Measuring the biological pump using oxygen concentrations on profiling floats

S. EMERSON*, S. M. BUSHINSKY AND S. RISER

School of Oceanography, University of Washington, Seattle, WA, USA, (*correspondence: emerson@uw.edu)

The flux of biologically-produced organic carbon from the surface ocean (the biological pump) plays an important role in maintaining the pCO_2 of the atmosphere and the oxygen content within the ocean interior. Evaluating this flux and the mechanisms controlling it are necessary to determine marine carbon cycle feedback to climate change. The three primary methods for determining the biological pump: field measurements, satellite remote sensing, and global climate models suggest different geographic distributions of the flux. The accuracy of model and remote sensing results can be judged against field measurements with the assumption that annual net community production (ANCP) is equal to biological carbon export on time scales of a year or more. Field determinations made so far indicate much less geographic variability of the biological pump than satellite-derived fluxes, but annual measurements are not presently sufficient in number or geographic distribution to provide credible calibration. One approach for expanding the number of field estimates of the biological pump is to determine the net annual biological oxygen production using upper-ocean oxygen mass balance and assume that the biological oxygen to carbon production ratio is 1.45. Profiling floats with oxygen sensors are a feasible, affordable method for increasing the number of oxygen time-series locations if accurate in situ measurements can be made. We show that in situ calibration of O_2 sensors improves accuracy enough that it is possible to determine net annual biological oxygen production in a wide variety of productivity regimens of the world's oceans.