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Detecting the spatio-temporal propagation of heatwaves

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Heat waves are among the most hazardous climate extremes in Europe, commonly affecting large regions for a considerable amount of time. Especially in the recent past, heat waves account for substantial economic, social and ecologic impacts and loss. Projections suggest that their number, duration and intensity increase under changing climate conditions, stressing the importance of quantifying their characteristics. Yet, apart from the analysis of single historical events, little research is dedicated to the general propagation of heat waves in space and time.
Heat waves are rare in their occurrence and limited observational data provide little means for robust analyses and the understanding of dynamical spatio-temporal patterns. Therefore, we seek to increase the number of analyzable events by using a large climate model ensemble. The use of several model members of comparable climate statistics allows to robustly assessing various spatial patterns of heat waves as well as their typical temporal evolutions.
Here, we explore a data-driven approach to infer cause-and-effect relationships from, in this case, regional climate model ensemble data in order to analyze the spatio-temporal propagation of spatially distributed phenomena. Our aim is to investigate specifically the transitions and inter-dependencies among heat waves in Europe. The approach includes the identification of most frequent heat wave patterns by clustering and the derivation of directed links between core regions of these heat wave classes using causal discovery in a data set of high spatial resolution.
We present the setup of our framework, including clustering results of heat waves and first results of our analysis.