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Evolving complex networks from global climatological fields on geodesic grids

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Recent research has revealed the applicability of complex network approaches for data analysis of global climatological fields. Designating points of a regular grid (of measurement stations, respectively reanalysis data sites) as nodes of a network and creation of edges between them using similarity measures (e.g., cross correlation, mutual information) leads to a network representation of the underlying dynamics. We use a geodesic grid (with roughly 2.5°x2.5° resolution), where each grid point covers approx. the same area. This approach inhibits biases due to the variable local node density, which appear in grids such as the frequently used regular latitude-longitude grid. The datasets of daily surface air temperature and pressure, covering the last 60 years, are split into partially overlapping windows (their width ranging from half a year up to decades), allowing to construct evolving networks, i.e., changing network topologies in time. Hereby, we are able to analyze correspondences in the temporal evolution of network properties and classical climate indices, e.g., SOI, NAO index. The spatiotemporally resolved network measures also highlight climatological phenomena such as ENSO or the impact of vulcanic eruptions.