



## **Anthropogenic carbon estimates in the North Atlantic in CMIP5 GCMs using reconstructed transient tracers (CFC-11, CFC-12, SF6).**

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Since the beginning of the industrial revolution, atmospheric concentration of carbon dioxide has raised from 280 ppm to nearly 400 ppm. The Global Ocean has limited the consequent greenhouse effect on the climate system by taking up around 26% ( $2.3 \pm 0.7$  PgC/yr) of the carbon produced by human activities (anthropogenic carbon,  $C_{ant}$ ), mostly in key areas, such as the North Atlantic.

Estimating anthropogenic carbon in the ocean is challenging because  $C_{ant}$  cannot be measured directly, it is difficult to separate from the biggest unknown natural fraction (DIC), it is influenced by the biogeochemical cycles and the circulation in the ocean. Therefore,  $C_{ant}$  is estimated with different methods ( $\Delta C^*$ ,  $\Phi_{CTO}$ , TTD) based on carbon parameters (DIC, alkalinity, silicate, phosphate) or transient tracers observations.

Here, we used CFC-11, CFC-12 and sulphur hexafluoride ( $SF_6$ ) measured along the subtropical North Atlantic ( $26^\circ$  N) in 2010 as proxies for the  $C_{ant}$  estimates. However, these transient tracer observations are sparse and few GCMs (e.g.: OCMIP project) have reported them in the outputs. Therefore, oxygen and potential temperature observations registered on 1992, 1998, 2004 and 2010 along the  $26^\circ$  N transect have been used, with a combined CFC-12/ $SF_6$  water masses ages trend and the CMIP5 GCM (MPI-ESM, IPSL-CM5) outputs to reconstruct transient tracers concentrations using regression models. Overall, the 2010 residual analyses confirm the validity of the statistical approach and derived values show a consistency with the tracer observations (averaged  $R^2 > 0.9$ ). These regression models have been used to derive  $C_{ant}$  from 1992 to 2014, in CMIP5 GCMs (MPI-ESM, IPSL-CM5), using the reconstructed transient tracers fields with the transit-time distribution (TTD) method. Results are, finally, compared to the  $C_{ant}$  distributions and budgets calculated, in the same area, with other methods ( $\Delta C^*$ ,  $\Phi_{CTO}$ ) and the  $C_{ant}$  directly estimated from the GCMs as the difference between the historical and the control DIC distributions ( $C_{ant} = DIC_{historical} - DIC_{control}$ ).