CTD Calibration Sample Data Set

During the North Sea Project a significant data set of samples used to calibrate the CTD sensors accrued. This document describes the methods used to obtain these data.

Salinity

A salinity sample, usually from the bottle fired nearest to the sea floor, was drawn from each cast after several washings with the sample sea water into a screw topped glass bottle with an airtight plastic seal. Samples were transferred in batches to the ship's constant temperature laboratory where they were left for at least 24 hours to attain thermal equilibrium.

Salinities were measured on a Guildline Autosal salinometer using standard sea water as a reference standard. Occasionally, if supplies of standard sea water ran low, batches of sea water calibrated against standard sea water were used as a secondary standard.

Quality control comprised the rejection of salinity values shown to be erroneous during the CTD calibration exercise.

Temperature

On each CTD cast one of the sample bottles (usually the first to be fired at the bottom of the cast) was fitted with a frame containing two SIS RTM-4002 digital thermometers which reversed, triggering the thermometers, when the bottle was fired.

The readings were corrected using manufacturers calibration sheets. If the calibrated values differed by more than 0.009C, the data were checked and erroneous values rejected. Checks were also made to eliminate erroneous data resulting from failure to reset the thermometers between casts. The two values (if both deemed good) were averaged. Any further values shown to be erroneous during the CTD calibration exercise were deleted from the data set.

Dissolved Oxygen

Three replicate samples were drawn from the water bottles into 60 ml borosilicate glass stoppered bottles and 0.5ml of each Winkler reagent added using BCD multi-addition pipettes. The reagents were prepared according to the recommendations of Carrit and Carpenter (1966). After mixing, the oxygen bottles were stored under fresh water until analysed.

Analysis was undertaken on board using the manual photometric endpoint detector method described by Bryan et al (1976).

Chlorophyll and Phaeopigment

Extracted chlorophyll and phaeopigments for all cruises where chlorophylls were done with the exception of CH72A and CH72C were determined in the same laboratory, Plymouth Marine Laboratory, using the following protocol.

Up to 2 litres of water for each sample were filtered through glass fibre filters (GFF) and frozen quickly on board ship. The samples were returned frozen to the laboratory where they were extracted with 90% acetone and assayed in a scanning spectrophotometer. The concentrations of chlorophyll and phaeopigments were calculated using the SCOR-UNESCO algorithms (Strickland and Parsons, 1968).

The chlorophyll and phaeopigment determinations on the two legs of Challenger 72 (A and C) in 1990 were undertaken by a different group using a totally different protocol as follows.

Up to 0.5 litres of sea water were filtered through Whatman GFF filters taking care to avoid unnecessary exposure to light. Filters were then extracted, on board ship, in the dark in 90% Analar grade acetone, 10% distilled water, neutralised with sodium bicarbonate.

Fluorescence was measured at sea using a Turner Designs bench fluorometer, calibrated using spectrophotometrically determined standards, before and after acidification with 8% HCl. Chlorophyll and phaeopigment concentrations were calculated using the equation in Tett (1987). The resulting measurement of 'chlorophyll' is the sum of chlorophyll-a and chlorophyllide-a.

Total and Organic Sediment

Two litres of water were drawn from each CTD bottle into a large measuring cylinder. Each sample was filtered using a vacuum filtration system onto a pre-weighed filter. On the early cruises (CH28, CH33, CH35, CH37 and CH39) Nucleopore filters were used. On later cruises these were replaced by GFF filters. Each sample was carefully washed with distilled water to remove salt, removed from the filtration system and air dried.

In some cases where samples had a large sediment load it proved impossible to filter two litres. In these cases, as much of the sample as possible was filtered and the volume filtered determined by noting the volume of water remaining in the measuring cylinder.

After the cruise, each sample was dried and reweighed to constant weight to give the total suspended matter concentration. The samples were then ashed and the organic sediment content obtained from the loss of weight on ignition. The polycarbonate Nucleopore filters used at the beginning of the project decomposed on ignition. Consequently, there are no organic sediment data for project cruises before Challenger 41.

References

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