

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

**V. Lucarini (Referee)**

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Dear authors,

your contribution is extremely relevant and I supports its publication pending the minor revisions I suggest in the annotated .pdf file.

This contribution is relevant because it attempts at giving a systematic treatment of the concept of emergent constraints, which had been - up to now - pretty vague. This lack of clarity needs to be addressed, and this paper does exactly this. The methodology used here - essentially, response theory - is a powerful mathematical idea that I also find extremely relevant.

I see as main (yet minor) pitfalls of your paper the somewhat confused presentation in

C1

Section 2 and the fact that the classification of the emergent constraints is also a bit unclear.

I think you should also discuss a bit more in detail the difference between considering multiple models, instead of one with parametric modulations.

Additionally, you might find useful a recent preprint of mine:

<https://arxiv.org/abs/1806.03983>

where I address the problem of looking at observables as predictands and predictors. This problem is (briefly) mentioned in your paper, but maybe my preprint can be useful for discussing your results.

Overall, this paper is a very good piece of work.

Valerio Lucarini

Please also note the supplement to this comment:

<https://www.earth-syst-dynam-discuss.net/esd-2018-15/esd-2018-15-RC2-supplement.pdf>

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Interactive comment on Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2018-15>, 2018.