Uncertainties in the Anthropogenic Carbon Inventory in the Atlantic Ocean along Section A16 over the Last Decade

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Repeat hydrography and biogeochemistry cruises such as those undertaken by the CLIVAR/CO_2 Repeat Hydrography Program have yielded high-quality and well-calibrated measurements of physical and biogeochemical parameters that can be compared with data of similar quality taken in the previous decade. Here we use data along a transect through the middle of the Atlantic Ocean from 63 deg N to 60 deg S, referred to as the A16N(orth) and A16S(outh) lines. The results from cruises in 2003 (A16N) and 2005 (A16S) are compared to data from cruises along these sections in 1993 (A16N) and 1989 (A16S). A prime objective is to determine the amount of anthropogenic carbon that has entered the Atlantic Ocean during this period. This effort is complicated by significant changes in biogeochemical cycling and ventilation that are observed, as manifested by changes in oxygen and nutrients. Since these changes in O_2 and nutrients have an associated signal in total inorganic carbon, this natural variability will mask the trend in anthropogenic carbon increase. Several different multi-linear regression (MLR) approaches have been developed to tease out the anthropogenic carbon signal from the natural changes but quantifying the uncertainties in these methods has been difficult. Here we present the biases and uncertainties in the MLR methods aided, in part, by applying the MLRs to the output of an ocean biogeochemistry model that can provide the "true" anthropogenic carbon signal.