Nonlin. Processes Geophys. Discuss.,
https://doi.org/10.5194/npg-2018-16-RC2, 2018

Nonlinear Processes in Geophysics
Discussions

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

Anonymous Referee #2

Received and published: 9 April 2018

This paper explores a scheme for parameterization and tests it on an idealized case. The paper is interesting and the results are convincing, albeit on the test case the authors chose. A few points remain unclear in the rationale of the paper and its formulation.

Major points

The introduction presents the motivation of the paper, which is subgrid parameterizations due to the wide range of scales that occur in the modelling of geophysical fluids. The introduction focuses on climate models, for which parameterizations essentially involve convection and clouds, i.e. a range of spatial scales. But the authors focus

on a temporal diversity of scales. I hence have the feeling that they treat a different problem than the one that is addressed by the works of Palmer et al. on stochastic parameterizations (of physical processes).

Can the authors provide an illustration (or a discussion) of how their results can be adapted to the problems of subgridscale parameterizations? (and not "just" the question of temporal scales).

The authors do not specify how they integrate the system Eqs. (7-12). I guess they use a Runge-Kutta scheme. But given the fact that two time scales are active, they must use an integration time step that is adapted to the fastest one. This problem occurs when coupling ocean and oceanic models, which bear different CFL conditions. When they integrate Eq. (7-9) alone and add a noise, they might chose to use a different time increment. This would be the rationale for parameterization. What is the new time increment? Please give more details on the experimental settings.

Minor points

p. 2, l. 27: The paper does not seem to deal with subgrid phenomena.

p. 2, l. 34: this paragraph states how you plan to solve a scientific question, but you do not mention the precise scientific question you want to address. The scientific question does not seem to that of subgrid scale parameterization.

p. 4, Eqs. (4-5): using lowercase for the Lorenz 63 system makes the reading confusing. The use of upper and lower case for symbols in mathematical works is generally well defined. I suggest using only uppercase.

Section 3: what are Ψ, D, S and M?

l. 18 says that they "indicate" [. . .], but this is not a definition.

The link between Ψ_K and x (from the Lorenz 63 system) has to be guessed to understand Eq. (18). Please make things more explicit.

p. 6, l. 5: what ergodic measure?

Eq. (19): is σ related to the σ in the Lorenz 63 system? It is not a standard deviation either. What is it?

Eq. (20): what is ρ? Why should the average of σ be 0?

I do not understand where Eq. (21) comes from. I do not understand why h is always 0.

Table 1: You use σ again, but it obviously means something different!

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