EGU21-4670, updated on 05 Dec 2022
https://doi.org/10.5194/egusphere-egu21-4670
EGU General Assembly 2021

Network-based approach to unravel sea-surface temperature and streamflow connectivity at different timescales

Abinesh Ganapathy[1], Ravi Kumar Guntu[1], Ugur Ozturk[2], Bruno Merz[3], and Ankit Agarwal[1]
[1]Department of Hydrology, Indian Institute of Technology Roorkee, Roorkee, India
[2]Institute of Earth and Environmental Science, University of Potsdam
[3]GFZ German Research Centre for Geosciences, Section 5.4: Hydrology, Telegrafenberg, 14473 Potsdam, Germany

Understanding the interactions between oceanic conditions and streamflow can deepen our knowledge on hydrological aspects. Most studies exploring this relationship only focus on seasonal or annual scales. However, various atmospheric and oceanic phenomena occur at different timescales and need to be accounted to attribute connectivity between sea-surface temperature and streamflow to specific oceanic and climate processes. In this study, we have investigated the influence of sea-surface temperature (SST) on German streamflow at timescales ranging from sub-seasonal to decadal. We apply wavelets' concepts to decompose the time series into multiple frequency signals and fed into complex networks to identify spatial connections. We employ degree centrality metric and average link distance concepts to interpret the outcomes of coupled SST-Streamflow networks. Our results indicate that the SST anomaly at North Atlantic Ocean region has a stable connection with German streamflow at shorter timescales up to annual scale. We also noticed scale-specific connections in the Pacific, Indian and Southern ocean regions at different timescales ranging from seasonal to decadal scale. Scale-specific connections exhibited by the streamflow stations at all timescales makes it difficult to cluster based on degree centrality. We observed that streamflow stations are influenced by short-range local connections at lower timescales and long-range teleconnections at higher time scale. Our preliminary analysis highlight that the low frequent streamflow extremes have long-range connections, usually not captured at the original scale, and geographical proximity plays a role in high-frequency streamflow signals, according to Tobler's first law of geography. The results obtained from this study reconfirms reported existing streamflow influences and helped gain insights over other possible large-scale climatic influences.