MEETINGS

Improving Intercomparability of Marine Biogeochemical Time Series

Global Intercomparability in a Changing Ocean: An International Time-Series Methods Workshop; St. George's, Bermuda, 28–30 November 2012

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Shipboard biogeochemical time series represent one of the most valuable tools scientists have to quantify marine elemental fluxes and associated biogeochemical processes and to understand their links to changing climate. They provide the long, temporally resolved data sets needed to characterize ocean climate, biogeochemistry, and ecosystem variability and change. However, to monitor and differentiate natural cycles and human-driven changes in the global oceans, time series methodologies must be transparent and intercomparable when possible. To review current shipboard biogeochemical time series sampling and analytical methods, the International Ocean Carbon Coordination Project (IOCCP; http://www.ioccp.org/) and the Ocean Carbon and Biogeochemistry Program (http://www.us-ocb.org/) convened an international ocean time series workshop at the Bermuda Institute for Ocean Sciences.

With representation from 17 countries and 33 time series around the globe, the workshop brought together participants who had both an understanding of the scientific goals of their time series and ample hands-on experience with sample collection and analysis. The workshop opened with plenary talks that highlighted scientific insights derived from shipboard and fixed-point time series, as well as the logistical challenges of maintaining time series, particularly in developing countries. Participants then broke into nine smaller groups to discuss sampling and analytical protocols. Each working group comprised representatives from multiple time series and focused on a different set of biogeochemical parameters, including pigments; in-line (bow intake) measurements; conductivity, temperature, and depth parameters; inorganic macro- and micronutrients; biomass; carbonate system; primary and bacterial production rates; sediment trap fluxes; and organic matter.

With a focus on sampling, standardization, nomenclature and data reporting, and quality assurance and control protocols, the working groups compared established methods and developed a consensus ranking of methods (optimal/good/acceptable) for each parameter. With the recognition that not all time series can easily adopt the optimal method for each parameter, working groups identified metadata (method details and descriptors) that would facilitate comparison of data derived from different methods. Working groups also discussed newly emerging technology that might improve data precision and accuracy in the future.

In the interest of improving internal consistency within individual time series as well as data intercomparability across multiple time series, working groups highlighted ongoing community intercomparison activities and devised simple, low-cost experiments to assess the efficacy of current sampling and analytical protocols. Suggested experiments and community intercomparison activities included seawater sample collection with repeat particulate sampling at regular time intervals to quantify the effects of particle settling and revisit sample extraction order if necessary, quantitative comparisons of chlorophyll extraction using different solvents, primary productivity incubation time (e.g., 12 versus 24 hours) comparisons, laser-based (flow cytometry) bacteria and phytoplankton cell count intercomparisons, nutrient intercomparison using both commercially available and secondary (internally calibrated) standards, and comparison of a suite of coulometric titration models being used for measuring dissolved inorganic carbon.

More information is available on the workshop Web portal (http://www.whoi.edu/website/TS-workshop/), which will be gradually transformed into a Web-based global network of shipboard biogeochemical time series that will include detailed information about parameters being measured and methods being used for each time series.

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