TOWARDS AN AUTONOMOUS GLOBAL OCEAN CARBON OBSERVATORY

J.K.B. Bishop[1,2] and T.J. Wood[2]

[1]Department of Earth and Planetary Science, University of California, Berkeley, CA 94720-4767, jkbishop@berkeley.edu
[2]Earth Sciences Division, Lawrence Berkeley National Laboratory, MS90-1116, Berkeley, CA 94720

Ocean acidification and circulation changes brought by increasing atmospheric CO_2 will have profound but unpredictable impacts on the natural ocean biological carbon pump, a process that naturally transports ~10 Pg C y^{-1} to waters below 100 m. The stability of the pump is in question. Prediction of future changes in the ocean carbon cycle requires cost-effective all-weather all-season observations of biotic carbon flows on appropriate time and space scales. This presentation describes work to close the space/time gap in observations of biologically driven ocean carbon cycle processes.

The ARGO program with 1000's of low-cost Lagrangian profiling floats operating at sea is providing sea-truth for simulations and forecasts of the climate state of the ocean. We have adapted floats for carbon observations.

Since 2001, a dozen low-cost long-lived robotic Carbon Explorers (CE, optics and telemetry enhanced ARGO floats) have been deployed return real-time information on the daily variation of particulate organic carbon (POC) concentration and systematic changes in POC sedimentation to kilometer depths in the ocean (Bishop et al., 2002, 2004). 7 years of data now exist from the worlds most remote and stormy locations. A sensor for particulate inorganic carbon (PIC; Bishop and Guay, 2006) can detect the effects of ocean acidification on carbonate particles and producers from surface to bottom and can be deployed on the CE. The first Carbon Flux Explorer, designed to follow hourly variations of POC and PIC sedimentation for seasons, successfully completed its first sea trials with operations to 800 m in June 2007.

It is feasible to ramp up a "Carbon ARGO" which will improve model predictive skill for the ocean biotic-carbon cycle and, when fully implemented, can provide in real time the atmosphere-ocean carbon balance and thereby enable closure and valuable cross check on the full carbon cycle.

References

Bishop, J.K.B., R.E. Davis and J.T. Sherman (2002) Robotic Observations of Dust Storm Enhancement of Carbon Biomass in the North Pacific. Science 298, 817-821.

Bishop, J.K.B., T.J. Wood, R.E. Davis and J.T. Sherman (2004) Robotic Observations of Enhanced Carbon Biomass and Export at 55°S. Science 304, 417-420.

Bishop, J.K.B. and C.K. Guay (2006). Method and apparatus for measuring birefringent particles. US Patent #7,030,981.