

QUARTERLY PROGRESS REPORT (APRIL 2021 TO JUNE 2021)

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Title: A Network-based approach for the analysis of ENSO episode

Update of work done:

Previously, we note the different heat maps pattern for ENSO episodes and neutral conditions of the Pacific ocean, constructed from the time series of surface air temperature for the onset month of ENSO episodes. We further analyze the correlation matrix and plot the teleconnection links based on a higher correlation threshold.

The correlation values among the pairs of geographical sites are used as the elements of the heat map. The rows and column labels correspond to geographical sites. In the heat map, we are looking at all possible correlations among all the nodes. The Equatorial region $30^{\circ}N$ to $30^{\circ}S$ is represented by the node labels 232^{nd} to 464^{th} .

The diagonals of heat maps correspond to the self-correlation of the nodes. The following lines parallel to the diagonal are the nearest neighbor correlations for all El Niño Southern Oscillations. Thus, we get most connections from nearest neighbors, telling us that the climate network is close to a small-world network. We focus on the eastern equatorial Pacific ocean $20^{\circ}N - 20^{\circ}S, 100^{\circ}E - 60^{\circ}W$, (ENSO episodes are seawater temperature anomaly on that specified region) which in the heat maps corresponds to 299^{th} to 431^{st} grid points. On arrival of ENSO episodes, we observed an increase in the parallel lines to the diagonal except self-correlation and nearest-neighbor correlations on the heat maps corresponding to the eastern equatorial Pacific. We plot the links with three different correlation thresholds and teleconnection distribution associated with the links.

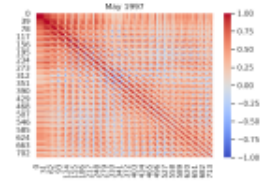


Figure 1: Very Strong El Niño episode onset.

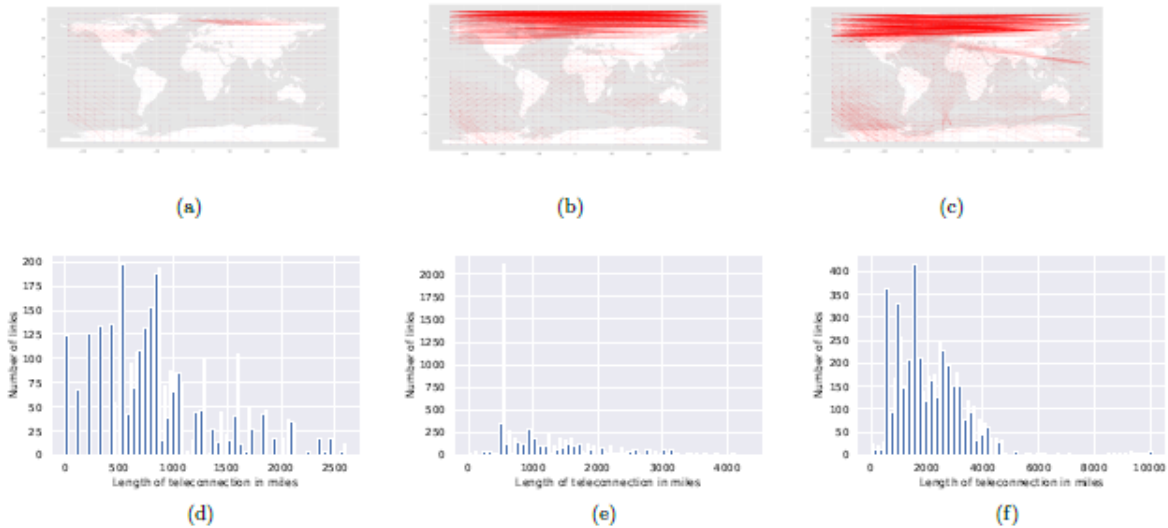


Figure 2: Links plot for El Niño episode onset with different thresholds and teleconnection distribution. (a),(d) plots correspond to correlation threshold 1.0 to 0.95, where we observe mostly the nearest neighbour correlation and the teleconnection plot support the fact. We observe near 500 miles the number of links is the highest. (b),(e) figures we plot for threshold 0.95 to 0.90. Here also we observe the nearest neighbour peaks near 500 miles. Fig.(c),(f) we plot the links for correlation threshold 0.90 to 0.85. and observe long range correlation (≥ 3500 miles). The Equatorial region become dense with lowering the correlation threshold during El Niño episodes in comparison with neutral condition of Pacific.

- We observe the percolation behavior of the climate network from Fig. 2.
- We analyze the significance of the numbers of diagonals in the heat maps and their distance. The figures with a correlation threshold of 0.95 to 0.85 observe long-range correlations, which are different during El Niño onset and the neutral period.