EGU21-8740, updated on 05 Dec 2022
https://doi.org/10.5194/egusphere-egu21-8740
EGU General Assembly 2021

A comparative study of extreme precipitation patterns using complex networks

Zhen Su[1,2], Shraddha Gupta[1,2], Norbert Marwan[1,3], Niklas Boers[1,4,5], and Jürgen Kurths[1,2]
[1]Potsdam Institute for Climate Impact Research, Complexity Science, Potsdam, Germany
[2]Humboldt University at Berlin, Berlin, Germany
[3]Institute of Geoscience, University of Potsdam, 14476 Potsdam, Germany
[4]Department of Mathematics and Computer Science, Freie Universität Berlin, Germany
[5]Department of Mathematics and Global Systems Institute, University of Exeter, UK

The spatio-temporal patterns of precipitation are of considerable relevance in the context of understanding the underlying mechanism of climate phenomena. The application of the complex network paradigm as a data-driven technique for the investigation of the climate system has contributed significantly to identifying the key regions influencing the climate variability of a target region of interest and, in particular, to improving the predictability of extreme events. In our work, we conduct a comparative study of precipitation patterns by constructing functional climate networks using two nonlinear event similarity measures – event synchronization (ES) and edit-distance (ED). Event synchronization has been widely applied to identify interactions between occurrences of different climate phenomena by counting the number of synchronized events between two event series. Edit-distance measures the similarity between sequences by minimizing the number of operations required to transform one sequence to another. We suggest edit-distance as an alternative approach for network reconstruction that can measure similarity between two event series by incorporating not only event occurrences but also event amplitudes. Here, we compare the global extreme precipitation patterns obtained from both reconstruction methods based on the topological characteristics of the resulting networks. As a case study, we compare selected features of network representations of East Asian heavy precipitation events obtained using both ES and ED. Our results reveal the complex nature of the interaction between the Indian Summer Monsoon (ISM) and the East Asian Summer Monsoon (EASM) systems. Through a systematic comparison, we explore the limitations of both measures and show the robustness of the network structures.