Using lagged covariances to assimilate RAPID data

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The motivation of this work is to assimilate observations of the Atlantic Meridional Overturning Circulation (AMOC), that have been made by the RAPID array at 26N in the Atlantic Ocean, by modifying ocean densities 'upstream' in the Labrador Sea. Previous studies have shown that the AMOC is robustly sensitive to anomalies in the Labrador Sea which occur at a time lag of several years earlier. The RAPID data will be assimilated into a high-resolution (0.25°) global NEMO-CICE model. Assimilating the data using a standard variational procedure with a multi-year time window would be impractical in such a model. Instead, the aim is to use robust covariance information to make earlier increments without the need for an adjoint. The covariances are used to assimilate the lagged data on top of the trajectory produced by an initial (standard) variational assimilation. Using earlier assimilation increments should give better continuity to the circulation and the heat transports, making the model more useful for coupled forecasting. We will present the lagged covariance methodology and show results from simulation studies of an idealised system. We will also show preliminary results related to the final RAPID assimilation.