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Variability of climate extremes in Romania and associated large-scale mechanisms

Aristita Busuioc, Andreea Dobrinescu, Alina Orzan, and Alexandru Dumitrescu
National Meteorological Administration, Romania (busuioc@meteoromania.ro)

The characteristics of spatial and temporal variability of seasonal indices associated to four thermal extremes (frequency of very warm days/nights, longest period of very warm days/nights) and three precipitation extremes (longest period without precipitation, frequency of very wet days, longest very wet period) in Romania are firstly analysed. This analysis is achieved over the period 1961-2010 using daily temperature and precipitation data recorded at all Romanian stations with complete observations (78 for temperature and 98 for precipitation). For these indices, the statistical significance of linear trends (given by the Mann Kendall test) as well as characteristics of their simultaneous variability (using multifield EOF analysis) is achieved.
Secondly, to understand the large-scale mechanisms controlling the characteristics of the spatial and temporal variability of the analysed climate extremes (predictands), the Canonical Correlation Analysis (CCA) is used. As large-scale predictors, various climate variables extracted from the NCEP/ERA40 (sea level pressure, temperature at 850 hPa, specific humidity at 700/850 hPa, etc) reanalysis data are used, either separately or together. In the CCA, the predictands are also used in various combinations allowing identification the complexity of interactions between climate extremes in Romania and large-scale predictors.
The results show a significant increasing trend, in all seasons (except for autumn), for all indices associated to the 4 thermal extremes, the increase rate being more pronounced in summer, when it is significant at 5% level for the entire country, and less pronounced in spring. Regarding precipitation, there were found significant increasing trends over large areas in the frequency of very wet days during autumn, and in the maximum interval without precipitation during summer. All other trends are not significant, except for few isolated stations. In order to enforce these findings, the same indices computed for the period 1901-2010 at the Bucuresti-Filaret station have been analyzed, the results being confirmed only for thermal extremes, in all seasons. Components of decadal-multidecadal variability are revealed by the long time series analysis, especially for precipitation.
The multifield EOF reveals, as principal mode, the same sign of simultaneous variability for all thermal extremes and opposite variability between thermal and precipitation extremes, except for longest period without precipitation, suggesting various mechanisms controlling the variability of climate extremes in Romania. These mechanisms are objectively identified through the CCA method, applied to combination between more large-scale predictors and combination of more extreme indices over Romania. The results show physically plausible connections between spatial patterns of simultaneous variability of more extreme indices in Romania and spatial patterns of simultaneous variability of more large-scale predictors. These results will be used in future studies to construct statistical downscaling models for these indices.
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