

Interactive comment on “Nonlinear feedback in a six-dimensional Lorenz Model: impact of an additional heating term” by B.-W. Shen

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This is an excellent analysis and is ready to accept in my view after consideration of the one comment below. I have read the paper in the past and am pleased that it is moving forward to a final form.

My one comment is with respect the "butterfly effect of the first kind" and the "butterfly effect of the second kind". In the text it is written

"The 5DLM and 6DLM collectively suggest different roles for small-scale processes (i.e., stabilization vs. destabilization), consistent with the following statement by Lorenz (1972): If the flap of a butterfly's wings can be instrumental in generating a tornado, it can equally well be instrumental in preventing a tornado."

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The paper writes in regards to this subject

"For example, although the butterfly effect (of the first kind) with dependence of solutions on initial conditions appears in the 3DLM within the range between $r = 25$ and 40, it does not exist in the 5DLM. Therefore, to examine whether or not small perturbations can alter large-scale structure (i.e., the butterfly effect of the second kind), a model containing proper representations of multiscale processes and their nonlinear interactions is required."

I would like to see the author discuss this difference and conclusions further. Lorenz used the butterfly analog for two reasons - its appearance visually in solution space and the sensitivity to initial conditions finding. The sensitivity to initial conditions is the basis for the statement that

"the flap of a butterfly's wings can be instrumental in generating a tornado."

However, this claim is based on a gross overstretch of the realism of the Lorenz model to multi-scale weather dynamics.

This claim should be further discussed in the paper (I suggest adding to the conclusion). With a model that contains the dissipation of coherent fluid motions into heat at even the finest spatial scales, there would not be a way for "a butterfly's disturbance of the fluid" to be transferred as a coherent signal such that it could affect the development of a tornado. This excellent paper could serve the role of clarifying this misinterpretation.

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