Geophysical Research Abstracts
Vol. 18, EGU2016-13814, 2016
EGU General Assembly 2016


# Reconstructing causal pathways and optimal prediction from multivariate time series using the Tigramite package

Jakob Runge (1,2)

(1) Potsdam Institute for Climate Impact Research, Research Domain IV: Transdisciplinary Concepts and Methods, Potsdam, Germany, (2) Imperial College, Grantham Institute – Climate Change and the Environment, London, UK

Causal reconstruction techniques from multivariate time series have become a popular approach to analyze interactions in complex systems such as the Earth. These approaches allow to exclude effects of common drivers and indirect influences. Practical applications are, however, especially challenging if nonlinear interactions are taken into account and for typically strongly autocorrelated climate time series.
Here we discuss a new reconstruction approach with accompanying software package (Tigramite) and focus on two applications:
(1) Information or perturbation transfer along causal pathways. This method allows to detect and quantify which intermediate nodes are important mediators of an interaction mechanism and is illustrated to disentangle pathways of atmospheric flow over Europe and for the ENSO - Indian Monsoon interaction mechanism.
(2) A nonlinear model-free prediction technique that efficiently utilizes causal drivers and can be shown to yield information-theoretically optimal predictors avoiding over-fitting. The performance of this framework is illustrated on a climatological index of El Nino Southern Oscillation.

References:

Runge, J. (2015). Quantifying information transfer and mediation along causal pathways in complex systems. Phys. Rev. E, 92(6), 062829. doi:10.1103/PhysRevE.92.062829

Runge, J., Donner, R. V., & Kurths, J. (2015). Optimal model-free prediction from multivariate time series. Phys. Rev. E, 91(5), 052909. doi:10.1103/PhysRevE.91.052909

Runge, J., Petoukhov, V., Donges, J. F., Hlinka, J., Jajcay, N., Vejmelka, M., … Kurths, J. (2015). Identifying causal gateways and mediators in complex spatio-temporal systems. Nature Communications, 6, 8502. doi:10.1038/ncomms9502