Dissolved Gas Measurements at Stn. P4 during the 97–98 El Niño

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Preliminary results and interpretation of measurements obtained at the N.E. Pacific El Niño monitoring station P4 during September 1997 to May 1998 are presented. Station P4 is situated in the vicinity of 48° 39' N and 126° 40' W approximately 75 km west of Vancouver Island, British Columbia, Canada in a water depth of approximately 1,300 m. An instrument package, consisting of a SBE16 DO CTD and an upward-looking sonar, was deployed on a subsurface mooring at a mean depth of ~20 m. Time series measurements, recorded with a 1-h sampling period, include total dissolved air pressure or gas tension, dissolved oxygen and nitrogen concentrations, fluorescence, water temperature and salinity, and acoustical back-scatter intensity.

Data Overview

Figure 1 displays a summary of the data. The instrument package remained at around 20 m depth for the majority of the deployment, although it was drawn down to depths in excess of 50 m for a short period during a storm on year day 415. Water temperatures in November 1997 (year day 280) were around 15°C. Water temperature at 20 m depth continued to cool until mid-January 1998 (year day 380). Dissolved oxygen, measured by a Beckman probe on the SBE16, appeared super-saturated by approximately 20–30% for the first 25–30 days of the deployment and then remained reasonably stable, close to saturation. Winkler calibration samples are indicated. The initial decline in dissolved oxygen concentration is suspect and probably associated with a calibration change during what appears to be a ‘settling in’ period of the sensor. This is apparent by comparing the dissolved oxygen sensor measurements with the gas tension signal as follows.

Gas tension is the dissolved air pressure. The signal is approximately 20% pO_2 (dissolved) and 80% pN_2 (dissolved). As dissolved N_2 is relatively biologically inert, the sensor responds, like an oxygen sensor, to variations in dissolved oxygen concentration. The accuracy of the gas tension measurement, however, is remarkable. Its absolute error is ± 0.01% yr^{-1} (the error bar is thinner than the plotted line). Unfortunately it stopped working on day 450 due to a pressure housing leak, but not before the spring bloom.

A bloom event is identified during mid-March, lasting approximately 10 days. The bloom is reflected in the dissolved oxygen measurements, the gas tension measurements and the fluorometer measurements, providing three completely independent means of determining the timing, duration and size of the bloom. We used a WETLABS WETStar fluorometer. The calibrations appear good (*cf.*, bottle sample). The fall bloom and spring bloom periods are identified. The spring bloom occurs shortly after a storm. The bloom appears to be triggered by a very calm period when there is no significant surface wave activity or bubble plume penetration (to be discussed). Peak Chl levels of ~ 4 $\mu g\ l^{-1}$ were recorded.

The meteorological and wave measurements we use are from the Environment Canada buoy # 46206 located at 48° 50' N and 125° 60' W. Shown also for comparison is a time series of the power at the inertial period (ϕ_1) of the CTD pressure period, which serves as a crude indicator of storm activity. Bubble cloud penetration depth is measured using an upward-looking sonar at 200 kHz, located at the top of the mooring with an unobscured view of the surface.

These data may be compared with historical measurements and differences interpreted in terms of the impact of the El-Niño on N.E. Pacific productivity.