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Interactive comment on "Stratospheric ozone and QBO interaction with the tropical troposphere on intraseasonal and interanual time-scales: a wave interaction perspective" *by* Breno Raphaldini et al.

Anonymous Referee #2

Received and published: 16 August 2020

Review of "Stratospheric ozone and QBO interaction with the tropical troposphere on intraseasonal and interanual time-scales: a wave interaction perspective" by Raphaldini et al.

Recommendation: major revisions

1) I am concerned about the use of the Granger causality method since this assumes linear dynamics and Gaussian statistics. The MJO is probably a non-linear phenomenon. Did you also test the convergent cross-mapping approach by Sugihara?

In a recently published studies we have shown that time-lagged CCM and machine learning approaches are much better: Huang, Y., C. Franzke, N. Yuan and Z. Fu,

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Discussion paper

2020: Systematic identification of causal relations in high-dimensional chaotic systems: Application to Stratopshere-Troposphere coupling. Clim. Dyn., in press. https://link.springer.com/article/10.1007/s00382-020-05394-0

Huang, Y., Z. Fu and C. Franzke, 2020: Detecting causality from time series in a machine learning framework. Chaos, 30, 063116

2) It is not really clear to me how you compute the time series you then use for the analysis. Are these just the projections of particular normal modes? If yes, how many normal modes do you use to represent the MJO and QBO? Or do you use just one normal mode for the respective wave type?

3) While the MJO normal modes have large amplitudes during MJO events and the set of normal modes are also then coherent. However, the normal modes can also have large amplitudes during non-MJO/QBO events. So, I think your results on the MJO time scale might be robust but I am not sure whether your results are related to the MJO on longer time scales; there probably is an effect of the QBO/ozone on the particular normal modes but I do not think you have shown that this is really related to the MJO.

4) The quality of some of the figures is rather poor (Figs. 3, 10, 11).

5) What do the diagonal plots in Fig. 1 represent? Is that the causality of the time series with itself? What can I learn from this?

6) How do you compute the significance of the causal relations? A brief description would be useful.

7) There is a recent paper: Franzke, C., D. Jelic, S. Lee and S. Feldstein, 2019: Systematic Decomposition of the MJO and its Northern Hemispheric Extra-Tropical Response into Rossby and Inertio-Gravity Components. Q. J. Roy. Meteorol. Soc., 145, 1147-1164.

They use a composite approach which might be better suited to investigate the MJO and QBO. Using linear regression might mix too many non-events into the analysis.

8) Please correct “Frankze” to “Franzke” in the references.

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