

Microturbulence profiler data series for cruises Valdivia VA174 and Belgica BG9912

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Content of data series

Parameter	Unit	Parameter code	Number of profiles	Comments
Depth	m	DEPHPR01	62/39	none
Temperature	deg. C	TEMPST01	62/39	none
Salinity	PSU	PSALST01	62/39	none
Water density (Sigma-t)	kg m ⁻³ -1000	SIGTEQST	62/39	none
Brunt-Vaisala frequency squared	s ⁻²	BVFSTP01	62/39	none
Thorpe scale	m	THSCTP01	62/39	none
Temperature gradient	deg. C m ⁻¹	PTDZTP01	62/39	none
Temperature variance	deg. C	TVARTP01	62/39	none
Shear dissipation rate (log ₁₀ (Epsilon))	log ₁₀ (W m ⁻³)	EPSIFY01	62	not available for BG9912

Instrumentation and data processing by originators

The MICSOS Profiler is a free sinking or rising multi-parameter probe equipped with high resolution temperature and current shear sensors for the microstructure observations and precision CTD sensors for standard hydrography. To compensate for disturbing vibrations of the profiler itself, an internal vibration sensor is incorporated. The shear is measured by an aero-foil-shaped shear probe with an overall time constant of 4 ms. The high resolution temperature probe works with a Negative Temperature Coefficient (NTC) sensor which has an overall time constant of about 10 ms. Data resolution of all sensors channels is 16 bits. The sampling rates of the sensors are about 1 kHz. The data are transmitted via a fast link to a computer on the mother ship. The descent rate of the profiler can be adjusted to the surrounding water density by removable weights.

The MICSOS-System consists of the profiler, a special neutrally-buoyant cable for data transmission, a data and power supply interface, and a logger. The system is completed by a data evaluation software package.

A brief characterization of the sensors used during the cruises with respect to their measuring range, accuracy and resolution is compiled in the table below. It was noticed that the CTD sensors generally exhibit high accuracies but low resolutions whereas the MICSOS sensors generally reveal relatively low accuracies but high resolutions. Both sensor types supplement each other in order to give a complete as possible picture of the physical environment in the water column.

Specification of precision CTD sensors:

Parameter	Principle	Range	Accuracy	Resolution	Time constant
Pressure	Piezo-resistive	0 – 200 dbar	+/- 0.2 dbar	0.004 dbar	40 ms
Temperature	Resistor Pt 100	-2 – +38 deg C	+/- 0.01 deg C	0.001 deg C	160 ms
Conductivity	7-Pole-cell	0 – 60 mS/cm	+/- 0.02 mS/cm	0.001 mS/cm	100 ms
MS temperature	Negative Temperature Coefficient sensor	-2 - +38 deg C	+/- 0.1 deg. C	0.001 deg. C	7 ms
MS shear		0 - 2 ¹⁶ Counter units	not specified	1 Counter units	4 ms

Characteristics of the shear sensor:

Shear Sensor Channel	Number	Sensitivity [Vms ² /kg]	Gain	Remarks
Shear	1007	2.73E-4	24.42	none

The procedures applied for the post-processing, in general are based on methods and algorithms developed during the EUREKA project EU 1246; EUROMAR MICSOS (MICSOS-EPU; data Evaluation and Processing Unit). These procedures were partly improved during the PROVCESS project by HYDROMOD in close co-operation with the University of Miami who participated as member in the EC Concerted Action CARTUM. The latter project accompanied PROVCESS and gave support particularly for the methodical and theoretical aspects (see, e.g., Peters 1999).

Further details on instrumentation and data processing including algorithms used can be found in the following documents included on the CD-ROM:

['Micro-Structure Measurements with the MICSOS-Profiler Data Reports from the Northern and Southern North Sea Campaigns' \(Baumert et al. 2001\).](#)

Sampling strategy

Northern North Sea Experiment: the MICSOS profiler was used to collect data about the microscale water stratification and turbulence characteristics around the main pycnocline during the cruise VALDIVIA VA174.

A series of about 50 sets of vertical profiles, each consisting of 8 casts, and therefore in toto about 400 casts, were measured from about ten metres below the sea surface down to a water depth of 80 to 90 m. The uppermost ten metres cannot be evaluated due to the strong influence of the ship on the hydrodynamic fields of interest. The measurements were carried out while the ship was anchoring on a permanent position in the centre of the target area (59 deg. 20' N and 001 deg. 00' E) within a water depth of about 100 m. The main pycnocline was in a water depth of about 40 m. When starting with the microstructure measurements the pycnocline was sharp. During the period of observations it changed its shape slightly with frequently occurring stair cases

The MICSOS measurements were made between 10/09/1998 16:00 and 14/09/1998 13:00. The sets of profiles were made at 90 minute intervals. Each set of casts took about 45 minutes. A vertical CTD-profile was acquired with a SEABIRD probe at the beginning of each set of microstructure measurements so that the MICSOS-CTD and SEABIRD data could be compared and correlated.

Southern North Sea Experiment: During the cruise Belgica BG9912, the MICSOS profiler was used to collect data on the microscale, specifically, water stratification and turbulence characteristics in the water column and especially in the near-bottom boundary layer. Two series of vertical profiles were carried out, one over a 13-hour cycle and the other over a 25-hour cycle. Whereas the 13-hour cycle, which was carried out during the first night on site (17-18/05/1999), consisted of 8 casts per measuring event, the 25-hour cycle (19-20/05/1999) was carried out with a number of 16 casts per event. These

different sampling rates were chosen to study the role of intermittence for turbulence measurements. Together, the two cycles add up to about 40 measuring events with 528 single casts. The profiles were measured from about three metres below the sea surface down to a depth of 16 to 19 m, which means that all profiles were measured down to the bottom. However, due to the strong influence of the ship's hull on the near-surface hydrodynamic field, the uppermost two to five metres of the water column cannot be evaluated in terms of water-column physics. Because of the high current velocities within the target area, the measurements were not carried out at anchor but while the ship was drifting. After each hourly measuring event the ship moved back to the central position (52° 18' N; 004° 18' E). When starting with the microstructure measurements the weather was rough and no stratification was detected during the first 13-hour cycle. During the second cycle (25 hours), the weather and sea were calm and a number of layers developed within the uppermost water column; a continuous change of stratification in time and space has been observed.

The MICSOS measurements were made from 17/05/1999 20:00 until 18/05/1999 11:00 (13-hour cycle) and from 19/05/1999 10:00 until 20/05/1999 11:00 (25-hour cycle). The sets of profiles were made at 60 minute intervals. Each set of casts took about 20 to 30 minutes.

BODC processing and quality control

In order to standardise parameter units with those held in the BODC Parameter Dictionary the following modification was carried out prior to loading the data into a database under the Oracle Relational Database Management System: dissipation rates were converted from $\text{m}^2 \text{s}^{-3}$ to W m^{-3} by multiplying the value by an average density value of 1027.093 calculated for the whole campaign. They were then expressed on a \log_{10} basis.

Comments on data quality

None to report.

References

Peters H (1999) Notes on the processing of microstructure data – General approach and specific recommendations; HYDROMOD Technical Report No. 7, HYDROMOD Scientific Consulting, Wedel i. Holstein.