Investigating the potential of SST assimilation for ocean state estimation and climate prediction

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The Norwegian Climate Prediction Model (NorCPM) assimilates the stochastic HadISST2 product with the ensemble Kalman Filter data assimilation method into the ocean part the Norwegian Earth System model. We document a pilot stochastic reanalysis for the period 1950-2010 and use it to perform seasonal-to-decadal (s2d) predictions. The accuracy, reliability and drift is investigated using both assimilated and independent observations. NorCPM is found slightly over-dispersive against assimilated observations but shows stable performance through the analysis period ($\sim$0.4K). It demonstrates skill against independent measurements: SSH, heat and salt content, in particular in the ENSO, the North Pacific, the North Atlantic subpolar gyre (SPG) regions and the Nordic Seas. Furthermore, NorCPM provides a reliable monitoring of the SPG index and represents the variability of the temperature vertical structure there in good agreement with observations. The monitoring of the Atlantic meridional overturning circulation is also encouraging. The benefit of using flow dependent assimilation method and constructing the covariance in isopycnal coordinate are investigated in the SPG region. Isopycnal coordinate discretisation is found to better captures the vertical structure than standard depth-coordinate discretisation, which can deepen the influence of assimilation when assimilating surface observations. The vertical covariance shows a pronounced seasonal and decadal variability, which highlights the benefit of flow dependent data assimilation method. This study demonstrates the potential of NorCPM for providing a long reanalysis for the 19–20 century when SST observations are available. The results of s2d predictions carried out will be presented, and the potential to use this method to assess decadal predictability over the historical period will be discussed.