Hybrid covariance super-resolution data assimilation

The super-resolution data assimilation (SRDA) enhances a low-resolution (LR) model with a Neural Network (NN), having learned the differences between high and low-resolution models offline and performing data assimilation in high-resolution (HR). The method enhances the accuracy of the EnKF-LR system for a minor computational overhead. However, performance quickly saturates when increasing the ensemble size due to the error introduced by the NN. We therefore combine the SRDA with the mixed-resolution data assimilation method (MRDA), into a method called ``Hybrid covariance super-resolution data assimilation" (Hybrid SRDA). The forecast step runs an ensemble at two resolutions (high and low). The assimilation is done in the HR space by performing super-resolution on the LR members with the NN. The assimilation uses the hybrid covariance that combines the emulated and dynamical HR members. The scheme is extensively tested with a quasi-geostrophic model in twin experiments, with the LR grid being twice coarser t

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