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Earth System Dynamics
Discussions

Interactive comment on "On the time evolution of ENSO and its teleconnections in an ensemble view – a new perspective" *by* Tímea Haszpra et al.

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Remarks on 'On the time evolution of ENSO and its teleconnections in an ensemble view – a new perspective'

This manuscript provides some interesting ideas by building on previous work that used the ensemble dimension in a large ensemble to describe forced changes in the statistics of the climate system. In particular changes in teleconnections, here characterised by the correlation coefficient in the ensemble dimension, may provide some new insights.

I was wondering why you decided to focus on the first EOF to characterise ENSO variability. Takahashi et al. (2011) argue that both EOF1 and EOF2 should be used

to characterise ENSO. Did you test if there are changes in the second EOF? Changes in EOF 2 might also project on the Nino3 region and could theoretically even have an opposing effect compared to the changes in EOF 1 discussed in this manuscript.

How much does the sampling uncertainty affect the detected changes? I.e. how much of the difference in variance between two years can be attributed to the forcing change and how much of the difference is due to the limited ensemble size? Note that we concluded in Maher et al. (2018) that 30-40 ensemble members are sufficient to quantify ENSO variability when analysing ENSO variability over time periods of 10-50 years. Arguably, 10 years and 30 members might not even be sufficient, depending on the acceptable error (figure 4 in Maher et al. 2018). Since you are using indvidual years, it could be possible that more than 30-40 members are required. Based on this, I would expect to see large sampling uncertainty in the correlation coefficients. It might be beneficial to show the time series for the correlation coefficients for some selected regions to demonstrate that the discussed changes are larger than the sampling uncertainty.

Separating amplitude and pattern changes: In figure 1, you standardised the PC1. Thus both pattern and amplitude changes, if they occur, can be seen in the regression maps. Did you use the same approach for the analysis in figure 3? An alternative approach to separate pattern and amplitude changes would be to normalise the pattern. Amplitude changes can then be seen in the PC, whereas pattern changes can be seen by comparing the regression maps for different states of the climate system. This is the approach we used in Maher et al. (2018).

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