

GALAI Particle Sizer data series for cruises: Pelagia PE136, Mitra MT0499 and Belgica BG9912

Co-Principal Investigators

Dr. Colin Jago and Dr. Sarah Jones, University of Wales (UWB), Bangor, UK.

Data Originators

Rebecca Latter, Dr. Robin McCandliss and Malcolm Hearn - UNW.

Content of data series

Parameter	Unit	Parameter code	Number of samples	Comments
Particle size distribution: percentage frequency by number in particle size classes of 1 µm from 2 to 600 µm			82 (PE136) 51 (MT0499) 44 (BG9912)	ASCII files
Particle size mode	µm	MOGSPSXX	82/51/44	see text
Proportion of total particle count in mode class.	%	PRSCPSMO	82/51/44	see text
Total particle count	dimensionless	NPRTPSXX	82/51/44	see text
Mean particle size	µm	MNGSPSXX	82/51/44	see text
Standard deviation of mean particle size	µm	SDGSPSXX	82/51/44	see text
Median particle size	µm	MDGSPSXX	82/51/44	see text
95 th Percentile (*)	µm	PC95PSXX	82/51/44	see text
5 th Percentile (*)	µm	PC05PSXX	82/51/44	see text

(*) cumulated frequency distribution sorted in order of decreasing size classes.

Originators' protocol

Sampling and analytical methods:

Particle size analyses on water samples collected with the CTD rosette sampler were performed during the three cruises (Pelagia PE136, Mitra MT0499 and Belgica BG9912) in the southern North Sea during spring 1999. Water samples were typically collected close to the surface and close to the seabed. The analyses were carried out on board using a laboratory-based laser particle sizer, Galai Cis-100. This instrument measures the obscuration from a particle and uses the 'time-of-transition' theory to provide particle size distribution.

Water samples for particle size analysis were normally obtained from 1.2L Niskin sampling bottles mounted on the CTD rosette. As soon as the CTD came back on board, the bottles were removed from the frame. A close fitting sleeve was slid into the top of the bottle. The bottle was then inverted and the sleeve containing the water sample, removed. The aim of this procedure was to disturb the sample as little as possible.

The sleeve was then connected to the Galai flow through cell and a small volume was flushed through to fill the cell with the new sample. The sample was gently pumped through the laser particle sizer in order to minimise disturbance to any flocs in the sample. Particle size data and video images were recorded on the computer disk and video tape, respectively. When the sample had run through, filtered seawater was poured into the container to flush the system through. The instrument was set to measure particles within a range of 2-600 µm.

Sampling method deviations:

- PE136: it was not possible to mount Niskin bottles on the specialised CTD frame and, as a result, water samples were drawn using a spigot. This method could, potentially, cause disaggregation of flocculated particles.
- MT0499: Niskin bottles were used and stored upright prior to processing through the particle sizer. Noticeable numbers of larger fast setting material were passing through the Galai system during the flushing of the sample cell and were therefore not accounted for in the measurement.
- BG9912: Sample sleeves were stored upside down to avoid the loss of faster settling particles when the sleeve was first connected to the Galai and the sample cell was flushed through.

Shape analysis of the video data was not possible due to hardware problems. The video data obtained were only used for qualitative assessment of the particle population and were not included in the PROVESS Data Set.

Originator's data file format:

The data were submitted to BODC as one ASCII file per sample. File names are composed of a cruise identifier, a CTD cast identifier and a letter to indicate the sample origin ('s' for surface, 'b' for bottom). The file contains a short header generated by the Galai processing software. This is followed by the particle size distribution consisting of two columns: particle size class upper boundary in microns, and percentage frequency by number.

BODC's data processing

Because of the impracticality of loading large frequency distributions into a relational database, a number of particle size distribution parameters were derived at BODC from the data submitted by the originators. These parameters provide an easily accessible summary of the particle size distribution measured by the Galai particle sizer. However it should be stressed that, in doing so, no attempt was made to "correct" the data for potential instrument-specific or sampling-specific bias in the particle size distribution. The parameters derived from the originator's data should therefore be used as relative quantities only. A comparative analysis of the Galai instrument with two other laser particle sizers can be found in the paper cited in reference (Latter et al. 2002).

The processing steps applied to each file were as follows:

1- information read from file's header:

filename > CTD cast number
> sample origin ('S' or 'B')
total count

2- Extract the particle size mode taken as the centre of the size class with the greatest percentage frequency.

3- Calculate mean size \bar{S} :

$$\bar{S} = \sum \frac{F_i * S_i}{100}$$

where S_i is the centre of each size class and F_i is its associated percentage frequency by number.

4- Calculate the arithmetic standard deviation of the distribution:

$$sdev = \sqrt{\sum \frac{F_i * (S_i - \bar{S})^2}{100}}$$

5- Calculate the particle size median.

The particle size median was determined by linear interpolation between the two frequencies closest to 50 percent.

6- Extract the 95th and 5th percentile of the distribution.

These were extracted from the cumulative frequency distribution with the size classes sorted in order of decreasing particle sizes. They represent the centre of the size class for which the cumulated frequency was lower than 95 and 5 % respectively.

The information extracted for each cruise was then compiled into a file containing one record per sample. The records were loaded into a database under the ORACLE Relational Database Management System by matching the records with their corresponding CTD event and bottle sampling depth entries.

The sampling bottle type associated with the Galai samples in the database is that of the CTD rosette sampler. While this is correct for data collected during the cruise PE136 (see originators' protocol above), for cruises MT0499 and BG9912, special 1.2 litres Niskin bottles were mounted on the CTD rosette and specifically used to collect water for analysis with the Galai particle sizer.

The originator's ASCII files are available from the PROVESS CD-ROM Disk 2. If reprocessing the files, the following cautions should be observed:

- the time stamp in the files does not correspond to sampling time and should not be used as metadata.
- sample name in the header of the file mv012s.asc was wrongly set to mv012b.
- for the Pelagia cruise PE136, the Galai files were named after the cruise station number rather than after the CTD cast number. This was incompatible with the structure already in place in the database at BODC and, as a result, Galai ASCII file names will not match CTD cast names in the database. Users who wish to establish the correspondence between the two numerotations should refer to LISST entries since LISST casts were simultaneous to CTD casts and were named after the cruise station number.

Comments on data quality

Galai data collected on PE136 should be treated with caution as the sampling procedure used was highly disruptive. There is evidence that the distribution measured is an underestimate of the actual distribution due to floc break-up during sampling. See Latter et al. (2002) for further discussion on Galai data.

Reference

Latter RJ, Jones SE, Jago CF, Bale AJ (2002) Comparison of three particle size analysers under field and laboratory conditions. Submitted to Journal of Sea Research (PROVESS Special Issue).