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Data assimilation assisted neural network parameterizations for subgrid processes in multiscale systems[1] SURAJ PAWAR, OMER SAN, Oklahoma State University-Stillwater — Despite the success of data-driven closure model for different types of flow, their online deployment may cause instabilities and biases in modeling the overall effect of subgrid scale processes, which in turn leads to inaccurate prediction. To tackle this issue, we exploit the data assimilation technique to correct the physics-based model coupled with the neural network as a surrogate for unresolved flow dynamics in multiscale systems. In particular, we use a set of neural network architectures to learn the correlation between resolved flow variables and the parameterizations of unresolved flow dynamics and formulate a data assimilation approach to correct the hybrid model during their online deployment. We illustrate our framework in an application of the multiscale Lorenz 96 system for which the parameterization model for unresolved scales is exactly known. We show significant improvement in the long-term perdition of the underlying chaotic dynamics with our framework compared to using only neural network parameterizations for the forecasting. Moreover, we demonstrate that these data-driven parameterization models can handle the non-Gaussian statistics of subgrid scale processes, and effectively improve the accuracy of outer data assimilation workflow loops.

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