



Relationships between eigen and network techniques for the statistical analysis of climate data

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Eigen techniques such as empirical orthogonal function (EOF) or coupled pattern (CP) analysis are frequently used for detecting patterns in multivariate climatological data sets. Recently, statistical methods originating from the theory of complex networks have been employed for the very same purpose. This climate network analysis is based on the same set of similarity matrices as is used in classical EOF or CP analysis, e.g., the correlation matrix of a single climatological field or the cross-correlation matrix between two distinct climatological fields. In this paper, formal relationships between both eigen and network approaches are derived and illustrated using exemplary data sets. These results allow to pinpoint that climate network analysis can complement classical eigen techniques and provides additional higher-order information on the structure of statistical interrelationships in climatological data sets. Hence, climate networks are a valuable supplement to the statistical toolbox of the climatologist, particularly for making sense out of very large data sets such as those arising in the coupled model intercomparison project (CMIP).