Microturbulence profiler data series for cruise Pelagia PE136

Principal Investigator:

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Data originators:

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Content of data series:

Parameter	Unit	Parameter code	Number of profiles	Number of stations	Comments
Depth	m	DEPHPR01	827	60	none
Height above sea bed	m	AHSFZZ01	827	60	none
Temperature	deg. C	TEMPPR01	827	60	none
Salinity	PSU	PSALPR01	827	60	caution
Water density (Sigma-t)	kg m^{-3}	SIGTEQST	827	60	caution
Epsilon1	$\log_{10}(W\ m^{-3})$	EPSIFY01	827	60	none
Epsilon2	$\log_{10}(W\ m^{-3})$	EPSIFY02	827	60	none

Instrumentation and data processing by originator:

The turbulence dissipation rate measurements were made with the FLY-IV profiler (Dewey et al. 1987). This instrument uses a pair of piezoelectric sensors (sensor 1 and sensor 2) to measure the vertical shear in the horizontal velocity field. In addition the probe is equipped with fast and slow thermistors, a conductivity cell and a pressure gauge. The sensors specifications (Dewey et al. 1987) are:

Sensor	**Range**	**Accuracy**	**Response time**
Conductivity	20-60 mmho/cm	±0.05 mmho/cm	0.34s
Fast thermistor	1.5 to 13 °C	±0.004 °C	0.018s
Slow thermistor	1.8 to 17 °C	±0.006 ±C	0.3s
Pressure	0 to 250 m	±0.5m	
Tilt	0 to 45°	±0.5°	
Shear probe	0 to 4 s^{-1}	±5%	1 to 2 cm resolution

The pressure case contained two tilt gauges, signal amplifiers (analogue to digital electronics) and the power supply. Syntactic floats were attached to the top of the case in order to control the fall velocity and ensure that the profiler remained vertical.

The profiler free falls to the bed at ~80 cm s^{-1}, sampling the shear 274 times per second. Profiles are thus measured every four minutes depending on the water depth. Valid results are obtained from 10 m below the surface to 15 cm above the bed.

For processing, the water column is subdivided into bins. In the interior, bin length is ~1.6 m with shorter bins used in the high shear zone near the bed in order to reduce the effects of non-stationarity. An FFT is performed on the shear signal from each bin to obtain the power spectrum and the dissipation rate spectrum.

Transfer functions are then used to compensate for deterioration in probe performance at high frequencies. Low and high frequency cut-offs are applied to isolate noise and the signal is then boosted to account for energy lying beyond these cut-offs. The level of noise experienced by the FLY system is low and is equivalent to a dissipation rate of ca. 3.0×10^{-7} W m^{-3} (Dewey et al 1987). Generally, over 80% of the dissipation spectrum is observed directly. The Epsilon profiles are then interpolated to give a result every 15 cm and is presented either as Epsilon itself (in W m^{-3}) or, since turbulence is largely confined to the near bed region, as $\log_{10}$(Epsilon).

Details on the calculation of the turbulent dissipation rate Epsilon from the velocity gradient can be found in Dewey and Crawford (1988).

Sampling strategy:

The sampling strategy adopted during Pelagia PE136 cruise was to carry out intensive measurements over periods of 15 hours. During this time the FLY was deployed every hour immediately following an hourly CTD profile. Each hourly deployment consisted of a series of approximately 15 profiles. This cycle was repeated 4 times during the cruise.

BODC processing and quality control:

The data were submitted to BODC in an ASCII file with datacycles sorted on a time (Day Numbers) and depth basis. Day numbers were converted to date and time and each FLY profile was attributed a unique identification number (BODC Event Number or BEN) and an originator's identifier. The originator's identifier was of the form FLYxxzz where xx is the two-digit number identifying hourly FLY series in the 'Summary of Activities' table of the cruise report (and attributed by matching on date and time); zz is a two-digit number identifying the individual profile within each series. The data were loaded without further modification into a database under the ORACLE Relational Database Management System.

Comments on data quality from data originator:

Although most of the bad data and spikes have been removed, the near surface data may still contain some effect of the ship's wake. In many casts it was not possible to easily separate the wave mixing from the ship's wake. Data were considered suspect if there was a significant disagreement between the two shear channels. Spectral analysis of the suspect data was then used to clarify if the data were bad or useable.

The salinity and density profiles should be used with caution due to a position offset between the temperature probe and conductivity cell on the FLY probe. In regions with high salinity and/or temperature gradients it is sometimes difficult to align the data accurately for the calculation of salinity and density.

The conversion of Epsilon from W m^{-3} to W kg^{-1} has not been performed because of the different views as to the best method to use. The three alternatives are:
- Divide by the point density.
- Divide by a depth averaged density.
- Divide by a fixed value i.e. 1025.

References:

Dewey RK, Crawford WR, Garret AE, Oakey NS (1987). A microstructure instrument for profiling oceanic turbulence in coastal bottom boundary layers. Journal of Atmospheric and Oceanic Technology 4(2):288-297.

Dewey RK, Crawford WR (1988). Bottom stress estimates from vertical dissipation rate profiles on the continental shelf. Journal of Physical Oceanography 18(8):1167-1177.