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Training a convolutional neural network to conserve mass in data assimilation

Yvonne Ruckstuhl¹, Tijana Janjic¹, and Stephan Rasp²

¹Meteorological Institute Munich, Ludwig-Maximilians-Universität München, Germany (yvonne.ruckstuhl@lmu.de)

²ClimateAi, San Francisco, USA

In previous work, it was shown that preservation of physical properties in the data assimilation framework can significantly reduce forecast errors. Proposed data assimilation methods, such as the quadratic programming ensemble (QPEs) that can impose such constraints on the calculation of the analysis, are computationally more expensive, severely limiting their application to high dimensional prediction systems as found in earth sciences. We therefore propose to use a convolutional neural network (CNN) trained on the difference between the analysis produced by a standard ensemble Kalman Filter (EnKF) and the QPEs to correct any violations of imposed constraints. On this poster, we focus on conservation of mass and show in an idealized setup that the hybrid of a CNN and the EnKF is capable of reducing analysis and background errors to the same level as the QPEs.