Nonlin. Processes Geophys. Discuss.,
https://doi.org/10.5194/npg-2018-16-AC2, 2018

Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "A Statistical Mechanical Approach for the Parametrization of the Coupling in a Fast-Slow System" *by* Gabriele Vissio and Valerio Lucarini

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Received and published: 26 April 2018

We wish to thank the reviewer for his/her useful comments, through which we hope to have improved the paper.

Major points:

1) In this paper we focus on the time scale separation between Lorenz 84 and Lorenz 63 - along with the fact that we can parametrize a slow system with the same approach used for a fast system, thus proving the extreme flexibility of the scheme presented here. In a previous paper (Vissio and Lucarini 2018) we treated more explicitly the case

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of parametrizing the effects of the interaction between the large scale, slow variables of interest with the small, fast scales we want to parametrize. Nevertheless, we have modified the introduction to better describe our aim.

2) We have added the scheme and the time increment right below Eqs.7-12. The latter has been set to the standard for Lorenz models (0.005) but, in order to check that this increment was small enough, we have run tests with timestep=0.001. The results found conform very well with what reported in the paper, using the larger time increment 0.005.

Minor points:

1-2) See Major point 1.

3) We have changed the name of Lorenz 63 variables from x to $\widetilde{x}$ (similarly for y and z).

4-5) We have specified the meaning of Ψ under Eqs.13-14 and that D, S and M are defined by Eqs.18-22.

6) We have written the value of the two couplings at the beginning of Section 3.1.

7) We are referring to the ergodic measure of $\widetilde{x}$ (added in the paper).

8) σ is a stochastic noise, we have clarified this right after Eq.19. In order to avoid confusion, we changed the notation to ω.

9) The reviewer is right, we have explained that, e.g., $\rho_{o,x}$ indicate the expectation average with the respect to the measure of the Lorenz 63 system.

10) As written at the beginning of Section 3, the derivation and main results concerning the paramerization scheme is reported in Wouters and Lucarini (2012, 2013, 2016) and further explained in Demaeyer and Vannitsem (2017). Our aim here is just to recap the main findings in order to apply the formulas to the model.

11) σ in Table 1 is the standard deviation, as specified in the caption. We have now changed notation in the other two cases (Lorenz 63 parameter, now s, and stochastic noise, now ω) and clarified in the text and in the table that the statistics are computed over the ensemble of realisations.

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