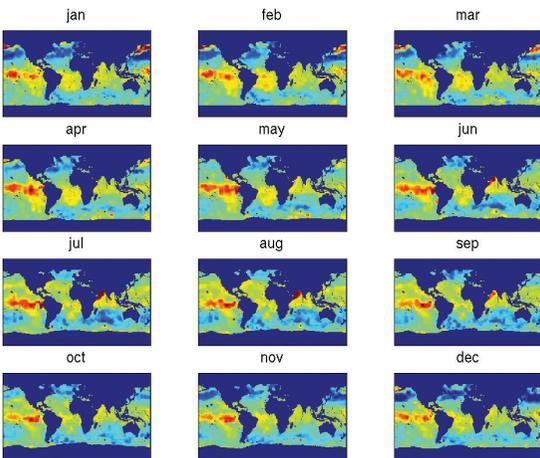




“ The integration of measurements from satellites with those from ships and sensors in the ocean, combined with the use of state-of-the-art forecast models, have been fundamental to CASIX success. ”

Dr Nick Hardman-Mountford, Acting Director CASIX (PML)



Monthly maps (climatologies) that integrate measurements from ships and satellites give an improved global picture of air-sea carbon dioxide fluxes.

For further details of these results see the CASIX showcase papers.

## CASIX Partners:

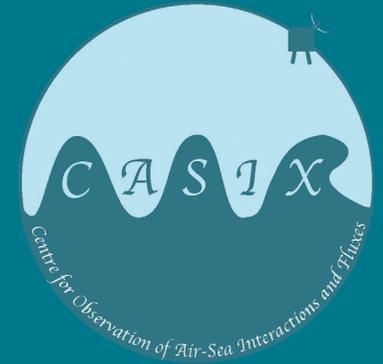
**PML** | Plymouth Marine Laboratory

**Proudman Oceanographic Laboratory**  
NATURAL ENVIRONMENT RESEARCH COUNCIL

**National Oceanography Centre, Southampton**  
UNIVERSITY OF SOUTHAMPTON AND NATURAL ENVIRONMENT RESEARCH COUNCIL

**University of Leicester**

**University of Reading**



**The Centre for observation of Air-Sea Interactions & fluxes 2003-2008**

Improving understanding of uncertainties in the cycling of carbon between the ocean and atmosphere

“ The margin of error in estimates of air-sea CO<sub>2</sub> flux for the North Atlantic has improved from up to 100% in 2003 to around 10% in 2008. ”

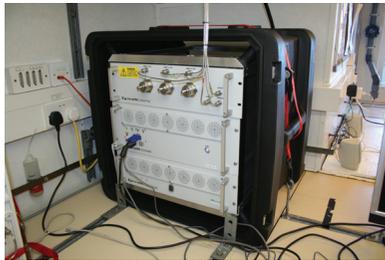
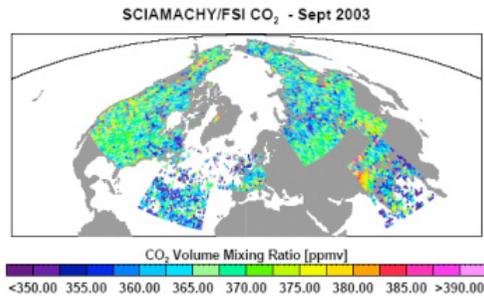
Prof Andrew Watson, FRS (UEA)

For further details, please contact:

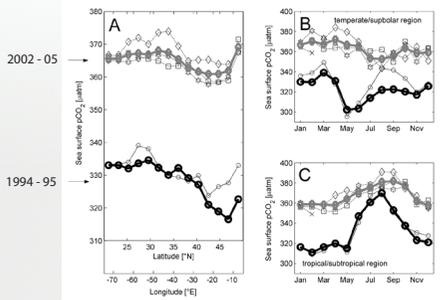
**CASIX Directorate Office**  
Plymouth Marine Laboratory  
Prospect Place  
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PL1 3DH, UK.  
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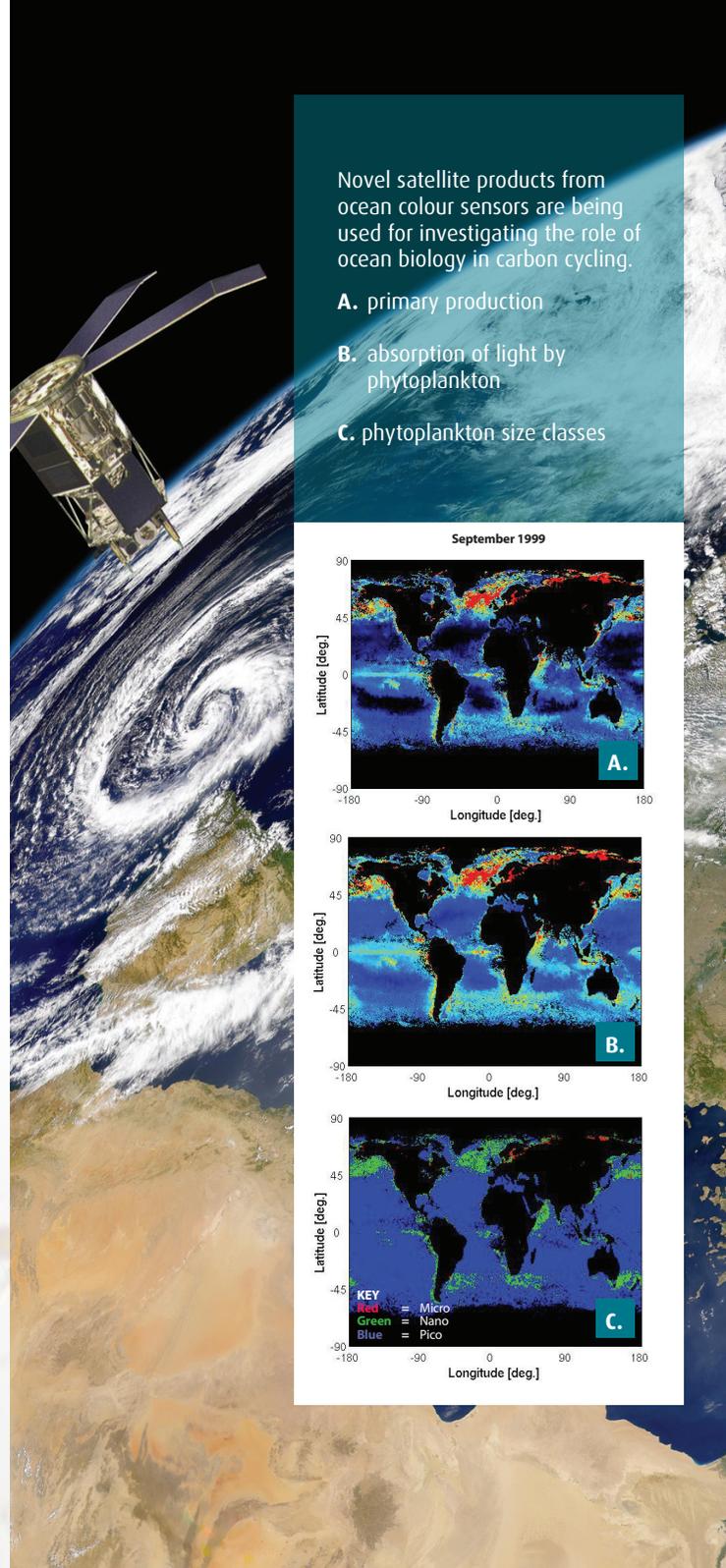
Atmospheric carbon dioxide levels over land and sea have been measured using novel methods for processing data from the European SCIAMACHY satellite sensor.



New automated sensor systems for measuring carbon dioxide in the ocean have been developed and operate on UK research vessels.

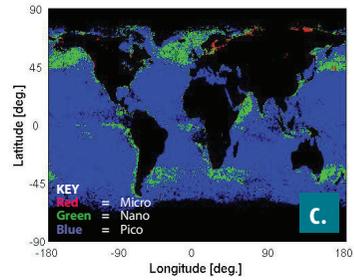
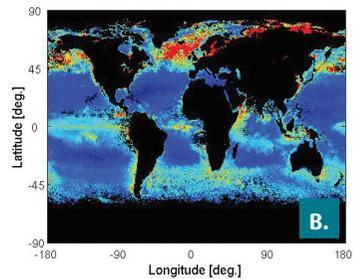
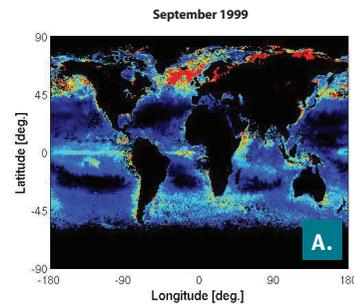


Large increases in levels of carbon dioxide in surface waters of the North Atlantic and decreases in seasonal variability have been seen from volunteer observing ships over the past decade.

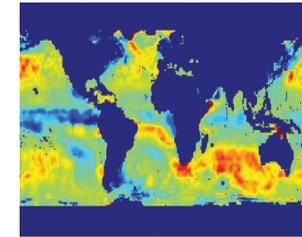


Novel satellite products from ocean colour sensors are being used for investigating the role of ocean biology in carbon cycling.

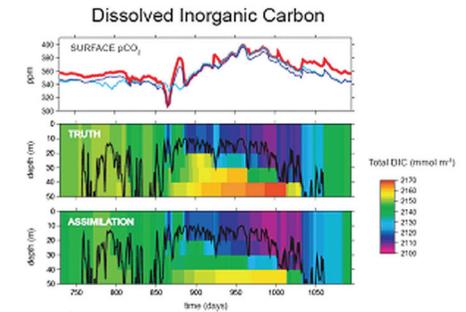
- A. primary production
- B. absorption of light by phytoplankton
- C. phytoplankton size classes



Air-sea CO<sub>2</sub> flux difference



Improved understanding of the speed at which carbon dioxide transfers between the ocean and atmosphere have come from using sea state measured by satellites.



Above

Satellite ocean colour data has been “assimilated” into ecosystem models to constrain forecasts of the ocean carbon cycle.

Below

Models of the NW European Shelf calculate the contribution of biological and physical processes to air-sea exchange in this region, enabling us to estimate its importance in the global carbon cycle (positive values show sinks).

Annual CO<sub>2</sub> Flux mol C m<sup>-2</sup> yr<sup>-1</sup> - 1993

