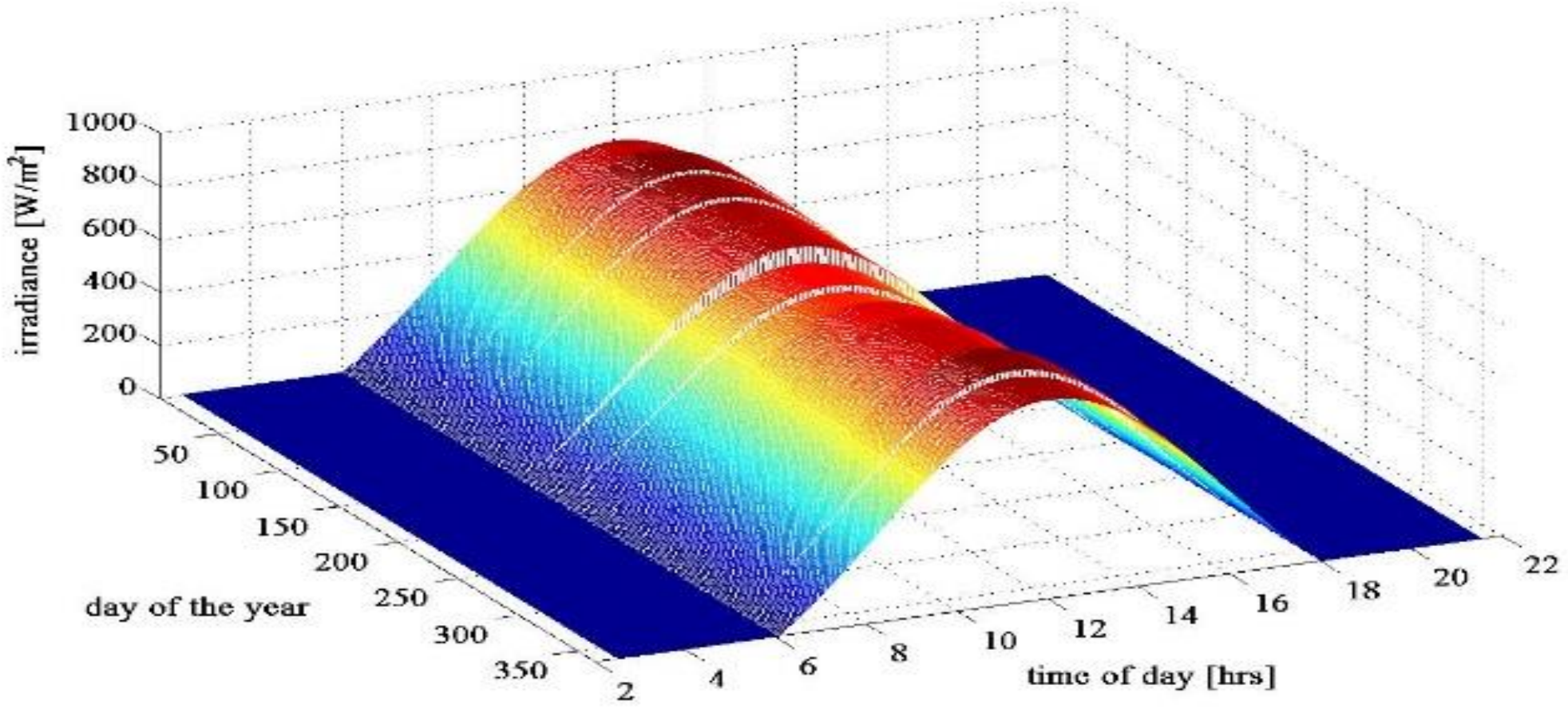
Seasonal variation of solar radiation in Keetmanshoop

Results – 3D …..



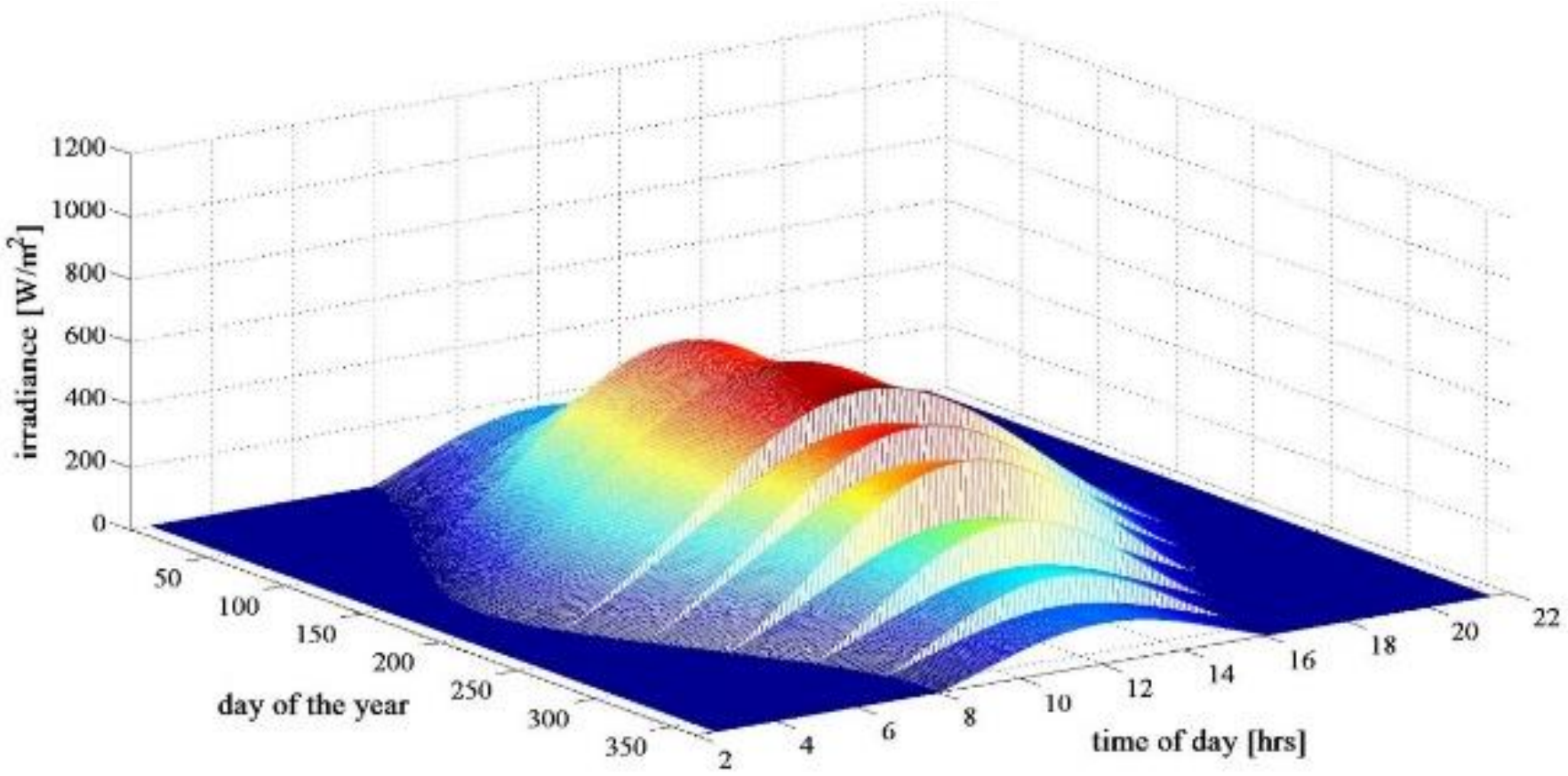
Seasonal variation of solar radiation in Rundu

Results – 3D …..



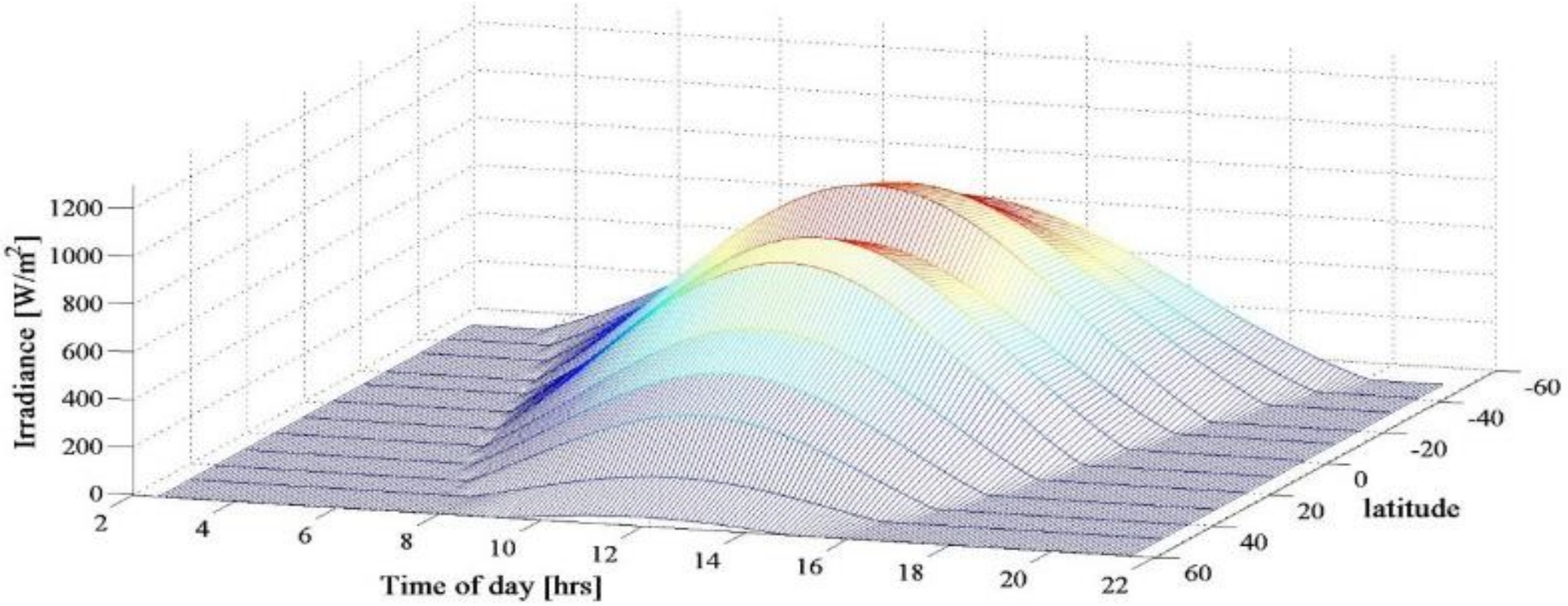
Seasonal variation of solar radiation in Kampala

Results – 3D …..



Seasonal variation of solar radiation in Paris

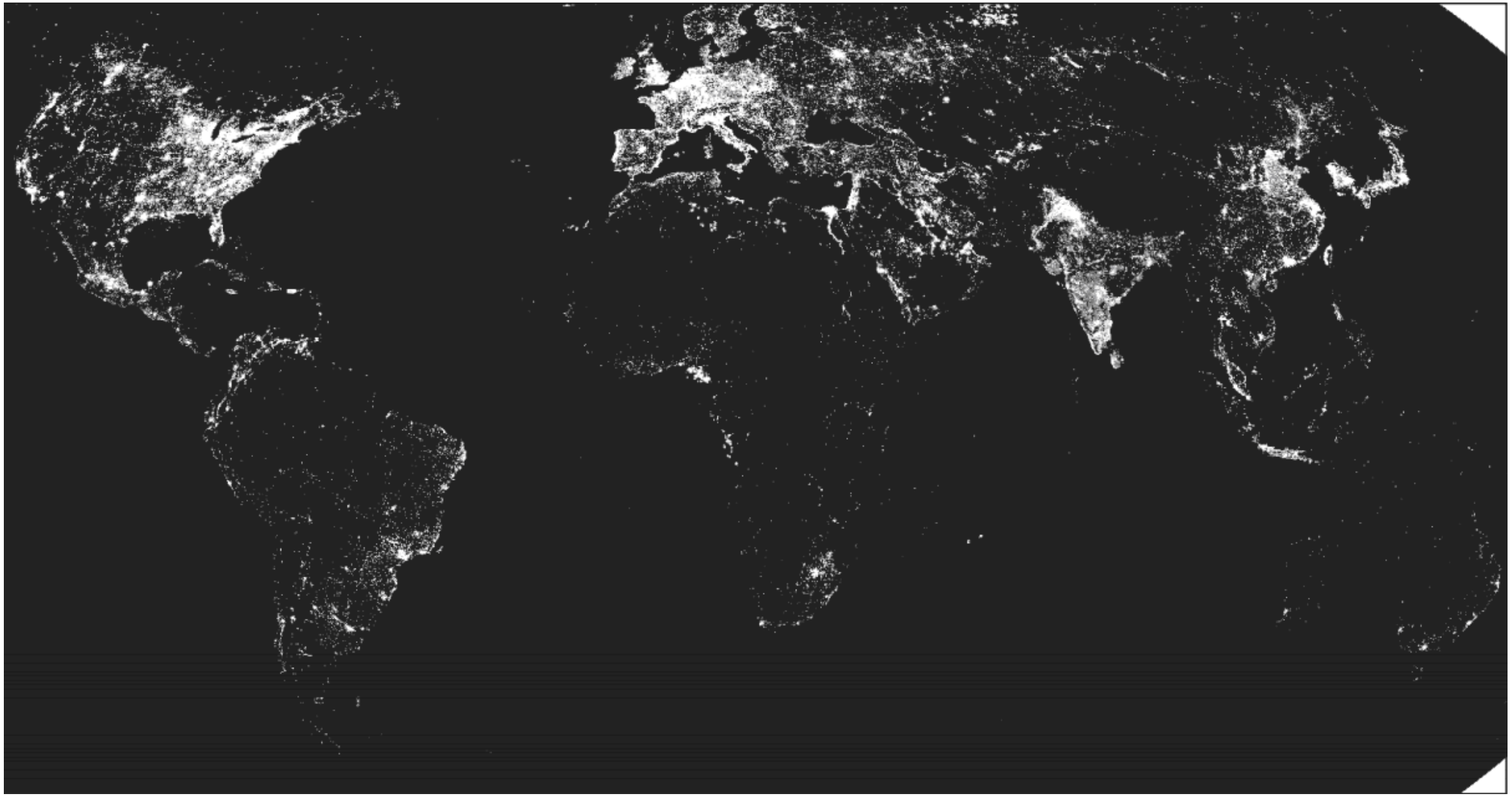
Results – 3D …..



Seasonal variation of solar radiation at different latitudes on 21st December

Conclusions

- The paper compared solar radiation models developed by various researchers. The models are based on assumption that the radiation is received with clear sky.
- Basing on the knowledge of 2-D models the regional and annual variations in radiation are represented by 3-D graphs.
- The 3-D representation is giving a visual demonstration of seasonal and regional variations in the solar radiation.
- Knowledge of 3-D modelling can be applied by researchers and educationists to demonstrate the seasonal variation.



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