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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Implications of model error for numerical climate prediction" *by* O. Martínez-Alvarado

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General Comments

This paper uses the Lorenz '63 system as a "toy model" for asking questions about numerical climate prediction. The suitability of an imperfect model for climate prediction is evaluated and contrasted to the use of a perfect model with imperfect initial conditions. This technique identifies a method for distinguishing between the two cases, which can be applied to operational numerical weather prediction and climate models. The author tests the theory using medium range weather forecasts from three operational models, and is able to use the theory to distinguish between the skill of the models. This is an interesting result, and the paper sets out a helpful framework for considering initial condition and model error, so I recommend the paper be accepted for publication, with

the minor corrections detailed below.

Specific Comments to Author

It would be helpful to indicate how one L63 model time unit relates to time in the real atmosphere (eg by comparing error doubling times, as in Lorenz, 1996)

P139 L11-14 it is unclear what data you are using to generate your PDFs for this figure. Do you use the cumulative data from many five-t.u. forecasts? Or do you use instantaneous data i.e. plot the pdf of forecasts at a lead time of 1 t.u. In which case, is a sample size of 16 forecasts (80/5) sufficient to estimate this pdf?

Section 4.1:

I found this section very interesting - it is an innovative way of using weather forecasts to reveal some of the characteristics of the climate attractor.

However, I am a little unsure of how you have produced figure 5, since you have moved from considering deterministic forecasts to ensemble forecasts. Do you collect together all one-day ensemble forecasts and calculate the IQR and median of this mega-ensemble (really looking at the climatology of the forecasts as a function of lead time). If this is the case, I would be interested to see the difference between the stochastically perturbed ensemble forecasts and the deterministic control run using this diagnostic. As you go on to discuss later, the ensemble tends to cluster around the control forecast in figure 6 instead of encompassing the analysis (which we would hope for an ensemble forecast which includes a representation of model error). However, stochastic parametrisation schemes have been shown to reduce model biases, so arguably a stochastic climate model would have a different attractor to its deterministic counterpart. Can you detect if there is a noticeable difference using your method in figure 5?

Technical Corrections

P134 L27-29: I found this sentence confusing to read. Perhaps replace with "...shares

its dimensionality with the prototype system, whereas numerical weather ..."

P136 L16. Should read "Figure 1"

P137 L15. Should read "Lorenz '63"

P150 Fig 2a caption: I found this caption very confusing to read - could it be restructured so that each model is addressed in turn, mentioning both the orbit and observations?

Interactive comment on Nonlin. Processes Geophys. Discuss., 1, 131, 2014.