

Interactive comment on “A mathematical approach to understanding emergent constraints” by Femke J. M. M. Nijsse and Henk A. Dijkstra

Anonymous Referee #1

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This manuscript is dealing with the problem of the understanding of emergent constraints in projections based on climate models. The main idea is to develop a mathematical framework based on the linear response theory. The approach is applied in the context of several models of increasing complexity. A classification of emergent constraints is also proposed. This is a very interesting approach to the problem that is worth publishing.

The organization of the manuscript is however confusing to me. Section 2 is mixing the general development of the approach and the application to an Ornstein-Uhlenbeck process. It is therefore difficult to figure out what is general or not. I would suggest the authors to reorganize this section 2 (and also section 3), by first presenting the general framework based on Response theory and then the specific application to the O-U

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process, maybe by putting a section 2.1 and a second section 2.2 (or by rearranging section 2 and 3 together).

Specific points:

- Page 1, Line 14, remove “variable”
- Page 3, Line 12. $O=x$. Is it really a mean value?
- Page 4, Eq 2.12-2.13. The way to compute the g_l and h_l should be explained.
- Page 5, Eq 3.1. Is it only valid for O-U process? This point is related to the general comment above. What is general and what is specific to the O-U process? This should be clarified.
- Page 6. Same as the previous point for Eq 3.4 and 3.5
- Page 6, line 29. Remove “the”.
- Page 8, Eq. 4.3. References to these type of models are needed. You can go back to the pioneers on that topic.
- Page 9. Eq. 4.6, one ω_2 should be ω_1 , I guess.
- Page 9. Eq 4.8. Is this model presented elsewhere? References are needed.
- Page 10. Line 12. What means “a 50-year spin-up was used”? Before the 20th and 21th centuries?

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