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Pattern recognition in complex networks, based on spatially embedded time series

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Already known phenomena in the global climate system resemble characteristic patterns of movement and transport processes on different scales of both, time and space. The approach of complex networks allows to reveal important features of a high dimensional dynamical system, such as advective processes in flows. Given a number of time series that are spatially embedded in the considered physical system, a complex network can be constructed, e.g, using Pearson's cross correlation. The directed and weighted network measures of betweenness centrality and node degree are applied to this complex network. Additionally, the newly developed measure of edge angle anisotropy is then able to indicate directed transport pathways of, e.g., the advected material or climate patterns. The combination of these measures is able to distinguish between static structures and advective dynamics. Moreover, these measures capture local as well as global phenomena. Teleconnections as large scale patterns in the climate system are a good example for the importance of separating directed spreading of distinctive patterns from tightly enclosed local dynamics that do not further contribute to global interactions. Investigating the patterns in the considered physical system can support a better understanding and interpretation of different quantities in climate complex networks and their mutual interrelations. Hence, valuable novel insights in the characteristics of complex systems and their dynamics at different scales are provided.