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# Uptake of anthropogenic carbon by the Labrador Sea Water using an accelerate simulation with an Ocean Circulation Model

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The high-latitude North Atlantic is a major conduit carrying anthropogenic $CO_2$ ($C_{ant}$) from the atmosphere to the deep ocean. Detailed estimates of the uptake remain uncertain, due, in part, to various assumptions made in observational analyses and sparseness of data. We have recently used the novel transit-time distribution approach to make estimates of $C_{ant}$ uptake by Labrador Sea Water (LSW), an important component of North Atlantic Deep Water. We found that $C_{ant}$ in surface waters of the Labrador Sea cannot keep pace with the atmospheric growth in $CO_2$. Here, we evaluate our methodology by applying it to synthetic data from a GCM. The GCM has been cast in matrix form, allowing computationally efficient solutions. The matrix formulation also allows us to perform easily adjoint experiments to test our assumptions on surface formation regions of LSW.