Interactive comment on "Causal dependences between the coupled ocean-atmosphere dynamics over the Tropical Pacific, the North Pacific and the North Atlantic" *by* Stéphane Vannitsem and Pierre Ekelmans

Anonymous Referee #1

In this manuscript the authors investigate causal relationships, in monthly to inter-annual time scales, between the climate dynamics of three ocean-atmosphere basins (The North Atlantic, the North Pacific and the Tropical Pacific region) using three re-analyses datasets (ORA-20C, ORAS4 and ERA-20C). The applied methodology, Convergent Cross Mapping (CCM) has been applied to other systems, but has not yet been used (to the best of my knowledge) to investigate climate causal relationships. I found this study very interesting. As the authors acknowledge in the introduction, unveiling causal relations is a very challenging task, and different methods (also depending on

the choice of variables), are likely to yield different results. Here the CCM method is well motivated and described, and also the datasets used for reconstructing three-dimensional attractors are well justified. The results obtained are sound. Therefore, I am happy to recommend the acceptance of this manuscript, after the authors have taken the following points.

1) By using three time series, the authors reconstruct three-dimensional attractors (instead of using one time series and Taken's delayed coordinates). Could the authors discuss how important is the method used to reconstruct the attractor and the chosen attractor dimension? What could be expected if i) two-dimensional attractors are reconstructed from two time series (instead of three, using, e.g., only the zonal velocity at either 200 or 500 hPa and the ocean temperature)? and ii) three-dimensional attractors are reconstructed from one time series using Taken's delayed coordinates?

2) The authors state that "If there is a causality relation of Y on X, "ro" (Eq. 3) will increase with L". However, what this study uses (and I am not sure is always true) is the fact that "an increase of "ro" with L reveals/uncovers a causal relation of Y on X". Could the authors discuss the limits of validity of these two statements? I assume they hold if "L" is appropriated (not too small, and not too close to the length of the dataset). How about if X and Y are both driven by Z?

Minor comments are

3) In the Introduction, the authors say "an important question nowadays is to know whether the Tropical Pacific system forces the dynamics of the climate system in the extratropics". In my view there is plenty of evidence (it is well known) that the Tropical Pacific system forces the dynamics of the climate system in the extratropics, and therefore, I suggest the authors to re-word this sentence.

4) Regarding the link between galactic cosmic rays and global temperature variations, there is a discussion (Questionable dynamical evidence for causality between galactic cosmic rays and interannual variation in global temperature, doi:

10.1073/pnas.1510571112 and the reply, DOI: 10.1073/pnas.1511080112) that the authors, in my view, should also cite.

5) Table 1 would be easier to read if there is a space between the numbers (i.e., instead of x|y, x | y), also the letters in the figures are too small.

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