EGU22-380
https://doi.org/10.5194/egusphere-egu22-380
EGU General Assembly 2022

Comparative analysis of wind and solar energy potential from differnet climate regions, case studies of Morocco , India and Kenya

Abderrahmane Mendyl[1], Arun Gandhi[1], Peter K Musyimi[2,3], Balázs Székely[2], and Tamás Weidinger[1]

[1]ELTE, Geography and Earth Sciences Institute, Department of Meteorology , Hungary (mendyl.abderrahmane@gmail.com)
[2]ELTE, Geography and Earth Sciences Institute, Department of Geophysics and Space Science, Hungary
[3]Karatina University, Department of Humanities and Languages, Kenya

Wind and solar energy have emerged as the one of the most popular and successful sources of renewable energy in combating environmental degradation and climate change. Countries around the world are developing policy mechanisms for increasing the share of renewable energy technologies for fulfilling their energy demands. Both wind and solar have proved their potential as clean and efficient sources of energy generation. Therefore, transitioning into a sustainable future requires a shift from fossil fuels to renewable energy technologies. The main goal of this study is to compare wind and solar energy potential for different climate regions of Morocco, India and Kenya using standard methodologies.

In this study we have used the wind profile power law relationship for estimating the wind speed and power at 100 m level. We are analysing long term synoptic datasets from 2 to 4 synop stations in arid and humid regions of North India, Morocco and Kenya based on the Meteomanz standard meteorological database. Stability dependent power law profile approximations were used and comparisons made with ERA5 reanalysis data. Estimation of wind energy production for different continental wind generators were also provided. Using the connection between the wind speed and profile law we demonstrated how wind energy can vary using different values of power law exponents for different climatic regions.

Standard meteorological measurements (temperature, humidity and cloudiness) gave the opportunity for estimation of global irradiance which was also compared with the ERA5 dataset. Applicability of widely used direct and diffuse irradiance parameterizations for different climate regions were also investigated.

For instance, in Marrakech the six Pasquill-Gifford stability classes were determined by estimating the global solar irradiance for cloudy and clear sky conditions as well as the wind speed. Analysis of the data showed that windspeed at 10 m varied between 1.8 m/s in the early morning (UTC 06:00) to 3.5 m/s in the evening (UTC 18:00) while the windspeed at 100 m varied between 2.6 m/s and 5 m/s at the same time periods. The estimated wind energy at 100 m level for rural areas was

more than that of urban areas The wind energy at 100 m varied between 47.2 KW in the early morning (UTC 06:00) to 573 KW in the evening (UTC 18:00) for the rural areas while in urban areas the variation was between 83.8 KW to 670.5 KW during the same time periods. The annual average global solar radiation was found to be maximum during the afternoon with a value more than 970 W/m^2.