

## Is there a Climate Network – A Backbone of the Climate System?

J. Kurths, J. Donges, N. Marwan, and Y. Zou

Potsdam Institute for Climate Impact Research and  
Humboldt University Berlin, Institute of Physics, Germany  
[Juergen.Kurths@pik-potsdam.de](mailto:Juergen.Kurths@pik-potsdam.de)

### Abstract

We consider an inverse problem: Is there a backbone-like structure underlying the climate system? For this we propose a method to reconstruct and analyze a complex network from data generated by a spatio-temporal dynamical system. This technique is then applied to reanalysis and model surface air temperature data. Parameters of this network, as betweenness centrality, uncover relations to global circulation patterns in oceans and atmosphere. We especially study the role of hubs and of long range connections, called teleconnections, in the flows of energy and matter in the climate system. The global scale view on climate networks offers promising new perspectives for detecting dynamical structures based on nonlinear physical processes in the climate system.

### References

- Arenas, A., A. Diaz-Guilera, J. Kurths, Y. Moreno, and C. Zhou, Phys. Reports 2008, 469, 93.  
Donges, J., Y. Zou, N. Marwan, and J. Kurths, Europ. Phys. J. ST 2009, 174, 157-179.  
Donges, J., Y. Zou, N. Marwan, and J. Kurths, Europhys. Lett. 2009, 87, 48007.  
Nawrath, J. et al., Phys. Rev. Lett. 2010, 104, 038701.  
Donner, R., Y. Zou, J. Donges, N. Marwan, and J. Kurths, Phys. Rev. E 2010, 81, 015101(R).