Metadata file for

On biogenic turbulence production and mixing from vertically migrating zooplankton in lakes

in Aquatic Sciences

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Description of the dataset fields

Title of dataset	Zooplankton concentration profiles, ADCP backscatter strength and turbulence profiles during zooplankton vertical migration
URL of dataset	`http://researchdata.bath.ac.uk/344`
Abstract	The dataset provides information of data collected on 21 July, 28 July and 28 August 2016 in Vobster Quay, a 40-m quarry, located in Radstock (UK). Data were collected during the diel vertical migration (DVM) of zooplankton at dusk to understand whether small zooplankton can generated turbulence in the lake interior. The dataset contains: (1) backscatter strength data from a 500-kHz ADCP by Nortek, (2) profiles of zooplankton concentration and (3) profiles of dissipation rates of turbulent kinetic energy acquired with a microstructure profiler.
Keywords	Biomixing, ADCP, turbulence, SCAMP, backscatter strength, zooplankton, DVM
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Position of data author	Postgraduate researcher
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Organization associated with the data	University of Bath
Usage Rights	Publicly available and free to use
Geographic region	Data were collected from Vobster Quay. The man-made basin is located in the southwest UK. It has an area of 59,000 m^2 with a maximum depth of 40m.
Geographic coverage	WGS84 coordinates of the bounding box: 51.2473766, -2.4273674 51.2474975, -2.4198357 51.244791, -2.4202112 51.2453215, -2.4268524
Temporal coverage	21/07/2016 28/07/2016 18/08/2016
General study design	The 500-kHz ADCP was deployed in the lake and let it measure from June up to August to track the zooplankton DVM from the measured amplitude. The device was set up to use the 4 beams for the current profiler mode and the 5th vertical beam for the turbulence mode. The device was deployed at a depth of approximately 25m in the east part of the basin. Data were collected with 0.5-Hz frequency from 0.5m from the ADCP transducer, every 0.5m and up to approximately 24m. Turbulence measurements were collected in close proximity to the ADCP from the surface to the bottom in the same flat bottom area of the lake.

Methods description	Data from the bottom-mounted ADCP were collected, analysed and exported using the Nortek's Signature software and custom MATLAB scripts. The raw measurements of backscatter strength are available for the vertical beam only. SCAMP data were collected in downward mode approximately every 5 minutes. To avoid sampling the wake generated from the device itself, when recovered after a previous profile, each cast position was tracked in real-time using a GPS. Data were exported and analysed for thermistor #1 using both libraries provided by PME and custom MATLAB scripts.
Laboratory, field, or other analytical methods	Amplitude data from the ADCP were exported and combined from the MAT files provided by the Nortek's Signature software Dissipation rates of turbulent kinetic energy were estimated by fitting the temperature spectrum derived by Batchelor to the experimental spectrum of temperature fluctuations (Batchelor 1959). Zooplankton were enumerated by counting the organisms under a dissecting microscope and distinguishing four taxonomic groups: *Daphnia* spp., copepods, small Cladocera and copepods nauplii. Due to the high numbers of organisms present in each sample, enumeration of zooplankton was conducted on three replicate sub-samples of each sample.
Quality control	In order to collect valid turbulence data, the turbulence profiler was deployed to travel at about 10 cm/s in the water column. After the acquisition of the first profile, the thermistor resolution has been checked and adjusted to collect reliable temperature gradient data. Microstructure temperature profiles were segmented using the segmentation method by Chen, Hondzo, and Rao (2002). The method employs a wavelet-based test, sensitive to changes in spectral shape and magnitude, to ensure that each segment is statistically stationary. Turbulence measurements were analysed with a statistical method provided by Ruddick, Anis, and Thompson (2000) in order to remove invalid or poor fittings of the Batchelor spectrum.

Description of the dataset variables

The dataset can be loaded from MATLAB.

Variable name	Definition
zoo_21_Jul_16	It contains zooplankton concentration profiles collected on 21 July 2016. Each row of the structure represents a different layer. Field names are: • "z_up" is the layer upper limit in m; • "z_down" is the layer lower limit in m; • "z_avg" is the average depth of the layer; • "daphnia" is the *Daphnia* concentration in ind. L^{-1}, "copepod" for copepod, "small_cladocera" for small Cladocera and "small_copepod" for copepod nauplii
zoo_28_Jul_16	Same as for zoo_21_Jul_16 but data were collected on 28 July 2016
zoo_18_Aug_16	Same as for zoo_21_Jul_16 but data were collected on 18 August 2016
ADCP_21_Jul_16.VBS	Volume backscatter strength from vertical beam on 21 July 2016. Each column contains a different acoustic profile, while each row contains the value for each depth
ADCP_21_Jul_16.time	Vector of MATLAB time
ADCP_21_Jul_16.bins	Depth vector (m)
ADCP_28_Jul_16.VBS	Same as for ADCP_21_Jul_16.VBS but data were collected on 28 July 2016
ADCP_28_Jul_16.time	Same as for ADCP_21_Jul_16.time but data were collected on the 28 July 2016
ADCP_28_Jul_16.bins	Same as for ADCP_21_Jul_16.bins but data were collected on 28 July 2016
ADCP_18_Aug_16.VBS	Same as for ADCP_21_Jul_16.VBS but data were collected on 18 August 2016
ADCP_18_Aug_16.time	Same as for ADCP_21_Jul_16.time but data were collected on 18 August 2016
ADCP_18_Aug_16.bins	Same as for ADCP_21_Jul_16.bins but data were collected on 18 August 2016
SCAMP_21_Jul_16.time	MATLAB time of each SCAMP cast collected on 21 July 2016
SCAMP_21_Jul_16.segments	Data from each SCAMP segments. Variables are: • "velocity" is the profiler velocity in the bin, m/s; • "depth" the bin depth; • "pressure" the pressure from the SCAMP sensor; • "tX" is the segment temperature, where X is the thermistor number; • "viscosity_tX" the bin viscosity, $m^2\ s^{-1}$; • "diffusivity_tX" its molecular diffusivity, $m^2\ s^{-1}$; • "ro_tX" its density, kg m^{-3}; • "grad_tX" the temperature gradient, C m^{-1}.

SCAMP_21_Jul_16.fit_t1	Batchelor fit data for each SCAMP bin. Variables are: • "k" is the wavenumber; • "psd" the power spectral density, $(C/m)^2/(cyc/m)$; • "psd_noise" the noise power spectral density, $(C/m)^2/(cyc/m)$; • "snr" the signal to noise ratio; • "dof" the degree of freedom of the observed PSD; • "chi" the estimate of the temperature variance dissipation rate χ_T, C^2/sec, • "chi_obs" the observed χ_T; • "log10_like_ratio" is the log10 of the ratio of the Likelihoods of the Batchelor spectrum and the straight line fit (see Ruddick, Anis, and Thompson (2000)); • "kb_fit" is the best fit of the Batchelor wavenumber, cyc/m; • "delta_kB_fit" is the 95% confidence interval of the Batchelor wavenumber, cyc/m; • "batchspc_fit" is the best fit of the Batchelor spectrum, $(C/m)^2/(cyc/m)$; • "eps_fit" is the TKE dissipation of best fit of the Batchelor wavenumber, W kg^{-1} • "eps_fit_lo" is the lower limit for the 95% confidence interval for "eps_fit", W kg^{-1}; • "eps_fit_hi" is the upper limit for the 95% confidence interval for "eps_fit", W kg^{-1}; • "var_chi2" is the variance of the reduced Chi^2 distribution (see Ruddick, Anis, and Thompson (2000)); • "mad_chi2" is the mean absolute deviation (mad) of the reduced Chi^2 (see Ruddick, Anis, and Thompson (2000)); • "pw_law" is the power law fitting (see Ruddick, Anis, and Thompson (2000)); • "is_it_valid" when 1 or 2 the fit is valid.
SCAMP_28_Jul_16.time	Same as for SCAMP_21_Jul_16.time but data were collected on 28 July 2016
SCAMP_28_Jul_16.segments	Same as for SCAMP_21_Jul_16.segments but data were collected on 28 July 2016
SCAMP_28_Jul_16.fit_t1	Same as for SCAMP_21_Jul_16.fit_t1 but data were collected on 28 July 2016
SCAMP_18_Aug_16.time	Same as for SCAMP_21_Jul_16.time but data were collected on 18 August 2016
SCAMP_18_Aug_16.segments	Same as for SCAMP_21_Jul_16.segments but data were collected on 18 August 2016
SCAMP_18_Aug_16.fit_t1	Same as for SCAMP_21_Jul_16.fit_t1 but data were collected on 18 August 2016

References

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