Geophysical Research Abstracts
Vol. 12, EGU2010-1958-1, 2010
EGU General Assembly 2010

Significance tests for spatially embedded complex networks

Jonathan F. Donges (1,2), Reik V. Donner (1,3,4), Yong Zou (1), Norbert Marwan (1), Jürgen Kurths (1,2)

(1) Potsdam Institute for Climate Impact Research, Potsdam, Germany, (2) Department of Physics, Humboldt University, Berlin, Germany, (3) Max Planck Institute for Physics of Complex Systems, Dresden, Germany, (4) Institute for Transport and Economics, Dresden University of Technology, Dresden, Germany

The analysis of spatially embedded complex networks, i.e., networks with vertices embedded in a metric space, is of increasing interest in many fields of science, particularly in the geosciences. Examples are climate networks in meteorology, earthquake networks in geology or recurrence networks for time series analysis. In many cases, there is some degree of uncertainty about the network structure, e.g., edges might be missing in the network that exist in the system under study (the opposite may also be true). This is particularly true for networks constructed from multivariate data using tools of time series analysis. Given this uncertainty, it is very important to evaluate the significance of measured network properties such as clustering coefficient, average path length, degree distribution or various vertex centrality sequences with respect to a given null hypothesis. Here we present different types of surrogates for spatially embedded networks, i.e., random networks with prescribed spatial constraints such as fixed edge distance distribution or a fixed average edge distance sequence, and show how to use them for testing the associated null hypotheses. We demonstrate the proposed significance tests for a global climate network constructed from coupled model surface air temperature data.