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OBJECTIVE

The characteristics of spatial and temporal variability of seasonal indices associated to thermal and precipitation extremes in Romania are firstly analysed. This analysis is achieved over the period 1961-2010. For these indices, the statistical significance of linear trends as well as characteristics of their simultaneous variability (using multifield EOF analysis) is achieved. Understand of large-scale mechanisms controlling the characteristics of the spatial and temporal variability of the analysed climate extremes (considered separately or in various combination) are secondly analysed.

Results

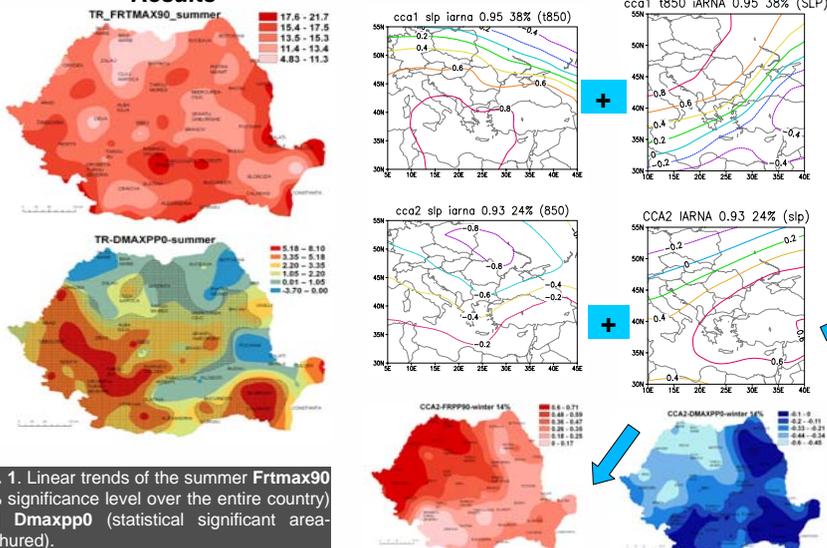


Fig. 1. Linear trends of the summer $Frtmax90$ (5% significance level over the entire country) and $Dmaxpp0$ (statistical significant area-hatched).

Results

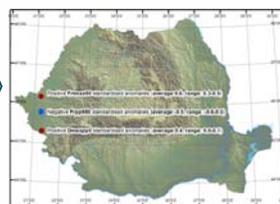
- Significant increasing trend, in all seasons (except for autumn), for all indices associated to the 4 thermal extremes, the increase rate being more pronounced in summer, when it is significant at 5% level for the entire country, and less pronounced in spring (fig.1).
- Regarding precipitation, significant increasing trends over large areas in the $Frppmax90$ during autumn, and in the $Dmaxpp0$ during summer;
- The multifield EOF analysis reveals, as principal mode, the same sign of simultaneous variability for all thermal extremes and opposite variability between thermal and precipitation extremes, except for $Dmaxpp0$ (fig. 1);
- CCA analysis applied to the combination between more large-scale predictors and combination of more extreme indices over Romania, shows 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 (see example from figures 2 and 3).

- 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.

DATA AND METHODS

- Seasonal indices associated to four thermal extremes (frequency of very warm days- $Frtmax90$ /nights- $Frtmin90$, longest period of very warm days- $Dtmax90$ /nights- $Dtmin90$) and three precipitation extremes (longest period without precipitation- $Dmaxpp0$, frequency of very wet days- $Frpp90$, longest very wet period- $Dmaxpp90$);
- Large/regional scale predictors (NCAR/NCEP reanalysis: temperature at 850hPa- $T850$, specific humidity at 700 hPa- $SH700$);
- Methods: Mann-Kendall and Pettitt tests, EOF and CCA .

CCA1 var:30%



CCA2 var:14%

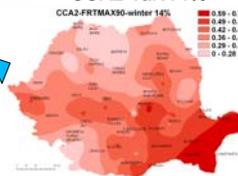
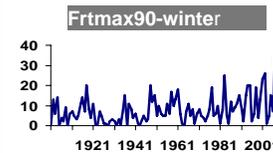
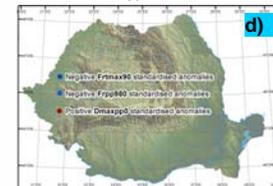


Fig. 2. CCA patterns of the two combined large/regional scale predictors (SLP -left, $T850$ -right) and three combined climate extreme indices in Romania as predictand; for CCA2 the three predictands are displayed separately ($Frtmax90$, $Frpp90$, $Dmaxpp0$). Correlation coefficient between CCA series and explained variance of predictor/predictand are displayed.



24%



Var: 5%

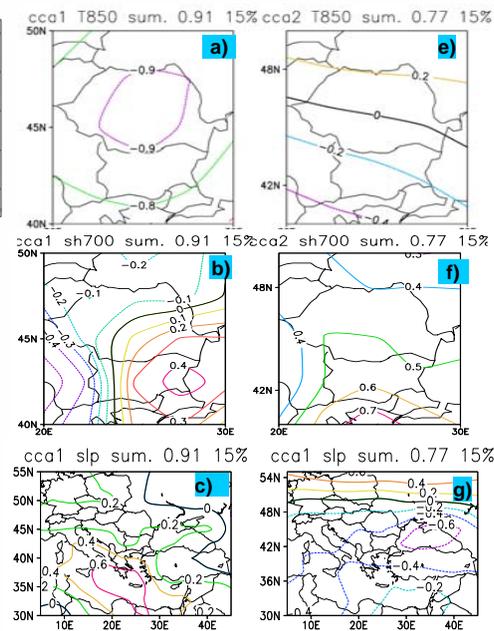
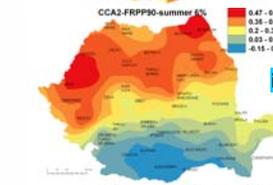


Fig. 3. CCA patterns of the three combined large/regional scale predictors and three combined extreme climate indices in Romania as predictand; CCA1: predictor patterns (a- $T850$, b- $Sh700$, c- SLP) associated to predictand anomalies in Romania (d); CCA2: predictor patterns (e, f, g, same order as for CCA1) associated to predictand anomalies in Romania (h- $Frtmax90$, i- $Frpp90$, j- $Dmaxpp0$). Correlation coefficient between CCA series and explained variance of predictor/predictand are displayed.

Acknowledgements

This study was funded by the Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI) through the research project CLIMHYDEX "Changes in climate extremes and associated impact in hydrological events in Romania, cod PNII-ID-2011-2-0073 (<http://www.climhydex.meteoromania.ro>).