Why measure CO$_2$ flux

At the sea surface, CO$_2$ is exchanged between ocean and atmosphere. Accurate measurements of this air-sea CO$_2$ flux are essential to improve our understanding of the role of the oceans in mitigating anthropogenic climate change. To date the oceans have absorbed around 25% of all human generated CO$_2$, which has helped to slow the impact of climate change on land, but is fundamentally changing the chemistry of the ocean.

What is ocean acidification?

The long-term absorption of atmospheric CO$_2$ by the ocean is causing a gradual decrease in the pH of the oceans, a phenomenon called ocean acidification. This is having an adverse effect on many important marine species such as corals, oysters, crabs and plankton, and due to the unparalleled rate of acidification the organisms may not have time to evolve mechanisms to cope with the changing ocean chemistry.

What is AMT?

AMT, or the Atlantic Meridional Transect, is a multidisciplinary programme which undertakes biological, chemical and physical oceanographic research during an annual voyage between the UK and the South Atlantic. The transect covers a vast range of environments from productive coastal and eutrophic regions to desert-like gyres in the centre of the ocean, areas rarely accessed by research ships.

AMT was heralded as one of NASA SeaWiFS ten greatest highlights since it provides an ocean observing platform providing vital calibration and validation data to support ocean satellite missions.

Partners and funding

The AMT4SentinelFRM consortium is funded by the European Space Agency.

Plymouth Marine Laboratory leads the consortium with three partners as subcontractors: the University of Southampton, the Institut Français de Recherche pour l’Exploitation de la Mer, Plouzane, France (IFREMER) and University of Exeter.

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Global estimates of CO$_2$ flux

Global estimates of CO$_2$ flux are calculated using the FluxEngine, an Open Source Python toolbox for calculating air-sea CO$_2$ fluxes from model, in situ and Earth observation data. These satellite estimates are compared and contrasted with direct measurements of the CO$_2$ flux calculated using in situ measurements.

Multi-sensor data allows the calculation of global air-sea CO$_2$ fluxes, which is central to our understanding of how the oceans regulate increasing levels of CO$_2$ and the extent that this leads to a decrease in ocean pH.

This large-scale direct comparison of satellite CO$_2$ air-sea flux estimates with in situ derived calculations has never been attempted before anywhere in the world.

The AMT cruise provides data from more than 60 CTD casts, 30 optics casts, 60 surface optical deployments, 28 radiosonde balloon launches and tens of thousands of underway measurements for the validation and development of satellite products.

Areas of the ocean most at risk from acidification are identified using satellite data to estimate pH and aragonite saturation state, the chemical many marine animals need to build their skeletons and shells.