

Analysis of Climate Variability and Proposal of Indices for the Quantification of Climate Change

Nikolaos Rapsomanikis, Efthimios Zervas
Hellenic Open University - Patra (Greece)

Introduction

The increase in the average temperature on Earth has led to changes in the climate system (changes in the atmosphere, cryosphere, hydrosphere) and an increase in the intensity and frequency of extreme events (IPCC, 2014). Temperature extremes (heat waves and cold spells) are associated with changes in variability. The Expert Team on Climate Change Detection and Indices (ETCDII) has created 27 indices to monitor climate change and extreme events. However, it is not possible to quantify climate variability with these indices. An attempt to quantify climate change was made by Zacharaki et al. (2022a, b) based on air temperature variability. Kalyvas et al. (2021) used a Fourier transform to calculate temperature variability within a year by calculating the difference between recorded temperature values

and those derived from Fourier harmonic analysis. Temperature extremes can also be calculated using Fourier harmonic analysis (Zervas & Kalyvas, 2021). However, these indices only refer to temperature and not to other meteorological variables. Moreover, there are only a limited number of studies dealing with the analysis and quantification of temperature variability. Therefore, the purpose of this work is to establish a set of indices for better quantification of climate change and better analysis of climate variability.

Methods

- In this study, meteorological data (such as temperature and humidity data) are collected from different stations around the world.
- Then, climate change indicators will be created for each meteorological parameter.
- Analysis will be performed on a monthly, seasonal and annual basis using the R programming language.

Results

- The quantification of variability will be carried out for each area.
- An analysis of the trend of climate variability will be performed using the indices.
- The future trends of climate variability will be examined for each area.

References

1. IPCC (2014). Climate Change 2014: Synthesis Report.
2. Kalyvas, T., Manika, S., & Zervas, E. (2021). Basic principles of the TEVY index for the quantification of temperature variability within a year. *IOP Conference Series: Earth and Environmental Science*, 899(1), 012023. <https://doi.org/10.1088/1755-1315/899/1/012023>
3. Zacharaki, K., Tseliou, A., Rapsomanikis, N., & Zervas, E. (2022a). New temperature indices for the estimation of temperature variability. Application in Athens's greater area. *IOP Conference Series: Earth and Environmental Science*, 1123(1), 012018. <https://doi.org/10.1088/1755-1315/1123/1/012018>
4. Zacharaki, K., Tseliou, A., Rapsomanikis, N., & Zervas, E. (2022b). Use of new indices for the quantification of climate change based on air temperature variability. *IOP Conference Series: Earth and Environmental Science*, 1123(1), 012017. <https://doi.org/10.1088/1755-1315/1123/1/012017>
5. Zervas, E., & Kalyvas, T. (2021). *Proposed temperature extremes index based on Fourier harmonic analysis*. Maltepe University International Student Congress, ENSAD, 5-7 May