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Thermodynamic configurations associated with heavy rainfall in Eastern Romania

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Worldwide, meteorological events associated with severe weather affect life, property and infrastructure. Lately, heavy rainfalls led to loss of life and produced damages in various areas of Romania. The main aim of the paper is to investigate the dynamic and thermodynamic, both synoptic and mesoscale, configurations associated with severe weather in eastern Romania. Using the empirical orthogonal functions analysis, simultaneously applied to daily average geopotential field at different pressure levels, a number of severe weather events were clustered into classes. At European scale, the analysis showed the existence of three eigenvectors which describe up to 73% of the data. Using the projections of these vectors on the dataset, eight classes of configurations resulted. For each class the main dynamic characteristics were highlighted. Repeating the empirical orthogonal functions analysis on the same fields, but using reanalysis data at six hours interval, it was revealed that each class has a limited number of eigenvectors which can be used to explain the dynamic similarity between different baroclinic evolutions. The mesoscale feature analysis was performed using Doppler weather radar data. For all the classes, thermodynamic instability and dynamic organization factors increase from south to north in the studied area. The occurrence of certain classes takes place in different times of the convective season, while the most persistent classes are positioned in the middle of the convective season. An important finding is that by projecting the three eigenvectors on the numerical weather prediction models outputs, one can observe the most likely dynamic behavior to expect in a synoptic time interval. The climatological evolution of the projection on the data of each class, for the 1980–2013 interval, shows a change in the baroclinic dynamic configuration associated with heavy rainfall.