

GW4+ Doctoral Training Partnership



Carbon From Space: determining the biological controls on the ocean sink of CO₂ from satellite, in the Atlantic and Southern oceans.

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Background: Oceanic phytoplankton contribute approximately half of Earth's net primary production, and so form an essential link in the regulation of global atmospheric CO₂. They influence gas exchange by photosynthesis (using CO₂) and respiration (exhaling CO₂). The Oceans are a key sink of atmospheric CO₂, but the significance of the biological control of this sink and how it may change in the future is not fully understood. Atmosphere-ocean CO₂ movement (flux) is affected by ocean physics and biology, commonly known as the solubility and biological pumps. Understanding of this flux has been greatly enhanced by satellite measurements but to date new advances in satellite measurements of biological growth or respiration have not been used. Ocean colour algorithms of production that account for the carbon respired have been developed, but as yet have not been exploited to study gas fluxes. The purpose of this work will be to improve our understanding of how biology controls air-sea flux of CO₂ in the Atlantic and Southern Oceans using Ocean colour algorithms of Net Community Production (NCP) applied to Sentinel-3 data to assess the role that biology plays in controlling the North and South Atlantic Gyres as a CO₂ sink or source, to or from the atmosphere.

Aim and methods: The successful PhD student will undertake a unique programme of research aimed at developing and exploiting merged ocean colour remote sensing data and net community production models to enable monthly estimates of CO₂ sources and sinks from satellite. These models will be ground truthed using in situ measurements taken in the Atlantic Ocean. The work will generate decadal time series, and evaluate how these have been affected by climate change. The research will feed into the international research effort of NASA and the European Space Agency (ESA).

Training: The student will receive multi-disciplinary training in sea going oceanography, chemical analysis of dissolved oxygen, remote sensing oceanography, impact of climate change on biogeochemistry, numerical and statistical data analysis. They will work in a world class research institute and have opportunities to present their work at international conferences. They will have the opportunity to take part in research cruises (e.g. Atlantic Meridional Transect www.amt-uk.org/). The project will make use of state-of-the-art field, laboratory, computing and instrumentation available across both institutions. The student should have obtained at least a 2i BSc in Remote Sensing, Oceanography, Computing, Marine Biology or a related field.

