Geophysical Research Abstracts
Vol. 14, EGU2012-5669, 2012
EGU General Assembly 2012

A model-free definition of coupling strength for assessing the influence between climatic processes

J. Runge (1,2) and J. Kurths (1,2)

(1) Potsdam Institute for Climate Impact Research, Research Domain IV: Transdisciplinary Concepts and Methods, Potsdam, Germany (jakobrunge@gmail.com), (2) Institute of Physics, Humboldt University, Berlin, Germany

Assessing the strength of influence between climatic processes from observational data is an important problem on the way to construct conceptual models or make predictions. An example being the influence of ENSO on the Indian Monsoon compared to the influence of other climatic processes.
It is an especially difficult task if the interactions are nonlinear where linear measures like the Pearson correlation coefficient fail. Apart from nonlinearity, auto-dependencies in the processes can lead to misleading high values of coupling strength.
There exist statistical methods that address these issues, but most of them assume some model, e.g., a linear model in the case of the partial correlation.
We propose a measure based on conditional mutual information that makes no assumptions on the underlying model and is able to exclude auto-dependencies and even influences of external processes. We investigate how the strength measured relates to model systems where a coupling strength is known and discuss its limitations.
The measure is applied to time series of different climate indices and gridded data sets to gain insights into the coupling strength between climatic teleconnections. Applied to more than two time series it is also able to shed light on mechanisms of interactions between multiple processes.