Aggregates from R/V Thomas G. Thompson TT050, TT054 cruises in the Arabian Sea in 1995 (U.S. JGOFS Arabian Sea project)

Website: https://www.bco-dmo.org/dataset/2562
Version: 26 January 1999
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Project
» U.S. JGOFS Arabian Sea (Arabian Sea)

Program
» U.S. Joint Global Ocean Flux Study (U.S. JGOFS)

Contributors	Affiliation	Role
Gardner, Wilford D.	Texas A&M University (TAMU)	Co-Principal Investigator
Walsh, Ian	Texas A&M University (TAMU)	Co-Principal Investigator
Chandler, Cynthia L.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

Aggregates with equivalent spherical diameters greater than .5 mm

Methods & Sampling

See Platform deployments for cruise specific documentation

Large Aggregate Profiling System Protocol

Ian D. Walsh, Wilford B. Gardner and Mary Jo Richardson

Camera systems have been developed to characterize millimeter size particle distributions in the water column (Honjo etal, 1984; Asper, 1987; Gardner etal, 1988). It is conjectured that the millimeter size class range of particles, thought to be primarily composed of aggregates (``marine snow") may dominate the total mass flux because of their abundance and high settling rates (Asper, 1987). Camera systems integrated with a CTD and transmissometer (such as the Walsh/Gardner Large Aggregate Profiling System (LAPS)) have the advantage of simultaneously collecting data on the distribution of suspended particles and aggregates along with the physical structure of the water column. This is important as previous work has shown that the distribution of aggregates at depth does not reflect the Suspended Particulate Matter (SPM) distribution, particularly in the case of intermediate depth layers of high aggregate abundance (Gardner and Walsh, 1990; Walsh 1990; Walsh and Gardner, in press). The continuous nature of the LAPS profile allows for the identification of mid-water aggregate nepheloid layers which might be missed by sediment traps or pumping because of low sampling density. This is particularly important to the success of the EQPAC program as the previous sediment trap moorings deployed in the area have shown mid-water column flux maximums (~1000--2000 m) on a yearly and seasonal basis except for a three month period at 11ï¿½ N, 140ï¿½ W during which the flux was dominated by a diatom bloom (Walsh *et al.*, 1988; Dymond and Collier, 1988).

The LAPS system as configured for the EQPAC program consists of a Deep-Sea Power and Light AVCS-101 Autonomous Video Camera (Sony CCD V801) synchronized with a high power strobe, and a Sea-Bird Seacat CTD coupled with a Sea Tech 25 cm pathlength deep transmissometer and a Sea Tech deep fluorometer. The strobe flash is contained and collimated using a stainless steel tube and a triple-lense Fresnel stack. PVC baffles on the lense stack can be set to produce a slab of light 5 to 10 cm thick, perpendicular to the camera. The illuminated imaging area can be varied using the zoom capability of the camera. For imaging the particle size range down to 0.5 mm, a 23 cm wide by 17.25 cm high image is acquired with a slab thickness of 10 cm. Calibration of the images is made by placing a target in the image volume during a preliminary cast and subsequent to all changes of the system parameters (e.g., image volume). Images from the camera are captured using a Data Translation frame capture board and NIH Image software on an Apple Macintosh IIci computer. Images are thresholded and particle counts made using the capabilities of the NIH Image program. Obvious zooplankton and nekton are excluded from the particle counts. Frames in the upper water column where sunlight is visible are excluded from the analysis because of potential ambiguity as to the water volume sampled (i.e., particles outside of the strobe illuminated volume may have been illuminated by sunlight). The strobe flash rate and lowering rate of the LAPS can be varied depending on the desired image density and the length of the cast. Generally the strobe interval is set for 6 seconds and the LAPS is lowered at 20 m/min yielding an image every 2 meters.

Each image is analyzed for the total number of particles and their maximum, minimum and equivalent circular diameters. The particles are binned into 0.5 mm size ranges based on the equivalent circular diameter starting at 0.5 mm. Particle volume is calculated assuming sphericity and diameters equal the means of the ranges.

The Seacat CTD will be factory calibrated prior to the EQPAC cruises. Transmissometer data reduction will be accomplished as outlined in the optics protocols.

Literature Cited

Asper, V.L. (1987).

Measuring the flux and sinking speed of marine snow aggregates. *Deep-Sea Research*, **34**(1A):1-17.

Dymond, J. and R. Collier (1988).

Biogenic particle fluxes in the equatorial Pacific: Evidence for both high and low productivity during the 1982-1983 El-Niï¿½o. *Global Bioceochemical Cycles*, **2**: 129-137.

Gardner, W.D. and I.D. Walsh (1990).

Distribution of macroaggregates and fine-grained particles across a continental margin and their potential role in fluxes. *Deep-Sea Research*, **37**: 401-412.

Gardner, W.D., I.D. Walsh, and V.L. Asper (1988).

Comparison of large-particle camera and transmissometer profiles. Presented at the *JOA Special Symposium on New Observation Methods, Acapulco, Mexico (1988).*

Honjo, S., K.W. Doherty, Y.C. Agrawal, and V.L. Asper (1984).

Direct optical assessment of large amorphous aggregates (marine snow) in the deep ocean. *Deep-Sea Research*, **31**: 67-76.

Walsh, I.D. (1990).

Project CATSTIX: Camera, transmissometer, and sediment integration experiment. Ph.D. Dissertation, Texas A & M University, 96pp.

Walsh, I.D. and W.D. Gardner (1992).

Comparison of large particle camera profiles with sediment trap fluxes. *Deep-Sea Research*, **39**: 1817-1834.

Walsh, I.D., J. Dymond and R. Collier (1988).

Rates of recycling of biogenic components of fast settling particles derived from sediment trap experiments. *Deep-Sea Research*, **35**: 43-58.

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Data Files

File
aggregates.csv (Comma Separated Values (.csv), 40.81 KB) MD5:34b4cc5a7f86b1f8a4f02c592581734c Primary data file for dataset ID 2562

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Parameters

Parameter	Description	Units
event	event number from event log	
sta	station number from event log	
sta_std	Arabian Sea standard station identifier	
cast	LAPS (Large Aggregate Profiling System) cast number	
depth_n	nominal sample depth	meters
agg_num	number of aggregates	number/liter

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Instruments

Dataset-specific Instrument Name	Sea-Bird Seacat CTD
Generic Instrument Name	CTD Sea-Bird SEACAT
Dataset-specific Description	Sea-Bird Seacat CTD coupled with a Sea Tech 25 cm pathlength deep transmissometer and a Sea Tech deep fluorometer.
Generic Instrument Description	The CTD SEACAT recorder is an instrument package manufactured by Sea-Bird Electronics. The first Sea-Bird SEACAT Recorder was the original SBE 16 SEACAT developed in 1987. There are several model numbers including the SBE 16plus (SEACAT C-T Recorder (P optional))and the SBE 19 (SBE 19plus SEACAT Profiler measures conductivity, temperature, and pressure (depth)). More information from Sea-Bird Electronics.

Dataset-specific Instrument Name	Large Aggregate Profiling System
Generic Instrument Name	Large Aggregate Profiling System
Dataset-specific Description	The LAPS system as configured for the EQPAC program consists of a Deep-Sea Power and Light AVCS-101 Autonomous Video Camera (Sony CCD V801) synchronized with a high power strobe, and a Sea-Bird Seacat CTD coupled with a Sea Tech 25 cm pathlength deep transmissometer and a Sea Tech deep fluorometer.
Generic Instrument Description	The Large Aggregate Profiling System (LAPS) is a camera system developed to characterize millimeter size particle distributions in the water column. Camera systems are integrated with a CTD and transmissometer and therefore have the advantage of simultaneously collecting data on the distribution of suspended particles and aggregates along with the physical structure of the water column (Honjo et al., 1984; Asper, 1987; Gardner et al., 1988).

Dataset-specific Instrument Name	SNOY CCD V801
Generic Instrument Name	Underwater Camera
Dataset-specific Description	Deep-Sea Power and Light AVCS-101 Autonomous Video Camera synchronized with a high power strobe
Generic Instrument Description	All types of photographic equipment that may be deployed underwater including stills, video, film and digital systems.

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Deployments

TT050

Website	https://www.bco-dmo.org/deployment/57711
Platform	R/V Thomas G. Thompson
Start Date	1995-08-18
End Date	1995-09-15
	Methods & Sampling PI: Ian Walsh and Wilf Gardner of: Texas A&M University dataset: Aggregates greater than .5 mm in diameter dates: August 22, 1995 to September 13, 1995 location: N: 20.3742 S: 9.9375 W: 57.1678 E: 68.7494 project/cruise: Arabian Sea/TTN-050 - Process Cruise 5 (Late SW Monsoon) ship: Thomas Thompson Large Aggregate Profiling System Protocol Ian D. Walsh, Wilford B. Gardner and Mary Jo Richardson Camera systems have been developed to characterize millimeter size particle distributions in the water column (Honjo etal, 1984; Asper, 1987; Gardner etal, 1988). It is conjectured that the millimeter size class range of particles, thought to be primarily composed of aggregates (``marine snow") may dominate the total mass flux because of their abundance and high settling rates (Asper, 1987). Camera systems integrated with a CTD and transmissometer (such as the Walsh/Gardner Large Aggregate Profiling System (LAPS)) have the advantage of simultaneously collecting data on the distribution of suspended particles and aggregates along with the physical structure of the water column. This is important as previous work has shown that the distribution of aggregates at depth does not reflect the Suspended Particulate Matter (SPM) distribution, particularly in the case of intermediate depth layers of high aggregate abundance (Gardner and Walsh, 1990; Walsh 1990; Walsh and Gardner, in press). The continuous nature of the LAPS profile allows for the identification of mid-water aggregate nepheloid layers which might be missed by sediment traps or pumping because of low sampling density. This is particularly important to the success of the EQPAC program as the previous sediment trap moorings

Description	deployed in the area have shown mid-water column flux maximums (~1000--2000 m) on a yearly and seasonal basis except for a three month period at 11ï¿½ N, 140ï¿½ W during which the flux was dominated by a diatom bloom (Walsh et al., 1988; Dymond and Collier, 1988). The LAPS system as configured for the EQPAC program consists of a Deep-Sea Power and Light AVCS-101 Autonomous Video Camera (Sony CCD V801) synchronized with a high power strobe, and a Sea-Bird Seacat CTD coupled with a Sea Tech 25 cm pathlength deep transmissometer and a Sea Tech deep fluorometer. The strobe flash is contained and collimated using a stainless steel tube and a triple-lense Fresnel stack. PVC baffles on the lense stack can be set to produce a slab of light 5 to 10 cm thick, perpendicular to the camera. The illuminated imaging area can be varied using the zoom capability of the camera. For imaging the particle size range down to 0.5 mm, a 23 cm wide by 17.25 cm high image is acquired with a slab thickness of 10 cm. Calibration of the images is made by placing a target in the image volume during a preliminary cast and subsequent to all changes of the system parameters (e.g., image volume). Images from the camera are captured using a Data Translation frame capture board and NIH Image software on an Apple Macintosh IIci computer. Images are thresholded and particle counts made using the capabilities of the NIH Image program. Obvious zooplankton and nekton are excluded from the particle counts. Frames in the upper water column where sunlight is visible are excluded from the analysis because of potential ambiguity as to the water volume sampled (i.e., particles outside of the strobe illuminated volume may have been illuminated by sunlight). The strobe flash rate and lowering rate of the LAPS can be varied depending on the desired image density and the length of the cast. Generally the strobe interval is set for 6 seconds and the LAPS is lowered at 20 m/min yielding an image every 2 meters. Each image is analyzed for the total number of particles and their maximum, minimum and equivalent circular diameters. The particles are binned into 0.5 mm size ranges based on the equivalent circular diameter starting at 0.5 mm. Particle volume is calculated assuming sphericity and diameters equal the means of the ranges. The Seacat CTD will be factory calibrated prior to the EQPAC cruises. Transmissometer data reduction will be accomplished as outlined in the optics protocols. Literature Cited Asper, V.L. (1987). Measuring the flux and sinking speed of marine snow aggregates. Deep-Sea Research, 34(1A):1-17. Dymond, J. and R. Collier (1988). Biogenic particle fluxes in the equatorial Pacific: Evidence for both high and low productivity during the 1982-1983 El-Niï¿½o. Global Bioceochemical Cycles, 2: 129-137. Gardner, W.D. and I.D. Walsh (1990). Distribution of macroaggregates and fine-grained particles across a continental margin and their potential role in fluxes. Deep-Sea Research, 37: 401-412. Gardner, W.D., I.D. Walsh, and V.L. Asper (1988). Comparison of large-particle camera and transmissometer profiles. Presented at the JOA Special Symposium on New Observation Methods, Acapulco, Mexico (1988). Honjo, S., K.W. Doherty, Y.C. Agrawal, and V.L. Asper (1984). Direct optical assessment of large amorphous aggregates (marine snow) in the deep ocean. Deep-Sea Research, 31: 67-76. Walsh, I.D. (1990). Project CATSTIX: Camera, transmissometer, and sediment integration experiment. Ph.D. Dissertation, Texas A & M University, 96pp. Walsh, I.D. and W.D. Gardner (1992). Comparison of large particle camera profiles with sediment trap fluxes. Deep-Sea Research, 39: 1817-1834. Walsh, I.D., J. Dymond and R. Collier (1988). Rates of recycling of biogenic components of fast settling particles derived from sediment trap experiments. Deep-Sea Research, 35: 43-58.

TT054

Website	https://www.bco-dmo.org/deployment/57715
Platform	R/V Thomas G. Thompson
Start Date	1995-11-30
End Date	1995-12-28
	Methods & Sampling PI: Ian Walsh and Wilf Gardner of: Texas A&M University dataset: Aggregates greater than .5 mm in diameter dates: December 03, 1995 to December 26, 1995 location: N: 19.8836 S: 9.9736 W: 57.3035 E: 68.7809 project/cruise: Arabian Sea/TTN-054 - Process Cruise 7 (Early NE Monsoon) ship: Thomas Thompson Large Aggregate Profiling System Protocol Ian D. Walsh, Wilford B. Gardner and Mary Jo Richardson Camera systems have been developed to characterize millimeter size particle distributions in the water column (Honjo etal, 1984; Asper, 1987; Gardner etal, 1988). It is conjectured that the millimeter size class range of particles, thought to be primarily composed of aggregates (``marine snow") may dominate the total

Description	mass flux because of their abundance and high settling rates (Asper, 1987). Camera systems integrated with a CTD and transmissometer (such as the Walsh/Gardner Large Aggregate Profiling System (LAPS)) have the advantage of simultaneously collecting data on the distribution of suspended particles and aggregates along with the physical structure of the water column. This is important as previous work has shown that the distribution of aggregates at depth does not reflect the Suspended Particulate Matter (SPM) distribution, particularly in the case of intermediate depth layers of high aggregate abundance (Gardner and Walsh, 1990; Walsh 1990; Walsh and Gardner, in press). The continuous nature of the LAPS profile allows for the identification of mid-water aggregate nepheloid layers which might be missed by sediment traps or pumping because of low sampling density. This is particularly important to the success of the EQPAC program as the previous sediment trap moorings deployed in the area have shown mid-water column flux maximums (~1000--2000 m) on a yearly and seasonal basis except for a three month period at 11ï¿½ N, 140ï¿½ W during which the flux was dominated by a diatom bloom (Walsh et al., 1988; Dymond and Collier, 1988). The LAPS system as configured for the EQPAC program consists of a Deep-Sea Power and Light AVCS-101 Autonomous Video Camera (Sony CCD V801) synchronized with a high power strobe, and a Sea-Bird Seacat CTD coupled with a Sea Tech 25 cm pathlength deep transmissometer and a Sea Tech deep fluorometer. The strobe flash is contained and collimated using a stainless steel tube and a triple-lense Fresnel stack. PVC baffles on the lense stack can be set to produce a slab of light 5 to 10 cm thick, perpendicular to the camera. The illuminated imaging area can be varied using the zoom capability of the camera. For imaging the particle size range down to 0.5 mm, a 23 cm wide by 17.25 cm high image is acquired with a slab thickness of 10 cm. Calibration of the images is made by placing a target in the image volume during a preliminary cast and subsequent to all changes of the system parameters (e.g., image volume). Images from the camera are captured using a Data Translation frame capture board and NIH Image software on an Apple Macintosh IIci computer. Images are thresholded and particle counts made using the capabilities of the NIH Image program. Obvious zooplankton and nekton are excluded from the particle counts. Frames in the upper water column where sunlight is visible are excluded from the analysis because of potential ambiguity as to the water volume sampled (i.e., particles outside of the strobe illuminated volume may have been illuminated by sunlight). The strobe flash rate and lowering rate of the LAPS can be varied depending on the desired image density and the length of the cast. Generally the strobe interval is set for 6 seconds and the LAPS is lowered at 20 m/min yielding an image every 2 meters. Each image is analyzed for the total number of particles and their maximum, minimum and equivalent circular diameters. The particles are binned into 0.5 mm size ranges based on the equivalent circular diameter starting at 0.5 mm. Particle volume is calculated assuming sphericity and diameters equal the means of the ranges. The Seacat CTD will be factory calibrated prior to the EQPAC cruises. Transmissometer data reduction will be accomplished as outlined in the optics protocols. Literature Cited Asper, V.L. (1987). Measuring the flux and sinking speed of marine snow aggregates. Deep-Sea Research, 34(1A):1-17. Dymond, J. and R. Collier (1988). Biogenic particle fluxes in the equatorial Pacific: Evidence for both high and low productivity during the 1982-1983 El-Niï¿½o. Global Bioceochemical Cycles, 2: 129-137. Gardner, W.D. and I.D. Walsh (1990). Distribution of macroaggregates and fine-grained particles across a continental margin and their potential role in fluxes. Deep-Sea Research, 37: 401-412. Gardner, W.D., I.D. Walsh, and V.L. Asper (1988). Comparison of large-particle camera and transmissometer profiles. Presented at the JOA Special Symposium on New Observation Methods, Acapulco, Mexico (1988). Honjo, S., K.W. Doherty, Y.C. Agrawal, and V.L. Asper (1984). Direct optical assessment of large amorphous aggregates (marine snow) in the deep ocean. Deep-Sea Research, 31: 67-76. Walsh, I.D. (1990). Project CATSTIX: Camera, transmissometer, and sediment integration experiment. Ph.D. Dissertation, Texas A & M University, 96pp. Walsh, I.D. and W.D. Gardner (1992). Comparison of large particle camera profiles with sediment trap fluxes. Deep-Sea Research, 39: 1817-1834. Walsh, I.D., J. Dymond and R. Collier (1988). Rates of recycling of biogenic components of fast settling particles derived from sediment trap experiments. Deep-Sea Research, 35: 43-58.

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Project Information

U.S. JGOFS Arabian Sea (Arabian Sea)

Website: http://usjgofs.whoi.edu/research/arabian.html

Coverage: Arabian Sea

The U.S. Arabian Sea Expedition which began in September 1994 and ended in January 1996, had three major components: a U.S. JGOFS Process Study, supported by the National Science Foundation (NSF); Forced Upper Ocean Dynamics, an Office of Naval Research (ONR) initiative; and shipboard and aircraft measurements supported by the National Aeronautics and Space Administration (NASA). The Expedition consisted of 17 cruises aboard the R/V Thomas Thompson, year-long moored deployments of five instrumented surface buoys and five sediment-trap arrays, aircraft overflights and satellite observations. Of the seventeen ship cruises, six were allocated to repeat process survey cruises, four to SeaSoar mapping cruises, six to mooring and benthic work, and a single calibration cruise which was essentially conducted in transit to the Arabian Sea.

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Program Information

U.S. Joint Global Ocean Flux Study (U.S. JGOFS)

Website: http://usjgofs.whoi.edu/

Coverage: Global

The United States Joint Global Ocean Flux Study was a national component of international JGOFS and an integral part of global climate change research.

The U.S. launched the Joint Global Ocean Flux Study (JGOFS) in the late 1980s to study the ocean carbon cycle. An ambitious goal was set to understand the controls on the concentrations and fluxes of carbon and associated nutrients in the ocean. A new field of ocean biogeochemistry emerged with an emphasis on quality measurements of carbon system parameters and interdisciplinary field studies of the biological, chemical and physical process which control the ocean carbon cycle. As we studied ocean biogeochemistry, we learned that our simple views of carbon uptake and transport were severely limited, and a new "wave" of ocean science was born. U.S. JGOFS has been supported primarily by the U.S. National Science Foundation in collaboration with the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, the Department of Energy and the Office of Naval Research. U.S. JGOFS, ended in 2005 with the conclusion of the Synthesis and Modeling Project (SMP).

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