**Data Article**

**Title**: Vine copula modelling of extreme temperature, wind speed and relative humidity towards enhancement of renewable energy production

**Authors**: [1]Maashele Kholofelo Metwane, [1]Daniel Maposa, and [2]Caston Sigauke
**Affiliations**: [1]Department of Statistics and Operations Research, University of Limpopo, Private Bag X1106, Sovenga 0727, South Africa
[2]Department of Mathematical and Computational Sciences, University of Venda, Private Bag X5050, Thohoyandou, 0950, South Africa. **Contact email**: caston.sigauke@univen.ac.za

**Abstract**

The study highlights that renewable energy, especially wind and solar, heavily depends on weather variables. However, in cases of extreme weather events, the generation of renewable energies can be disrupted. Research shows that traditional copula models fail to capture tail dependencies in multivariate weather data, but vine copulas offer greater flexibility for modelling such extremes. The research used vine copulas to analyse extreme temperature, wind speed, and humidity in South Africa's Eastern Cape province. Using partitioning around medoids (PAM), commonly known as K-Medoids, the province was clustered into five subregions based on coordinates, longitudes and latitudes. Results showed that vine copulas effectively model non-linear, tail-dependent relationships, indicating the region's high potential for renewable energy. These findings can guide policy and grid resilience strategies, emphasising the importance of risk assessment for extreme weather impacts on renewable energy production. The data are stored in an Excel file.

**Specifications Table**

| | |
|---|---|
| Subject area | *Renewable Energy Modelling* |
| Specific subject area | *Extreme weather events* |
| Type of data | *Excel file* |
| How data was acquired | *Provided by the South African Weather Services and from the internet https://open-meteo.com/en/docs/historical-weather-api* |
| Data format | *Filtered and analysed.* |
| Data source location | South African Weather Services and Historical Weather API *data portal webpage* |
| Data accessibility | *The data is hosted on https://drive.google.com/file/d/1_QUJpzOyVJEsRhRWqNIPh-htxEkufWlW/view?usp=sharing* |
| Related research article | Vine copula modelling of extreme temperature, wind speed and relative humidity towards enhancement of renewable energy production |

## Value of the Data

The data can be used for modelling extreme temperature, wind speed, and relative humidity to improve renewable energy generation.

## Data

The data used in this study is from the Historical Weather API, and it can be accessed from https://open-meteo.com/en/docs/historical-weather-api. The data comprises the following weather variables: hourly temperature, relative humidity and wind speed.

## Experimental Design, Materials, and Methods

The data used in the study is from the Historical Weather API.

## Acknowledgements

The authors acknowledge the South African Weather Services and Historical Weather API for providing the data.

## References

Historical Weather API https://open-meteo.com/en/docs/historical-weather-api (accessed on 10 March 2025).