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Geoscientific Model Development Discussions

Interactive comment on "Combining data assimilation and machine learning to emulate a dynamical model from sparse and noisy observations: a case study with the Lorenz 96 model" *by* Julien Brajard et al.

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This is very good and timely paper that should be accepted in GMD. The combination between deep learning and data assimilation as studied in this paper has great potential and the paper could basically be published as it is. However, the authors may decide to adjust it slightly following the minor comments below.

- Section 3.3.2: This is quite a specific network architecture that you are using. Can you provide more detail how you discovered it? Can you speculate whether

the "x" and "+" are required due to the underlying shape of the equations of the Lorenz model?

- I assume that you have 1-D periodic boundary conditions for the network.
- Figure 2: It took me a while to understand that 2a, 2b and 2c are in parallel. This is not intuitive from the figure. However, I am not sure how to improve this.
- What would happen if some of the parameters would never be observed during the training period?
- Figure 4: This may be my ignorance but I would have expected to see the high frequencies to be correct and the low frequencies to be incorrect since you are basically training on a timestep level. Do you have any comments on this?
- Section 4.5.2: Could this configuration therefore be used to tune stochastic parametrisation schemes? This could maybe be discussed. We had some success using GANs and dropout methods to develop neural network parametrisation schemes for Lorenz 95 that showed some variability.
- P18: Could this also be made more efficient by training on interpolated observations in a first instance with no need to use the entire data assimilation scheme? Once the neural network model has converged here, the data assimilation configuration could be use to refine it.?
- Caption Figure 7. "0. 50
- Caption Figure 8: "with with"
- P16: "if was" -> "if it was"
- P18: "parallel computing" I would suggest to call this "concurrent computing" since you do not refer to standard MPI/OpenMP parallelisation.

- "resolvent" could be explained a bit more.
- Abstract: "applies alternatively" could be re-phrased.
- P2 l11: "precipitations" -> "precipitation"
- P5 l1 and P7 l14: There are unnecessary line breaks.
- P7 l3: It could be stated that σ^{obs} is a rather arbitrary choice at this stage.
- One of the references is incomplete: "E, W.:"

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