Geophysical Research Abstracts, Vol. 8, 08514, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08514

Productivity estimates from triple oxygen isotopes and oxygen/argon ratios in the Equatorial Pacific

J. Kaiser (1,4), M. K. Reuer (2,4), B. Barnett (4), B. Sturtevant (3,4) and M. L. Bender (4)

(1) School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom (2) Colorado College, Colorado, Springs, Colorado, USA, (3) Department of Physics, University of Maine, Orono, Maine, USA, (4) Department of Geosciences, Princeton University, USA

Many atmospheric trace gases display oxygen isotope anomalies, i.e., deviations from a mass-dependent relationship between relative $^{17}O/^{16}O$ and $^{18}O/^{17}O$ enrichments. They inherit these anomalies usually directly or indirectly from atmospheric ozone. In 1999, Luz et al. showed that even the most abundant atmospheric oxygen-bearing species, molecular O_2, displays an anomaly, which is largely due to isotope exchange reaction between oxygen species and carbon dioxide in the stratosphere. The anomaly of O_2 can be exploited to distinguish the fraction of dissolved O_2 introduced by gas exchange from that introduced by photosynthesis [Luz and Barkan, 2000]. Together with measurements of the dissolved O_2/Ar ratio and parameterizations of gas exchange it is possible to calculate rates of net community O_2 production (N) and gross photosynthetic O_2 production (G) in the oceanic mixed layer.

We have made combined triple oxygen isotope and O_2/Ar ratio measurements in the Equatorial Pacific on three cruises in October/November 2003 (95°W and 110°W), June/July 2004 (155°W and 170°W), and September/October 2004 (125°W and 140°W). N/G ratios estimated from ^{17}O isotope anomalies ($\Delta^{17}O$ values) and O_2/Ar ratios show low values of about 0.1 throughout the region, excluding values that are influenced by upwelling of undersaturated waters near the equator and near divergent fronts. Meridional and zonal gradients of net and gross community production are observed and qualitatively interpreted in the context of the governing oceanic transport patterns and nutrient regimes. For example, the asymmetric nitrate distribution in the east with higher nitrate concentrations south of the equator seems to lead to a corre-

sponding productivity gradient. Moving westward along the equator, one can observe a decreasing influence of upwelling oxygen-undersaturated waters, until the effect of biological production fuelled by nutrient-rich upwelled waters dominates at 170žW, manifesting itself in biological O_2 supersaturations up to 3%.