Deep Atlantic equatorial transport resultiing from the initialization of an ocean ensemble assimilation system

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At the National Center for Atmospheric Research, a 48-member ensemble adjustment Kalman filter (EnKf) is being used to assimilate daily subsurface temperature and salinity data into the POP 1ox1o global ocean model. EnKf systems are typically initialized with an ensemble of model states that represent a climatological distribution. Over many cycles of the assimilation system, the ensemble narrows into a distribution that is a function of the internal variability of the system and the observations that are constraining it. A well-equilibrated ensemble should not be strongly influenced by the choice of the initial ensemble. The POP/EnKf system was initialized in model-yr 1998, with the goal of having an equilibrated ensemble of ocean states by model-yr 2000. While the dynamic time-scales of the upper ocean support this choice of "burn-in" time, we show here that the deep ocean remains sensitive to the choice of initial ensemble for at least a decade. We illustrate this here with a case-study from the equatorial Atlantic ocean, where the choice of initial ensemble leads to spurious, transient behavior that impacts large-scale climate variables like the vertically integrated northward heat transport and the meridional overturning circulation.