United Nations Educational, Scientific and Cultural Organization | Intergovernmental Oceanographic Commission | World Meteorological Organization | Data Buoy Cooperation Panel | International Oceanographic Data and Information Exchange

A Training Course on Buoy Programme Implementation and Data Management
IOC Project Office for IODE, Ostend, Belgium
11-15 June, 2007

At its last session (La Jolla, October 2006), the Data Buoy Cooperation Panel (DBCP) received a report from its Task Team, a group that had been established by the chair to examine ways in which a mature group such as the DBCP could develop new initiatives in support of the wider observational community. Key recommendations concerned the exploitation of the DBCP's experience and resources in the development of training materials, and in Capacity Building (CB) in developing nations. Such activities would both promote the wider use of buoy data in support of regional oceanographic, climatological and meteorological initiatives, and assist the DBCP in achieving and sustaining its objectives for a globally distributed data buoy network.

As one initiative within the DBCP's CB efforts, a training course on Buoy Programme Implementation and Data Management was convened at the IOC Project Office for IODE, Ostend, Belgium, from 11 to 15 June 2007. This course was developed in close cooperation with the International Oceanographic Data and Information Exchange (IODE) and the Ocean Data and Information Network for Africa (ODINAFRICA). The majority of trainees were drawn from the African continent, and care was taken to select applicants who showed the best potential to develop data buoy initiatives in the region.

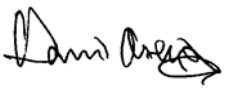
The curriculum covered the application and management of data from *in situ* oceanographic and marine meteorological platforms, and trainers were drawn from a wide spectrum of the international data buoy community. To maximize the impact and benefit of this course, practical work and assignments were given to participants at each stage. For example, a drifting buoy was deployed in Ostend harbour, and the whole range of data processing and quality control steps explored, leading to the eventual release of data from the buoy on to the GTS. As a final exercise, the trainers and trainees worked together to create a standard checklist for buoy programme operators, with the aim of documenting best practice in the deployment of drifting buoys (*Annex III*).

The list of trainers and trainees, as well as the programme of the course are reproduced in *Annex I* and in *Annex II*. Some training material and presentations are available online at: http://www.ioc-goos.org/DBCPTraining.

The course was pursued with great enthusiasm by both trainers and trainees, ably supported by the staff of the IODE Project Office. Overall, the course was felt to have been very successful, and many participants expressed their interest not only to join the regional action groups of the DBCP, but also to initiate a dialogue with the Global Drifter Programme in order to actively participate in buoy deployment and data management activities.

It was noted that such CB efforts should be supported on a sustained basis. In doing so, standardized training materials will be developed and kept updated in parallel with the organization of training programmes. Technical and in-kind support (such as donating drifting buoys) should also be considered in order to build upon the training results in a concrete way. A request from the trainees for more information on mooring buoy programmes – deployment, maintenance, and data management – will be addressed in the curriculum of future courses.

It is confidently expected that this and subsequent courses will help strengthen partnerships with regional institutes, resulting both in improved resourced sharing (such as deployment ship-time) and in a wider appreciation, implementation and use of buoy programmes and their data.



David Meldrum
Chair, Data Buoy Co-operation Panel

Annex: 1. List of Participants
2. Programme of the training course
3. Buoy Programme Checklist

Annex I

List of Participants

A Training Course on Buoy Programme Implementation and Data Management
(IOC Project Office for IODE, Ostend, Belgium, 11-15 June, 2007)

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DBCP Training Course on Buoy Programme Implementation and Data Management
The why, how and where of data buoy observations and programme management

Day	Theme, topics and sub-topics	Prepared and delivered by	Supporting materials	Practical work and assignments

Mon a.m.	**1. Overview of marine observing systems**
	• Satellites
	  o Active
	  o Passive
		Meldrum	• To be defined	Access to satellite imagery archives

	• Ships
	  o OWS, VOS
	  o XBTs, XCTDs
	  o ASAP
	  o Manual obs
	  o Shipboard AWS
		Ball	• To be defined	

	• Fixed platforms
	  o Oilrigs, lighthouses
	  o Moored buoys
	• Profiling floats
		Turton	• To be defined	

	• Drifting buoys • Tsunameters and tide gauges • Autonomous vehicles • Seabed observatories	Meldrum	• To be defined	
Mon p.m.	**2. The need for buoy observations** • Role of oceans in weather and climate • Limitations of satellite obs • Limitations of ship obs • Value for money considerations	Turton	• To be defined	

	• Specific needs in terms of
	  o Observed variables
	  o Spatial coverage
	  o Temporal coverage
	  o Availability and timeliness
		Charpentier	• WMO and OOPC docs	• Summarise marine observing systems and their underlying requirements

Tues a.m. and p.m.	**3. Buoy hardware: platforms**
	• Fixed platforms
	  o Construction
	  o Mooring
	  o Safety and vandalism
	• Profilers
	  o Profiling engines
	  o Other design issues and calculations
	  o Ballasting calculations
		Turton	• To be defined	

	• Drifters
	  o Hull design
	  o Drogue design and validation
	  o Drag calculations
	  o Submersion issues and calculations
	  o Deployment packages
		Motyzhev	• SVP-B design manual
			• Niiler *et al* drogue studies
				• Practical deployment of tethered drifter in Ostend harbour

	• Marine animals
	• Energy
	  o Sources
	  o Budget calculations
		Meldrum		• Energy budget calculation

Wed a.m.	**4. Buoy hardware: sensors** • SLP and baro port design • T (air and sea surface) • T(z) • Submersion	Motyzhev	• SVP-B design manual	• Practical exercise: review of the sensor suite of the SVPB
	• C and the computation of S • Wind speed and direction • Rainfall and humidity • Location (GPS) • Current velocity • Wave spectra • Ocean depth, sea level • Other (e.g. pCO_2, bio, tracers)	Meldrum		

Wed p.m.	**5. Buoy hardware: sensor processing**
	• Sensor connection and interfacing
	  o Connectors
	  o Networking protocols and technologies
	  ▪ Hard-wired
	  ▪ Radio (e.g. Wi-Fi)
	  ▪ Optical
	  ▪ Acoustic
	• Microprocessors, microcontrollers, onboard memory
	• Timing sources
	• Sampling, averaging, despiking
	• Smart data processing
		Motyzhev	• SVP-B design manual	• Practical exercise: description of the sampling scheme and message format of the SVPB prototype

	• Data formats and message handling	Charpentier	• DBCP message formats	

Thu a.m.	**6. Buoy hardware: communications**
	• GSM and radio
	• Satellite
	  o LEOs: Argos, Orbcomm, Iridium, Globalstar
	  o GEOs: Meteosat/GOES/GMS, Inmarsat
	• Acoustics
	• Energy considerations
		Meldrum	• Satcomms overview	• Practical work with satellite transmitters and modems

	7. Buoy and float deployment
	• Strategic issues
	  o High impact areas
	  o Optimisation strategies
	  o Remote areas
	  o Contact with national focal points and high level sponsors
	• Practical issues
	  o Air and sea deployment opportunities
	  o Coordination with other agencies
		Pazos		• See Theme 3

	o Deployment techniques and handling of deployment packages o Pre-deployment tests o Safety issues	Motyzhev		

Thu p.m.	**8. Shore-side data processing, dissemination and archiving**
	• Data reception
	• Location techniques
	• Conversion issues
	  o Transfer functions, calibrations
	  o End-user formatting
	  ▪ GTS formats
	• Metadata
	• Data delays
	•
		Charpentier	• DBCP docs	• Practical exercise: Setting up the technical file of the SVPB prototype

	• Developments by service providers
	  o Argos
	  o Iridium
	  o Inmarsat
		Meldrum		

Fri a.m.	**9. Quality control**
	• Importance of QC
	• Techniques available
	  o Initial calibration and validation
	  o Gross error checks
	  ▪ Sensor values
	  ▪ Location accuracy
	  o Nearest-neighbour checks
	  o Comparison with model fields
	• RMS differences and biases
	  o Météo France real-time QC data
	  o Delayed-mode buoy monitoring statistics
	• Practical implementation
	  o Real-time automatic checks
	  o Identification of steady offsets
	  o Rescaling procedures
	  o Post-calibration tests
		Viola	• DBCP docs	• Practical exercise: analysis of the SVPB prototype data from the demonstration deployment

	• Practical implementation at the GDC
	  o Delayed mode procedures
	  o Importance of metadata
		Pazos		

	10. Data access and consultation • Data access policies • Data systems o WMO Information System (WIS) o Global Telecommunication System (GTS) o Other data pathways ▪ Designated archiving centres: RNODC/DB, SOC/DB ▪ GDP Data Assembly Centre ▪ ICOADS ▪ WDCs ▪ TAO, OceanSITES, Arctic data, Argo ▪ National Centres • Archival mechanisms • o o Operational support centres: JCOMMOPS, OSMC, NDBC o	Charpentier	• DBCP, WMO and MEDS docs	• Report on the availability of buoy data from various sources
Fri p.m.	**11. International coordination** • WMO • IOC • JCOMM and JCOMMOPS • DBCP and its action groups	Lee	• WMO and IOC docs	• Assignment: the relevance of the Law of the Sea to buoy operations
	• Case study : IBPIO, Indian Ocean activities and coordination	Ball		
	• Argo • Other emerging initiatives: GEOSS, EU FP7 • Future visions	Lee		
	12. Conclusions • Feedback on assignments and project reports • User feedback • Next steps o Network creation o Continuation support	Meldrum		

Annex III

Buoy Programme Checklist

(Version 0.1, 20/6/2007)

These are simple instructions for the shipping, checking, setting up, deployment, and data processing and distribution of a drifting more.

a) Buoys have arrived

1. Deal with customs
   - 1.1. Get copies of shipping paperwork
   - 1.2. Maybe get official letter from IOC or WMO or DBCP
   - 1.3. Maybe ship to local UNDP office
2. Who will pay Argos costs?
3. Contact owner to confirm receipt and find out where and when to deploy, and permissible leeway
4. Arrange secure, 24/7 accessible and inexpensive storage

b) Find suitable ship

1. Are there any research vessels in the area?
2. Are there ships of opportunity?
   - 2.1. Check websites, e.g.
     - 2.1.1. http://www.sailwx.info/shiptrack/
     - 2.1.2. WMO website, PMO list, Pub 47 (http://www.wmo.int/pages/prog/amp/mmop/documents/Jcomm-Groups/pmo_cp.pdf, http://www.wmo.int/pages/prog/www/ois/pub47/pub47-home.htm)
     - 2.1.3. Local ports authority
     - 2.1.4. Shipping companies
   - 2.2. Get official letter from drifter donator, WMO or IOC if needed
3. Issue deployment training and written instructions (see http://www.jcommops.org/dbcp/1bdm.html)
4. Translate into appropriate language if needed (WMO and/or IOC can provide assistance if needed)

c) Check that buoy is working

1. Use Argos tester or beeper at least to check transmission
   - 1.1. Check that transmission is received by Argos
   - 1.2. Check that GTS technical file has been implemented by Argos
2. Arrange transfer of buoys from storage to ship
   - 2.1. Check buoy again
     - 2.1.1. May need to get someone from institute to check Argos
     - 2.1.2. Consider leaving it switched on so that ship can be tracked etc
   - 2.2. Personally give buoy and deployment instructions to captain
     - 2.2.1. Remind captain to send deployment details and weather conditions to operator

d) Monitor buoy data

1. When deployment details have been received from ship:
   - 1.1. Check that data is of good quality
     - 1.1.1. Compare with analysed fields etc
     - 1.1.2. Reply to captain to say thank you!
   - 1.2. Contact operator/owner (GDC etc)
     - 1.2.1. Forward deployment details
     - 1.2.2. Ask the NFP for buoy programmes (or WMO directly if there is none) of the deploying country to assign a WMO ID. NFP obtains series of WMO numbers for the appropriate deployment areas directly from WMO. Details on WMO numbers and NFPs at http://www.wmo.int/pages/prog/amp/mmop/buoy-ids.html
     - 1.2.3. Request Argos to process the buoy and distribute the data on the GTS and provide Argos with WMO number, and GTS bulletin header
     - 1.2.4. Advise the Program Coordinator of the appropriate Action Group about the buoy deployment - WMO Id, Argos Id, location, name of deploying vessel. Details on DBCP Action Groups at http://wo.jcommops.org/cgi-bin/WebObjects/JCOMMOPS.woa/wa/menu?abbrev=J_CURR_ACTION_GROUPS
     - 1.2.5. Check that it really is on the GTS
     - 1.2.6. Check the QC sites (http://www.meteo.shom.fr/qctools/), monitor drogue status
2. Relax and have a big drink!

Participants in the first DBCP Training Course, Ostend, 11-15 June 2007,
in front of the IOC Project Office for IODE

Practical deployment of tethered drifter during the Course, in Ostend harbour.