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Extending NEMO for ensemble data assimilation on supercomputers with the parallel data assimilation framework PDAF

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The NEMO model is a state-of-the-art ocean circulation model. For data assimilation applications with ensemble Kalman filters like the SEEK filter, e.g. for operational ocean forecasting, NEMO is typically run separately from the assimilation algorithm. This procedure generates a set of restart files on disks that hold the ensemble of model forecasts providing the error covariance matrix information for the ensemble Kalman filter. These files need to be read by a separate assimilation program that computes the analysis step of the filter algorithm and generates new restart files for NEMO. This scheme requires a large amount of disk storage as well as time to read and write restart files and to perform the model restarts. Here, a data assimilation system for NEMO is introduced that is built using the parallel data assimilation framework PDAF (http://pdaf.awi.de). Inserting a few subroutine calls to the source code of NEMO, one extends NEMO to a data assimilation system that consists of a single program. Utilizing the parallelization capacity of today's supercomputers, the system performs both the ensemble forecasts and the analysis step of the filter algorithm in a single execution of the program. The features of the resulting assimilation system are discussed as well as the parallel performance of the program when it is applied with a idealized double-gyre configuration of NEMO.