

## Robotic Observations of Carbon Cycle Processes in Remote and Very Stormy Oceans

Jim K. B. Bishop

Lawrence Berkeley National Laboratory, Berkeley, CA, 94708, USA, Tel. +1 (510) 495 2457

Approximately 1 Pg ( $10^{15}$  g) of marine plant carbon biomass photosynthetically fixes ~50 Pg of carbon per year. The very fast turnover times for ocean carbon biomass coupled with slow traditional observing systems means that a major “space-time” gap exists for ocean carbon cycle observations in all but a few locations.

The international project ARGO is now beginning to seed the ocean with several thousand autonomous profiling floats over the next few years to measure mid-depth ocean circulation, temperature, and salinity to provide an improved view of the climate state of the ocean. The recent 20-times plus improvement of rates of ocean to satellite data telemetry permits augmentation of the long-lived ARGO - style floats with low-power sensors for carbon system components and fluxes. We have developed a robotic autonomous Carbon Explorer capable of performing real-time high frequency (diurnal) observations of carbon biomass variability of the upper kilometer for seasons to years.

Our first two Carbon Explorers were deployed in the subarctic North Pacific Ocean on 10 April 2001 near ocean station PAPA (50°N 145°W) to explore biological/physical coupling of high nutrient low-chlorophyll (HNLC) waters. Several days later, an intense cloud of Gobi desert dust passed overhead. The Explorers both recorded a two times biomass enhancement - likely due to iron fertilization from the dust - in the weeks following the passage of the dust. Both Explorers continued observations until late December 2001.

Another four profiling Carbon Explorers were deployed during the NSF/DOE funded SOFEX experiment in January 2002 and are still operating in the southern ocean in the howling 50's and seasonal ice zone 60's. The ability of these low cost observers to survive 25+  $\text{m s}^{-1}$  winds and 12+ m seas (we do not know yet about ice cover) in the southern ocean while at the same time transmitting nearly unbroken data streams opens up a real possibility for an international 'C-ARGO' program aimed at carbon biogeochemistry of the seas.