



Instruments and Methods

Continuous shipboard sampling of gas tension, oxygen and nitrogen

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Abstract

A novel shipboard gas tension device (GTD) that measures total dissolved air pressure in ocean surface waters is described and demonstrated. In addition, an improved method to estimate dissolved N₂ levels from simultaneous measurements of gas tension, dissolved O₂, water temperature, and salinity is described. Other than a flow-through plenum, the shipboard GTD is similar to the previously described moored-mode GTD (McNeil et al., 1995, Deep-Sea Research I 42, 819–826). The plenum has an integrated water-side screen to protect the membrane, and prevent the membrane from flexing in super-saturated near surface waters. The sampling scheme uses a well mixed and thermally insulated 15 L container that is flushed by the ship's seawater intake at a rate of 3–15 L min⁻¹. Dissolved gas sensors are placed inside this container and flushed with a small recirculation pump. Laboratory data that characterize the response of the modified GTD are presented. The modified GTD has a constant, isothermal, characteristic (e-folding) response time of typically 11 ± 2 min at 20 °C. The response time decreases with increasing temperature and varies by ± 35% over a temperature range of 5–35 °C. Results of field measurements, collected on the R.V. *Brown* between New York and Puerto Rico during September 2002, are presented, and provide the first look at co-variability in surface ocean N₂, O₂, and CO₂ levels over horizontal length scales of several kilometers. Dissolved N₂ concentrations decreased by approximately 16% as the ship sailed from the colder northern continental shelf waters, across the Gulf Stream, and into the warmer northwestern Atlantic Ocean. Historical database measurements, buoy time series, and satellite imagery, are used to aid interpretation of the dissolved gas levels.

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1. Introduction

Improved knowledge of the processes that control upper ocean distributions of CO₂ and O₂ will lead to improved understanding of the role of

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