Climate Network based El Niño Forecasting

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The El Niño Southern Oscillation (ENSO) is the most prominent phenomenon of climate variability and affects weather and climate in large parts of the world. Recently [1,2], we have developed a dynamical network approach for predicting the start of El Niño events well before the spring barrier. In the climate network, the nodes are grid points in the Pacific, and the strengths of the links (teleconnections) between them are characterized by the cross-correlations of the atmospheric surface temperatures at the grid points. In the year before an El Niño event, the links between the eastern equatorial Pacific and the rest of the Pacific tend to strengthen such that the mean link strength exceeds a certain threshold. This feature allows predicting an El Niño event in the following year with 80% probability. The threshold was determined in a learning phase (1950-1980) and the prediction performance was tested in a hindcasting phase (1981-2011).

Here we discuss the excellent *forecasting* performance of the algorithm in the subsequent period 2012-2018 and compare it to standard El Niño forecasts. In addition, we examine if the observed strengthening of the links in the year before an El Niño event is also present in control runs of coupled general circulation models.

References

[1] Ludescher J, Gozolchiani A, Bogachev MI, Bunde A, Havlin S, Schellnhuber, HJ (2013) Improved El Niño forecasting by cooperativity detection. *Proc Natl Acad Sci USA* 110(29), 11742.

[2] Ludescher J, Gozolchiani A, Bogachev MI, Bunde A, Havlin S, Schellnhuber, HJ (2014) Very early warning of next El Niño. *Proc Natl Acad Sci USA* 111(6), 2064.