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Comparisons of anthropogenic CO_2 storage between Models and Observations in the North Atlantic Ocean

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Observational methods to estimate anthropogenic CO_2 (Cant) are applied to a high quality dataset of the Atlantic Ocean from 65ºN – 80ºS. The database consists of CARINA and GLODAP datasets (76363 data) that was extended to 104043 using a local MLR and neural networks to recover carbon data available for Cant computations, assuming no temporal variability of alkalinity. A multiparametric method using conservative water mass properties of WOA'09 for interpolation was applied to the Cant estimated using the observational methods (Phi-Ctº, TrOCA, TTD) to obtain the Cant storage in the Atlantic Ocean. These Cant storages were compared with four model outputs (LSC, CSIRO, ETH, WHOI) and an inverse solution based on constraining the oceans transport Green function with observations. All Cant storages give similar spatial distributions however, the output of the models give systematically 75% lower Cant storage than the observational methods. We find even more marked difference when we consider the water column below 5ºC that represent the 82% of the total volume, where the Cant storage given by models are two and a half times lower that the observational methods, where the highest differences appear south of 40ºS. While in waters above 5 º C, there is a good agreement with a difference of only 20% that is located in the subtropical North Atlantic area. To evaluate the areas where the highest discrepancies occur, a specific study through the vertical profiles is carried out. These results will help to assess biogeochemical ocean models and coupled climate-carbon models.