A NEAR-SURFACE MICROSTRUCTURE SENSOR SYSTEM WITH REDUNDANT T AND C AND FAST RESPONSE DISSOLVED OXYGEN PROBES

A near-surfacemicrostructure sensor system was developed according to the NOAA OACES project entitled,

Fine Thermohaline Structure and Gas Exchange in Near-Surface Layer of the Ocean

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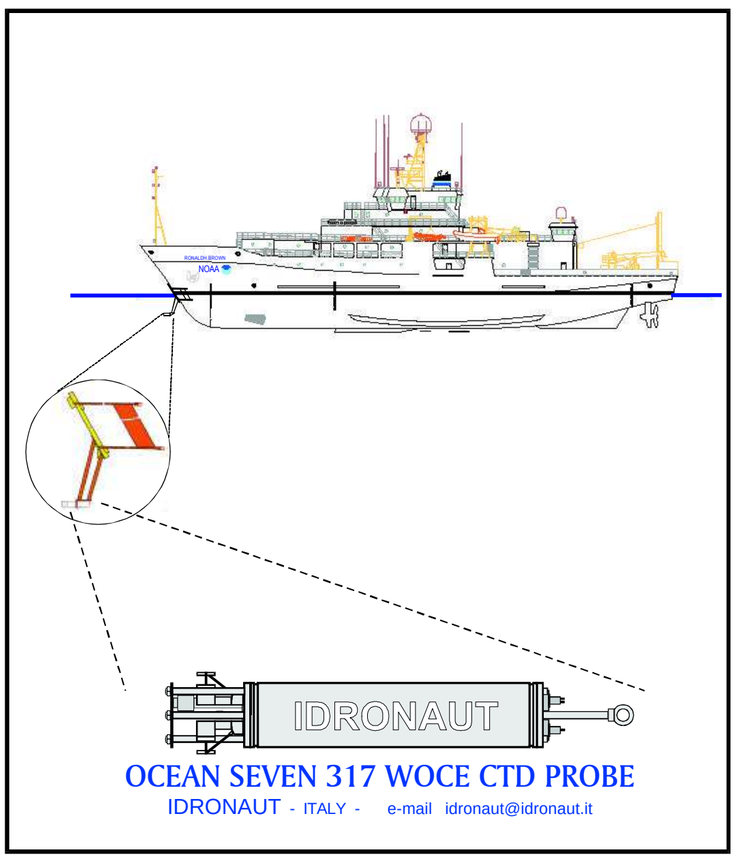

Figure 1

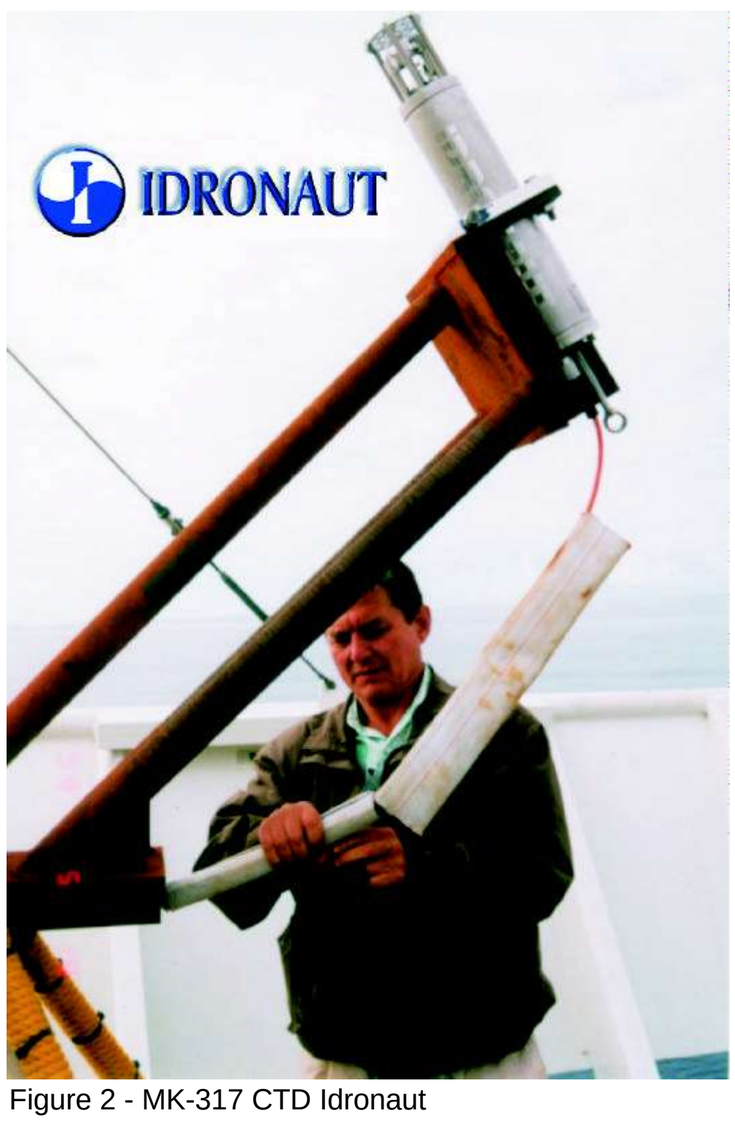

Figure 2 - MK-317 CTD Idronaut

The main goal of this NOAA project is to identify useful connections between the near-surface mixing processes and air-sea gas-exchange. During the Gas-exchange cruise on the R/V Ronald H. Brown (May-June 1998), the microstructure sensor system was installed on the bow of the vessel at a 1.7-m depth, using a specially designed bow frame (Figure 1). A high resolution pressure sensor protected from the influence of the dynamical component maintained the co-ordinate system fixed to the surface. Three different types of sensor configuration were tested in Leg 1. Most of the measurements during the main part of this project (leg 2) were performed with the MK 317 WOCE CTD Idronaut (Figure 2) equipped with two additional dissolved oxygen (DO). The use of redundant T and C channels allowed us to develop an effective algorithm for removing the segments of record contaminated by the air-bubbles and occasional probe surfacing. The two examples of measurements in the Atlantic Ocean are shown in figures below.

Figures:

Fig. 1 - The sensor system mounted on the bow of the R/V Ronald H. Brown in GASEX-98.

Fig. 2 - MK-317 CTD Idronaut

Fig. 3 - A histogram demonstrating statistics of the difference between two conductivity channels. The bias between the channels is determined as the position of the distribution maximum (Δc_{max} = -0.002mS/cm). After removing this bias, the difference between two conductivity channels serves as an indicator of disturbances produced by bubbles or sensors' surfacing.

Fig. 4 - A test of the response time dynamical correction. Blue is the original temperature signal and red is the corrected one. Test was performed at the NSU Oceanographic Center at the intersection of the air-sea interface with an about 3-m/s speed.

Fig. 5 -A segment of the record obtained during a strong diurnal warming event in the Atlantic Ocean near Azores (17 May 1998). Calm, clear-sky weather with the air much warmer than the bulk of the mixed layer water resulted in an unusually strong diurnal warming localized in the upper ~½ meter only. Because of surface waves and associated pitching of the vessel, the sensors 'scan' a very near-surface layer of the ocean. Note surfacing of the sensors which is clearly seen on the conductivity channels.

Fig. 6 - Vertical profiles of temperature (T), conductivity (C) and dissolved oxygen (O_2) obtained from the bow sensors by averaging the corresponding records within 5-cm depth bins over 1 min time period. Note an ~4°C temperature difference localized in the upper half a meter of the ocean.

Fig. 7 - An example obtained during the intersection of a surface freshwater lens at calm weather. Averaging is over a 5-min time period.

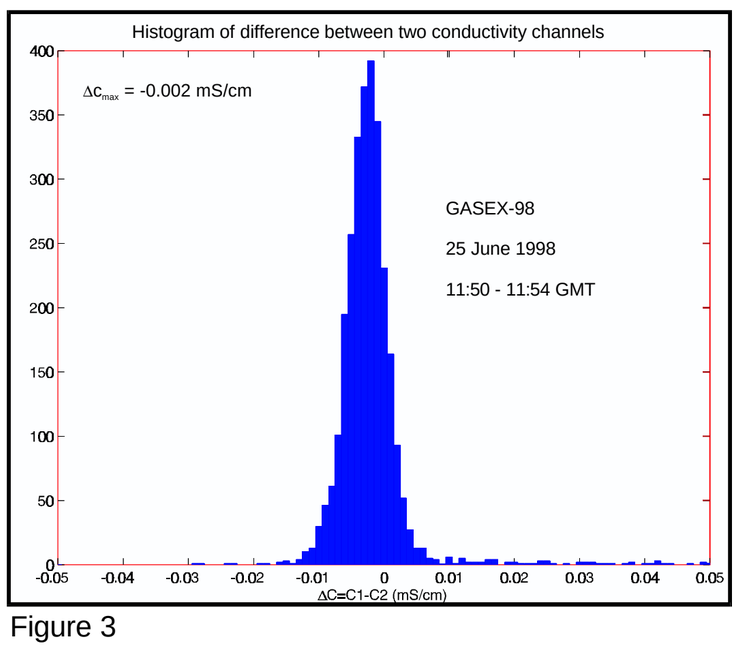

Figure 3

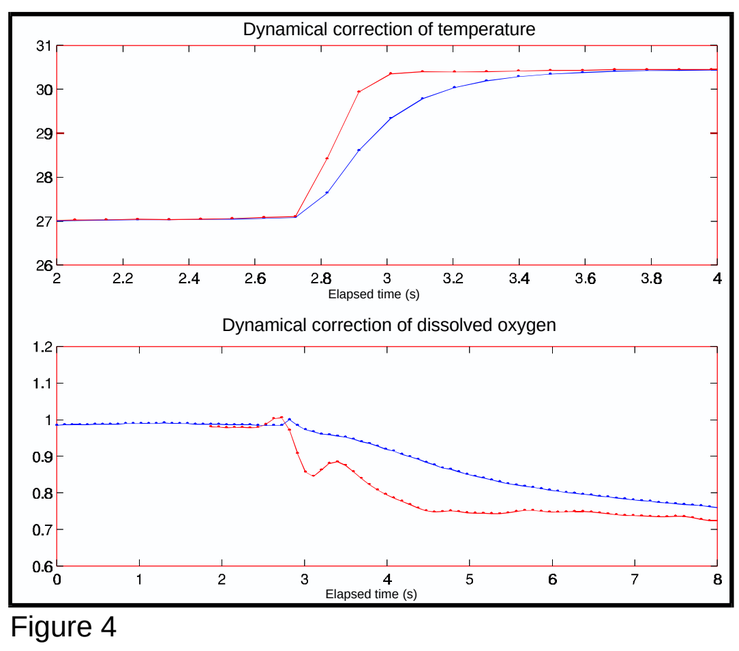

Figure 4

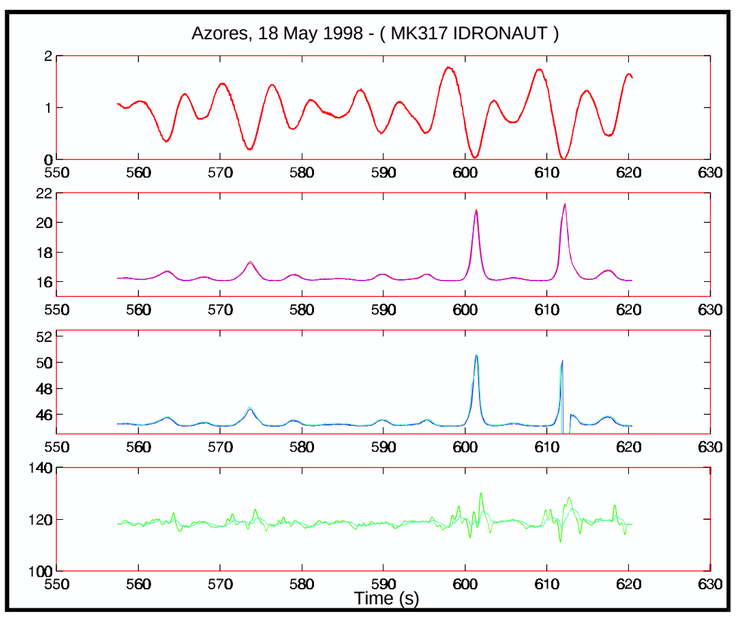

Figure 5

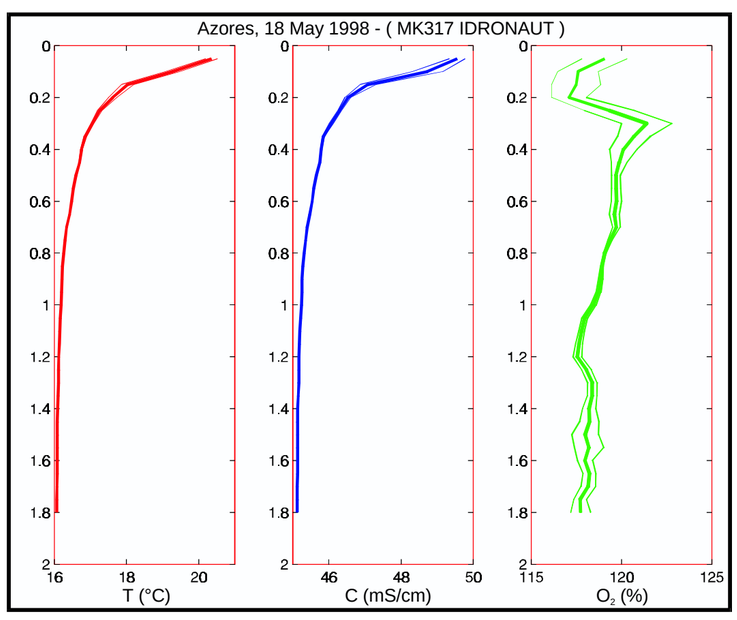

Figure 6

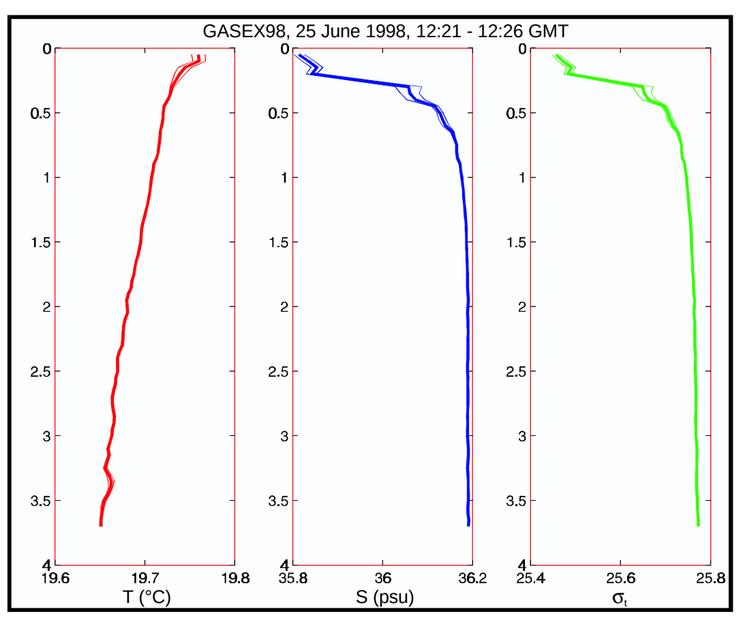

Figure 7