Responses to Reviewer II's comments:

General comments:

In this paper the author extends the 5d Lorenz model to 7d Lorenz model by adding two more high wavenumber modes to the temperature perturbation. The addition of such small-scale perturbations in temperature provides negative nonlinear feedback to stabilize solutions is emphasized. Moreover, the hierarchical scale dependence of chaotic solutions between the pure vertical terms in temperature perturbation is revealed. Both results are helpful to our understanding of the chaos phenomenon. The paper is well organized and good written and I recommend it for publication.

Thanks for your comments.

Specific comments:

1. On page 3 Ln 43 the author explains the butterfly effect of the first kind, and mentions the butterfly effect of the second kind without explanation on Ln 45. C1 NPGD Interactive comment Printer-friendly version Discussion paper At least a reference should be given here.

Thanks for your help. The related sentences have been revised as follows:

In our previous studies, this feature is referred to as the butterfly effect of the <u>first kind</u> (e.g., Shen 2014a, 2015b). Based on the numerical phenomenon, it has been inferred that tiny perturbation may alter the large-scale flow (e.g., producing a tornado in Lorenz, 1972), which is referred to as the butterfly effect of the <u>second kind</u> (e.g., Pielke 2008; Shen 2014a).

2. On Page 3 Ln 58 the author mentioned the data assimilation schemes have been developed to improve the initial conditions. Actually the data assimilation schemes can also be used to optimize the parameters in a dynamical system.

The related sentences have been revised as follows:

To minimize the negative impact of inaccurate initial conditions and <u>to optimize parameters in a dynamical system</u>,

Thanks for your help. The derivation of Eq. (9) is provided below. To be more precise, I replace "≈" by "=" in Eq. (9) of the revised manuscript. Results remain unchanged.

$$
\begin{aligned}
J(M_1, M_6) &= \left(\frac{\partial M_1}{\partial x}\frac{\partial M_6}{\partial z} - \frac{\partial M_1}{\partial z}\frac{\partial M_6}{\partial x}\right) \\
&= \frac{\partial M_1}{\partial x}\frac{\partial M_6}{\partial z} \\
&= 4\sqrt{2}mlcos(lx)sin(mz)cos(4mz) = 2\sqrt{2}mlcos(lx)\Big(sin(5mz) - sin(3mz)\Big) \\
&= 2ml\Big(\sqrt{2}cos(lx)sin(5mz) - \sqrt{2}cos(lx)sin(3mz)\Big) \\
&= 2ml(M_8 - M_5)
\end{aligned}
$$

Thanks for your help. This has been fixed in the revised manuscript, which has been submitted.