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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Lyapunov analysis of multiscale dynamics: The slow manifold of the two-scale Lorenz '96 model" *by* Mallory Carlu et al.

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Dear Editor,

please find enclosed a revised version of the paper "Lyapunov analysis of multiscale dynamics: the slow bundle of the two-scale Lorenz '96 model" that we wish to resubmit to your attention (included here as supplement).

The remarks of the referees have been addressed in the modified version of the manuscript (and our manuscript title slightly changed according to the first referee remarks) and a detailed answer to all the points raised in the reports is provided in the other attached pdf (included as Fig.1 here).

All changes of note we have made to the manuscript have been marked in red for easy

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Discussion paper

reference. Additionally, an indexing mistake has been corrected in Table 1 and its LEs estimates have been slightly improved by newer numerical data.

Sincerely yours, The authors

Please also note the supplement to this comment:
https://www.nonlin-processes-geophys-discuss.net/npg-2018-41/npg-2018-41-AC1-supplement.pdf

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Sincerely yours,

The authors

Reply to Referee 1

We wish to thank the referee for carefully reading our manuscript and for judging our results novel, interesting and highly relevant.

We believe, however, that some criticisms have been induced by a misunderstanding due to our careless use of the term "slow manifold" while referring to the sub-space spanned by the effectively slow variables. For this reason, we have decided to change our terminology, and renamed the subspace "**slow bundle**".

In any case, we wish to make clear that the "wide spectral band", whose covariant Lyapunov vectors project strongly onto the slow variables, is not "close to a neutral spectrum" in an *absolute* sense. With the only exception of the single zero LE associated to the flow, the absolute value of all other LEs of the non-conservative, full L96 model is strictly larger than zero; there is no trace of any band characterized by a sub-exponential grow, which would correspond to the central manifold and make the system only partially hyperbolic.
In fact, in our numerical analysis we are able to perfectly discriminate the single zero exponent from the rest of the spectrum with a precision of one or two orders of magnitude. See for instance the example in the first figure included in this reply.

Fig. 1.