

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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Dear reviewer,

We wish to sincerely thank the Reviewer for his/her insightful revision of our manuscript. We have no doubts that, addressing most of the points in there, will result in an improved version of our work. We look forward to work on producing a full response and a revised version.

Nevertheless, before doing that, it urges us to clarify what, in our opinion, appears is

C1

a key misunderstanding on the main goals and objectives of our work. This misunderstanding seems to be the driver of the Reviewer main concerns and therefore we consider important to clarify this as soon as possible. These are the two main controversial points.

1) EM algorithm.

The reviewer makes a lot of meaningful remarks on the EM algorithm. These remarks will be very helpful in the future. But the reference in the paper to the expectation-maximization algorithm was very general and qualitative and was made in the purpose of contributing to the general reflexion on this type of methods. We don't claim that our method is an EM algorithm, and in fact, for the reasons pointed out by the reviewer, it is not. We are trying to minimize the classical regression cost used in machine learning, but, as the state of the system is unknown, we are feeding the neural network by estimation of this state using data assimilation. EM method was never within the design nor the conception of our approach.

2) Model error.

We are totally in line with the reviewer in that model error is an important point in general, and a possible improvement of our method in particular. It is also true that choices have to be made in the practical implementation of our algorithm. As such, we have made a choice of a diagonal model error which is standard for the toy models employed and presents a lot of advantages in term of cost and stability. This particular choice (among other: e.g. the architecture of the neural network, the choice of ensemble data assimilation) is already leading to good performances. The fact that there is still room for improvement is inherent to all implementation and shows, in our opinion, the high potentiality of this method.

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C2