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Nonlinear Processes
in Geophysics
Discussions

Interactive comment on "Data-driven prediction of a multi-scale Lorenz 96 chaotic system using deep learning methods: Reservoir computing, ANN, and RNN-LSTM" *by* Ashesh Chattopadhyay et al.

Anonymous Referee #2

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The manuscript presents a comparison of Recurrent neural networks with Long Short-Term Memory (LSTM), Reservoir Computers termed Echo State Networks (ESNs) and deep multi-layered Artificial Neural Networks (ANNs) on forecasting the evolution of the slow dynamics (X) of a Lorenz-96 multi-scale problem, while two other states with faster dynamics cannot be observed (i.e. assumed to be unknown) both during training and testing.

According to the findings of the study, the ESN shows a remarkable performance surpassing both ANN and LSTM by a large margin.

1. The authors are augmenting the dynamics of the reservoir of the ESN based on

the dynamics of the equation used to generate the data. As reported in the appendix, the equation agnostic ESN diverges. In order to cope with this divergence, the authors augmented the ESN reservoir with the grid dynamics of the equations (refer to Algorithm T2 and T3 in the Appendix and compare to equation (1) of the main text). This augmentation seems to be very heuristic and is driven by the form of the equations used to generate the data in this application, and is by no means standard in Reservoir Computing (ESNs).

As a consequence, the overall approach utilized to generate the ESN predictions cannot be considered equation-agnostic and as such the comparison with ANNs and LSTMs is not fair. The same augmentation can be easily extended to LSTM and ANN. The authors are not emphasizing this augmentation in the main document, even though this seems to be the main reason for the success of the ESN approach.

2. No information is provided about the value of ρ in Fig 5. This is an important parameter and needs to be discussed.

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