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Shoaling aragonite saturation horizon along North Atlantic repeat section A16N

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Recent model projections suggest that due to the invasion of anthropogenic CO_2, the aragonite saturation horizon (ASH), which separates aragonite-saturated overlying waters from underlying undersaturated waters, will shoal dramatically during the 21^{st} century. The greatest changes are expected in the North Atlantic where the ASH is projected to shoal from its present depth (about 2500 m) to within a few hundred meters of the surface. To evaluate model projections, we compared simulated to observed changes along the northern end of the A16N repeat section (between 35°N and 64°N along 20°W), which was occupied in 1993 during WOCE/OACES and then reoccupied in 2003 during CLIVAR. Large observed and modeled changes occur between 40°N and 52°N. In this area, the observed average depth of the ASH shoals by 240 m, whereas the median model projects an average shoaling of 84 m. This discrepancy will be examined by further data analysis and by studying results from various models. The 84-m simulated change between 1993 and 2003 is 2/3 that of the simulated preindustrial-to-1993 shoaling (128 m). By 2020, the projection from the OCMIP-2 median model under the IS92a scenario is that the ASH will shoal by another 175 m. These observed 1993-to-2003 changes in ASH are accompanied by systematic changes in $[CO_3^{2-}]$ of 5 μmol kg^{-1}. That shift is larger than our estimated precision for calculated $[CO_3^{2-}]$, i.e., 4 μmol kg^{-1} based on measurement precision for DIC and alkalinity (3 μmol kg^{-1} and 3 μeq kg^{-1}, respectively). Future changes in the ASH should also be detectable if A16N can be reoccupied roughly every 10 years.