Geophysical Research Abstracts
Vol. 18, EGU2016-6146, 2016
EGU General Assembly 2016

Investigating Hilbert frequency dynamics and synchronisation in climate data

Dario Zappalà, Cristina Masoller, and Giulio Tirabassi

Universitat Politècnica de Catalunya, Departament de Física, Terrassa, España (dario.zappala@upc.edu, cristina.masoller@upc.edu, giulio.tirabassi@upc.edu)

In this work we investigate climate dynamics and interactions from the point of view of synchronisation. We analyse daily Surface Air Temperature (SAT) time series in 10512 grid points over the Earth's surface. [1] From each SAT time series we calculate the anomalies time series and also, by using the Hilbert transform, we calculate the frequency time series. By plotting the map of the average frequency in every grid point, we extract relevant information about the SAT dynamics in different regions of the world. Then, we calculate frequency and anomalies autocorrelations. The autocorrelation maps also allow uncovering geographical regions with different memory properties.

In a second step, to detect Hilbert-frequency synchronisation in different regions, we compute the zero-lag cross correlation (CC). By thresholding the CC matrices (both, of SAT anomalies and of Hilbert frequencies), we build two undirected networks. A comparison between these networks allows to test the recent demonstration of optimal network inference when the similarity analysis is performed over Hilbert frequency time series. [2]

In a third step, we consider non uniform thresholds and keep in each geographical location only the links with the highest CC values. In this way, we build directed networks that allow identifying in each geographical region the most relevant inward teleconnections.

[1] ERA-Interim analysis daily data, from the European Centre for Medium-Range Weather Forecasts.
[2] G. Tirabassi, R. Sevilla-Escoboza, J. M. Buldú and C. Masoller, Inferring the connectivity of coupled oscillators from time-series statistical similarity analysis, Sci. Rep. 5 10829 (2015).