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Does the Natural DIC Affect the Storage of Total Inorganic Carbon in the Central Labrador Sea?

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The Labrador Sea plays a central role in the oceanic storage of carbon. In particular, several studies have shown that this region has amongst the highest integrated column inventories of anthropogenic carbon (C_{ant}) in the world's ocean. The rate at which C_{ant} is stored in this region appears to be connected to changes in ocean circulation and can therefore vary over time. Nevertheless, it is still unclear whether the temporal variability of the total Dissolved Inorganic Carbon (DIC) inventory is solely due to the changes in C_{ant} concentrations or whether there is a contribution of the natural component of DIC to this signal.

The Bedford Institute of Oceanography has been maintaining the Atlantic Zone Off-Shore Monitoring Program (AZOMP) in the Labrador Sea since the early 1990s. The AZOMP involves annual occupations of the AR7W line that crosses the Labrador Sea and includes sampling of DIC, as well as multiple transient tracers such as CFC-12 and SF_6.

By using observations of DIC along the AR7W line, as well as previous estimates of C_{ant} obtained with transient tracers (using a refined version of the Transit Time Distribution method; TTD) and new estimates of C_{ant} based on the extended Multiple Linear Regression (eMLR) method, we provide a first insight on the role that the natural component of DIC plays in the temporal variability of inorganic carbon in the central Labrador Sea between 1993 and 2016.

We show that different methods to estimate C_{ant} can lead to different conclusions on the role of the natural variability of DIC and that these discrepancies could be related to the assumptions implied in the C_{ant} estimation methods. In particular an analysis of C_{ant} estimates obtained with our refined version of the TTD method in different water masses, highlighted that further refinement of the tracers' saturation assumption could be necessary in this region. This refinement could reconcile the C_{ant} estimates from the two methods and therefore lead to an unambiguous role of the natural DIC in this region.