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Review of “Control simulation experiment with the Lorenz’s butterfly attractor” by T. Miyoshi and Q. Sun

Anonymous Referee #1

Referee comment on "Control simulation experiment with Lorenz's butterfly attractor" by Takemasa Miyoshi and Qiwen Sun, Nonlin. Processes Geophys. Discuss., <https://doi.org/10.5194/npg-2021-24-RC1>, 2021

General comment

This manuscript is devising an approach to control the trajectory of the Lorenz system in one specific wing of its attractor. The approach is based on the perturbing the solutions once some forecasts show transitions toward the other wing. The idea behind their approach is to control the weather in order to reduce disaster risks.

The approach proposed is interesting but I think that the authors are presenting their method as a positive way to reduce risks although it could be completely disastrous. A perturbation at some location in the world can suppress or generate a thunderstorm elsewhere. In the idealized setting of this manuscript, from the point of view of a certain observer, to be in one wing of the attractor is disastrous (e.g. not enough rain), but for another observer this could be the opposite (more rain expected). So selling that the method will solve the problem of risks is to my opinion not appropriate. The authors should be more balanced on this, and add cautious comments in the introduction and in the conclusions.

Another major point not discussed in the manuscript is how this type of perturbations could be made in practice. Imagine that one wants to reduce the risk of a hurricane or a Typhoon flooding a region. We can imagine to reduce the temperature of the ocean. What energy do we need to do that and how to do that? My guess is that it is probably a huge amount of energy. The author should discuss the applicability of their method in the conclusions in the perspective of their results.

Again in the previous example of the Hurricane or Typhoon, the impact of such perturbation could lead to considerable problems elsewhere, and the benefit for it could not be oversold and even misleading.

Specific comments:

- At page 4, lines 98-105. The authors present the way they perturb the system. In step 4 they are indicating the way the perturbation is introduced. Please provide equations for that to clarify where the parameter D and the perturbations are appearing.

- From a dynamical perspective, I am wondering what is the nature of the successful perturbations (aligned along the stable, unstable or neutral directions...). Please comment on that.

- Certain periods, T , seem to be more favorable for the control. Is there any relation with the characteristic time scales of the dynamics, the mean transition time between the two wings for instance? This should be discussed.

- What is the impact of changing the DA cycle and the absence of observations of some variables?