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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Global teleconnectivity structures of the El Niño-Southern Oscillation and large volcanic eruptions – An evolving network perspective" *by* Tim Kittel et al.

Anonymous Referee #1

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Using functional network theory applied to the global NCEP reanalysis SAT data set, the authors aim to quantify teleconnectivity changes associated with ENSO variability (El Nino and La Nina) and due to several 20th century volcanic eruptions. The new aspects are the combined use of the transitivity, modularity and global averaged link distance measures as well as regionalized versions of the degree and average distance measures.

The use of functional network analysis is relatively new in climate. However, many papers have already appeared on more descriptive aspects of the reconstructed networks. One would expect that new papers would also attempt to connect such results

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Discussion paper

better to phenomena deduced from more classical analysis of observations and climate models. The present paper could particularly serve such a connection but, as it is written, it does not extend much above a description of the results on the network level.

My major point is therefore that the authors should make a better effort to connect this (network) description to physical phenomena found in observations and models. This requires a substantial literature search and a rewrite of the sections 2, 4 and 5. In addition, I have some other remarks that the authors may use to improve the paper.

Remarks:

1. p2, l6-l8: That statement makes no sense (to me). Please rephrase and add a reference.

2. p2, l32-33: References missing here are the papers by Fountalis et al., Clim. Dynamics, (2015) and Tantet and Dijkstra, Earth System Dynamics, (2014) and these should be put in the right context (i.e. application of community detection algorithms).

3. p4, l10: This is not the long-term variability of ENSO (which is decades and longer) but the dominant interannual time scale.

4. Section 2: This section should focus more on known responses (teleconnections) to extreme phases of ENSO variability and responses to volcanic eruptions.

5. Section 3: This section can be shortened substantially by moving most of section 3.2 to an appendix (it has presented many times before). Section 3 could then focus on the data, how they are filtered and what the network quantities computed (with reference to the appendix) mean.

6. p8, l9: On which criteria is the choice 0.5% based and how sensitive is a result such as in Fig. 2 dependent on this choice?

7. section 3.3: Maybe good to mention here that the subset is taken after the network

is reconstructed (and no new network is reconstructed only based on the subset of nodes).

8. p13, l15-19: Just when it gets interesting ... No further analysis is done here, but this should be much better clarified in a revised version of the paper.

9. p13, l20-25: There is also a second (weak) minimum in the modularity so it should be much better explained what the different behavior of Q and T indicates here (also in lines 30-35) in terms of teleconnections (e.g. more midlatitude like such as the PNA pattern or more global along tropical latitudes). This should also be consistent with the patterns found in Fig. 3.

10. section 4.1.3: One would expect that the Nino3 and Nino3.4 regions are each highly connected so what new information is extracted from the results in Fig. 4 regarding teleconnections?

11. section 4.2: These results are interesting, but for their interpretation it would help to look at which specific changes have been observed (changes in atmospheric circulation, convection, etc.) during these periods.

12. p21, l25-27: The statement does not make sense (to me). Please rephrase.

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