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Nonlinear Processes in Geophysics Discussions
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Interactive comment on "Dynamical properties and extremes of Northern Hemisphere climate fields over the past 60 years" *by* Davide Faranda et al.

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QUERY: Authors present an important application of the of the extreme value theory to Poincaré recurrences in dynamical systems, which can provide estimations of some metrics of the ergodic chaotic attractors, namely the phase-space local dimension and local recurrence. Authors apply the technique to relevant daily fields: the sea level pressure, surface air temperature and precipitation rate, trying to understand their seasonal dependency in the Northern Hemisphere and exploring the atmospheric patterns which are consistent with maximum and minimum values of those metrics. There are, however some minor worthwhile points which should be addressed before publication.

ANSWER: We thank the Referee for the positive comments. We provide a point-by-point reply below.

QUERY: 1 – Annual cycles of the local dimension d for slp and Temp(air) are in phase opposition (Figs. 2a, 2c). There is any physical reasonable explanation for that? The authors present a hypothetical explanation for the minimum of d for slp at the summer and maximum at the equinoxes as being more 'unstable' because of an incremented exploration of the summer and winter configurations. However, that could apparently be valid for any field but in fact it is totally contradicted in the case of the Temp(air) where d is higher in summer. Therefore, the authors should reformulate the explanation (which, as presented looks somehow ad-hoc) or give and explanation why it does not work for Temp(air).

ANSWER: This is an interesting question that motivated some further discussion. Eventually, we concluded that the t2m dynamics fits into a single potential well dynamics, with the extremes located in winter and in summer. We can imagine a sort of Langevin model for slp-t2m, where the slp is the variable pushed in the "winter" or "summer" potential wells, while the temperature acts as forcing noise term (i.e. single potential well dynamics) with extremes in summer and winter. We have now added this possible explanation to Sect. 3.2 of the manuscript.

QUERY: 2 – On pg. 8 in the Analysis of Precipitation data. Authors explain the higher value of d (compared to slp and air) thanks to the scattered and noisier character of the precipitation field. However, analysis of precipitation extremes has been done using the multifractal analysis (MFA) (Langousis et al. 2009) which also give hints about the dimension. Authors should try to relate the presented results with those of MFA.

ANSWER: We have read with interest the paper suggested by the Referee and included it in the discussion of prp results. We have also replaced the precipitation rate with the precipitation frequency, as suggested by Referee #2. This has led to a radical restructuring of the section analyzing the precipitation data.

QUERY: 3 – The graphs of ACFs(s) (Fig.1 and others) present discontinuities or overlaps near the zero line. This is maybe because of the symbol size? Use a format avoiding that artifact.

ANSWER: Thanks for spotting this, the original ACF figures have been replaced with ones displaying the values with cross-shaped markers to avoid artefacts.

QUERY: 4 – Caption of Fig. 11 should be more complete, i.e. making explicit the pairs of variables: Fig11a,b (slp-air), Fig. 11c,d (slp-prp), Fig. 11e,f (air-prp). Which variable lags in the future?

ANSWER: We have updated the panels in that figure that currently is figure 13, and we have explained which variables lag in the future.

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