



## **Anthropogenic carbon estimates in the North Atlantic in CMIP5 GCMs using reconstructed transient tracers (CFC-11, CFC-12, and SF<sub>6</sub>)**

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### **Abstract**

Since the beginning of the industrial revolution, atmospheric CO<sub>2</sub> has raised from a value of 280 ppm to ~400 ppm. The Global Ocean has limited the effect on the climate by taking up around 26% ( $2.3 \pm 0.7$  PgC/yr) of carbon produced by human activities (anthropogenic carbon, C<sub>ant</sub>), mostly in key areas, such as the North Atlantic. Estimating anthropogenic carbon in the ocean is challenging because C<sub>ant</sub> cannot be measured directly and it is estimated with different methods based on carbon parameters (DIC, alkalinity) or transient tracers observations. Here, we used CFC-11, CFC-12 and sulphur hexafluoride (SF<sub>6</sub>) measured along the subtropical North Atlantic (26° N) in 2010 as proxies for the C<sub>ant</sub> estimates. However, these transient tracer observations are sparse and few GCMs have reported them in the outputs. Therefore, oxygen and potential temperature observations registered on 1992, 1998, 2004 and 2010 along the 26° N transect have been used, with a combined CFC-12/SF<sub>6</sub> water masses ages trend and the CMIP5 GCM outputs to reconstruct transient tracers concentrations using regression models. Overall, the residual analyses confirm the validity of the statistical approach and derived values show a consistency with the tracer observations (averaged  $R^2 > 0.8$ ). These regression models have been used to derive C<sub>ant</sub> from 1992 to 2014 using the reconstructed transient tracers fields with the transit-time distribution (TTD) method. Results are, finally, compared to the C<sub>ant</sub> distributions and budgets calculated, in the same area, with other methods ( $\Delta C^*$ ,  $\Phi_{CTO}$ ) and C<sub>ant</sub> directly estimated from the GCMs as  $C_{ant} = DIC_{historical} - DIC_{control}$ .

### **Biography**

Tobia Tudino has completed his Bachelor and his Master at the University of Genoa both on marine environmental sciences. He published a paper on the journal of *Marine Systems*, titled: 'Shallow-water gaseohydrothermal plume after massive eruption at Panarea, Aeolian Islands, Italy'. He attended five international cruises on board at Italian and UK research vessels, both on the Mediterranean Sea and Atlantic Ocean. Currently, he is pursuing his PhD research at the University of Exeter, under the framework of the RAGNAROOOC project, aiming to compare the methods of C<sub>ant</sub> estimate in the ocean using different GCMs within the international CMIP5 project.

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