Contribution ID: **211** Contribution code: **S10-MG-213** Type: **Poster presentation**

The evaluation of vulnerability to extreme climate events over Balkan Peninsula using modified Climate Extremes Index

Monday, 29 August 2022 18:00 (1h 30m)

Assessing the variability of climate extremes in changing climate is one of the greatest and most important challenges in climate science, not only because these events are rare, but also because they can be accompanied by devastating consequences. Climate change in the future could lead to an increase in the frequency, intensity and duration of extreme events and the greatest impact on the global ecosystem will be manifested through extreme weather events.

A climate index is defined as a calculated value that can be used to describe the state and the changes in the climate system. By using such climate indices, we are able to perform statistical analyses of variations of the dependent climatological aspects, such as analysis and comparison of time series, means, extremes and trends and to better understand current and future exposure to combined extreme climate conditions.

Previous studies mostly focused on single extreme events, but in order to explain the combined impacts and future exposures to have comprehensive knowledge, we also need to examine the concept of combining extreme events. The aim of this study is to estimate exposure to the aggregated climate extremes in historical and future climate.

In this study we used the modified Climate Extremes Index (mCEI) which was developed by Kelebek et al. (Kelebek et al. 2021) for spatiotemporal analyses of climate extremes. The domain of our study is focused on the Balkan peninsula, because this area is marked as one of the major hotspots for the combined extremes. For the calculation of the annual and seasonal values of mCEI we first calculated ten different percentile based climate indices, including temperature and precipitation indices of extremes and drought indicator (scPDSI). Each of the percentile values is calculated using the 1961–1990 standard reference period. We used E – OBS observational gridded dataset with horizontal resolution 0.1 degree, for historical period, and EURO-CORDEX Project database, for future projections. For the annual and seasonal time series, the trend of the index was computed and tested for statistical significance using the nonparametric Man-Kendall test and the Sen's slope estimator. The individual change of each index integrated in mCEI was analysed to better understand the drivers of the final mCEI.

We conclude that mCEI is a very useful tool because it assimilates the effects of different extreme climate conditions in one combined index. We found that our research area has experienced an increase in extremes in recent decades and, according to scenario RCP8.5 for climate projections, an upcoming change that exposure to these extremes is expected to exceed in the future and become more vulnerable to climate extremes.

Kelebek, M.B., Batibeniz, F. and Önol, B., 2021. Exposure assessment of climate extremes over the Europe–mediterranean region. Atmosphere, 12(5), p.633.

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Session Classification: Poster session

Track Classification: Scientific Sections: S10 Meteorology and Geophysics