Geophysical Research Abstracts
Vol. 20, EGU2018-6627-2, 2018
EGU General Assembly 2018

ENSO's different flavors and global patterns of seasonal climate anomalies

Catrin Kirsch, Anna Lensch, and Reik Donner

Potsdam Institute for Climate Impact Research, Transdisciplinary Concepts & Methods, Potsdam, Germany (catrin.kirsch@pik-potsdam.de)

During the last decades, the global teleconnectivity of the El Niño Southern Oscillation (ENSO) as one of the most prominent patterns of interannual climate variability has been a subject of many studies. In particular, it has been shown that the strongly positive (El Niño) and negative ENSO phases (La Niña) have strong impacts on meteorological conditions in remote regions. Thereby, knowledge of the present ENSO state provides enhanced skills to global weather predictions.
Recent studies point towards a heteorogeneity of spatio-temporal correlation patterns in the global climate system associated with different El Niño and La Niña events and their specific teleconnections, which have motivated a classification of both types of climate events into East Pacific (standard) and Central Pacific (Modoki) flavors. In this work, we study the likelihood of co-occurrence of these different flavors with seasonal extremes in 2-meter temperature, precipitation, geopotential heigth at 850 hPa and surface wind fields all around the globe.
For our study, we utilize gridded precipitation data provided by the Global Precipitation Climatology Centre (GPCC) v7 and 2-meter temperature, geopotential height and wind field from NCEP/NCAR Reanalysis 1 with a spatial resolution of 2.5×2.5. From the monthly values, we calculate seasonal aggregates as averages (temperature, geopotential height, wind field) and sums (precipitation), respectively, for the three seasons boral fall (SON), winter (DJF) and spring (MAM).
For each grid point, we then determine anomalous years as years where the corresponding values exceed the local 80th, or fall below the local 20th percentile of all values for this season at the given site. For both, positive and negative anomalies, we then estimate the likelihood of co-occurrence with any type of ENSO period (i.e., East or Central Pacific El Niño or La Niña). Within the framework of event coincidence analysis, we finally test the obtained likelihoods for all combinations of events for their significance against the null hypothesis of independent and randomly distributed events. Recording only those event combinations with a resulting p-value below 0.05 allows identifying characteristic spatial patterns highlighting those regions where seasonal climate anomalies are likely related with any of the different types of ENSO phases.
Our results reveal three important facts: (1) The characteristic patterns of anomalous seasonal climate conditions differ between EP and CP type events, pointing towards essentially different teleconnectivity patterns controlling the emergence of extraordinary climate conditions. (2) In some areas, we identify even opposite behaviors between EP and CP type events. For example, Central Africa commonly exhibits particularly cool and dry conditions during EP El Niños as opposed to warmer and wetter conditions than usual during CP El Niñnos. (3) Finally, our results identify some regions where the effect changes qualitatively between subsequent seasons. Among others, during EP El Niños, the region north of Australia frequently experiences unusually cold SON seasons, but also an elevated frequency of extraordinarily warm DJF seasons.