

LARGE PARTICULATE MATTER and ZOOPLANKTON Study

Underwater Video Profiler

Cruise report

Marc PICHERAL / Gaby GORSKY
CNRS/UPMC
LOV
Station Zoologique
BP 28 La Darse
06234 Villefranche/mer
Tél. : +4 93 76 38 08/16
Fax : +4 93 76 38 34
Email : picheral@obs-vlfr.fr, gorsky@obs-vlfr.fr

Quantification and distribution of the particulate matter and the large zooplankton in the contrasted environments of the Keops cruise.

Quantification et distribution de la matière particulaire et du zooplankton dans le cadre de la mission Keops

-Parameters and methodology

The moored system The Underwater Video Profiler (UVP) was constructed in the Laboratoire d'Océanographie de Villefranche sur mer, France (UPMC/CNRS) with the support of the CNRS (Centre National de la Recherche Scientifique) and the European MAST II and III programs. The UVP has been developed for the acquisition of large-particle (> 60 µm) abundance and size distribution data from 0 to 1000 m. Different models have been constructed since 1990 (Gorsky et al. 1992). They were designed to minimise the disturbance of the illuminated volume in order to reduce a possible disruption of imaged particles. All models are autonomous and can be lowered on any hydrological cable. The fourth digital model utilised during Keops cruise is described here.

The UVP model IV is a vertically lowered instrument mounted on a galvanized steel frame (1.1 x 0.9 x 1.25 m). The lighting is based on two 54W Chadwick Helmuth stroboscopes. Two mirrors spread the beams into a structured 8 cm thick slab. The strobes are synchronized with two full frame 25 and 8 mm C-mount lenses video cameras with and IR filters. The illuminated particles in a volume of respectively **1.25** and **10.5** liters are recorded simultaneously. The cameras are positioned perpendicular to the light slab and only illuminated particles in dark background are recorded. The short flash duration (pulse duration = 30 µs) allows a fast lowering speed (up to 1,5 m/s) without the deterioration of image quality. Depth, temperature and conductivity data are acquired using a Seabird Seacat 19 CTD probe (S/N 1539) with fluorometer and nephelometer (both from Chelsea Instruments Ltd.). The system is powered by four 24V batteries and is piloted by a powerful computer. The data acquisition can be time or depth related and programmed prior to the immersion.. The UVP is well adapted to count and measure fragile aggregates such as marine snow as well as delicate zooplankton.

Daylight can modify the optical properties of particles in the upper 10-60 meters. The depth range of this layer depends on the characteristics of the light penetration. Therefore, data analysis starts at depth where the measured background value of daylight remains identical to that of night profiles or to that of deep layers, not influenced by changing light regimes. This depth is automatically computed by the UVP using home made algorithms.

Samples consist of computer specific .seq and resulting files processed in situ during the ascent of the instrument. The zooplankton and CTD processing is made onboard or in the laboratory (LOV)

The UVP has two important features: a) it does not disturb the recorded particles or organisms and b) it allows quick data retrieval and processing. Processing of images obtained by the UVP in the structured light beam is automated and made by the system during the recovery. The images are analysed and treated automatically by custom-made software. The objects in each image are detected and enumerated. The area of every individual object is measured and size filtered targets are

described by 27 parameter for automatic sorting. Data are stored in an ASCII file and can be combined with the associated CTD, fluorometer and nephelometer data (Seasoft Software) using a spreadsheet software. Vertical profiles are printed out onboard immediately after the recovery of the UVP.

The results of the calibrations indicate that the tested configuration can detect 60 µm-sized particles and can reliably measure particles larger than 83 µm in diameter. The metric surface as a function of the pixel surface for the 25 mm and 8 mm lens cameras can be expressed by the following equations:

Equations for cam0 (X=0) : $S_{réelle} = 0,0024 \times (S_{pixels})^{1,4959}$

Equations for cam1 (X=1) : $S_{réelle} = 0,0149 \times (S_{pixels})^{1,6128}$

The calibrations were carried out in a dark test tank filled with 3 m³ filtered (20 µm) sea water. The brightness measured in the test tank was similar to that in the aphotic layers. A calibration grid, placed at different depths of the light slab, was used to estimate the recorded water volume. The dimensions and volume of the parallel light beam recorded by the cameras are :

Caméra 25 mm : **14.1 x 10.6 cm**

Caméra 8 mm : **43.5 x 32.7 cm**

The pixel/mm relationship was calibrated in a test tank by injection of biological particles (range 40 µm - 20 mm) measured prior to their use with a stereomicroscope (Gorsky et al., Estuarine, Coastal and Shelf Science, 2000). Results are expressed in Number of Particles per Litre and Biovolume (ppm). The data are sorted in 22 Volume classes.

Zooplankton results are obtained by automatic sorting of following given parameters. Manual identification is rapidly performed by taxonomist from the automatically selected images.

-Sampling strategy

Due to cable problems onboard RV Marion Dufresne, the UVP had to be deployed on the main CTD cable. We had to disconnect and displace the CTD-Rosette gear before and after each UVP cast. In order to reduce the risks of this operation, the UVP deployments during the different occupations of station A3, B5 and C11 have been cancelled. We could only sample correctly the 3 transects A, B and C.

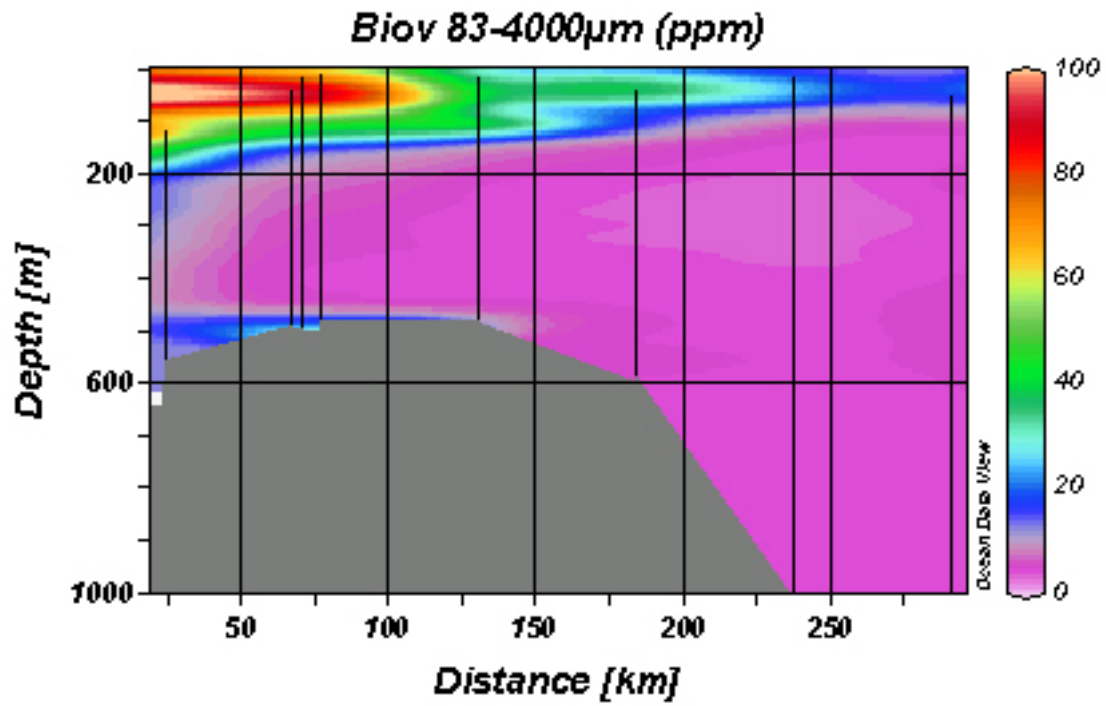
-UVP station list and file names

UVP-CTD filename	Particules UVP Bru filename(0)	Date(UTC)	Starting Time(UTC)	Station Name	Bottom Depth	CTD Rosette file	Latitude	Longitude
keop01	20050120_084800000_0	20050120	84800	A11	2580	10	-49.15	-74.00
keop02	20050121_163500000_0	20050121	163500	A09	2200	16	-49.52	-73.52
keop03	20050122_084600000_0	20050122	84600	A07	635	18	-49.88	-73.03
keop04	20050122_164500000_0	20050122	164500	A05	516	21	-50.27	-72.57
keop05	20050122_232700000_0	20050122	232700	A03	522	24	-50.63	-72.08
keop06	20050123_064900000_0	20050123	64900	A01	670	26	-51.00	-71.60
keop07	20050123_161800000_0	20050123	161800	A03	525	28	-50.67	-72.00
keop08	20050124_055500000_0	20050124	55500	A03	516	34	-50.72	-72.03
keop09	20050126_171100000_0	20050126	171100	C11	3400	42	-51.63	-77.97
keop10	20050128_182700000_0	20050128	182700	B11	3300	50	-50.50	-77.00
keop11	20050129_224700000_0	20050129	224700	B09	3103	56	-50.70	-76.20
keop12	20050130_074400000_0	20050130	74400	B07	573	58	-50.90	-75.40
keop13	20050201_170200000_0	20050201	170200	B05	546	62	-51.10	-74.60
keop14	20050202_035600000_0	20050202	35600	B03	456	66	-51.30	-73.80
keop15	20050202_121400000_0	20050202	121400	B01	371	71	-51.49	-73.01
keop16	20050205_192700000_0	20050205	192700	C11	3550	81	-51.65	-78.00
keop17	20050206_130400000_0	20050206	130400	C09	380	86	-51.92	-77.20
keop18	20050206_210200000_0	20050206	210200	C07	548	89	-52.18	-76.40
keop19	20050207_193000000_0	20050207	193000	C05	540	93	-52.38	-75.58
keop20	20050208_094900000_0	20050208	94900	C03	445	98	-52.70	-74.78
keop21	20050208_152200000_0	20050208	152200	C01a	85	100	-52.99	-74.00
keop22	20050210_212100000_0	20050210	212100	Kerfix	1600	106	-50.67	-68.42
keop23	20050211_055000000_0	20050211	55000	Kerfix	1600	109	-50.67	-68.42
keop24	20050212_053000000_0	20050212	53000	A03	527	115	-50.62	-72.05
keop25	20050212_161300000_0	20050212	161300	A03	527	120	-50.62	-72.05

-Planning for data availability

- Particulate matter results are available under a preliminary output format.
- UVP Sbe19 probe data are available at 5m depth intervals.
- Large Zooplankton distributions will come by the end of 2005.

-Example of Keops preliminary results of Biovolume of particles along transectA



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