INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

WORLD METEOROLOGICAL ORGANIZATION

DATA BUOY COOPERATION PANEL

DBCP-XXVI/Doc. 6.3
(2.IX.2010)

TWENTY-SIXTH SESSION

ITEM: 6.3

OBAN, UNITED KINGDOM
27 – 30 SEPTEMBER 2010

ENGLISH ONLY

REPORT BY THE TASK TEAM ON MOORED BUOYS

(Submitted by Jon Turton, Chairperson TT-MB, United Kingdom)

Summary and purpose of the document

This document contains the report by the chairperson of the DBCP Task Team on Moored Buoys.

ACTION PROPOSED

The Panel will review the information contained in this report and comment and make decisions or recommendations as appropriate. See part A for the details of recommended actions.

Appendices: A. Report by the Task Team on Moored Buoys

B. Terms of Reference of the DBCP Task Team on Moored Buoys

-A- DRAFT TEXT FOR INCLUSION IN THE FINAL REPORT

6.3.1 Mr Jon Turton, Chairperson of the Task Team on Moored Buoys reported on the progress during the intersessional period.

6.3.2 The Panel noted with appreciation that the Task Team has been working pro-actively on defining the comprehensive metadata on moored buoy systems that needs to be collected. The details of the metadata needing to be collected were refined (i) by having consistency with agreed OceanSITES metadata, (ii) defining Meta-T categories (which indicate whether the information should be distributed with the observation report), (iii) better specification of sampling/reporting times. Further a metadata validity record is included thus enabling a new metadata record to be specified when details (e.g. sensors) change. Version 5.a. of the draft metadata specification was circulated in early July 2010 with the aim of a final iteration to agree an initial specification. Environment Canada and UK Met Office have subsequently compiled much of the metadata (via an Excel spreadsheet and convertible to csv format) that would be required.

6.3.3 The Panel also noted the recommendations from the fourth Session of the Data Management Coordination Group, Ostend, Belgium, 8-9 April 2010 regarding the DBCP taking responsibility for metadata from automated rigs and platforms.

6.3.4 The Panel also noted with appreciation that the Task Team had substantially reviewed and proposed updates to Section 4.3 (Moored Buoys) of WMO Publication No. 8 (Guide to Meteorological Instruments and Methods of Observation), Part II (Observing Systems), Chapter 4 (Marine Observations).

6.3.5 The Panel reviewed the latest technical developments and performances with regard to moored buoys:

- Environment Canada (47 units) using the Watchman100 “payload” provided by AXYS Technologies Inc. Canada is working at enhancing satellite telemetry through SatLink2 GOES transmitters and increasing reliability of antennas. Canada has also deployed 2 Datawell MarkIII wave rider buoys in support of the PP-WET project and equipped two other buoys with a TRIAXYS sensor;
- NOAA’s enhancement of the tropical Moored Buoy Array (shore data processing, web site, data logger, iridium data collection, subsurface conductivity/ temperature (CT) sensors, and the compass for measurement of wind direction). Refreshed buoy systems have been designed, fabricated, integrated, deployed and tested. Intercomparisons will continue to be made for the new design;
- Some ATLAS moorings in RAMA have been modified to inhibit vandals from boarding the buoy. While proving successful at keeping moorings in place (3 of 4 moorings deployed have been recovered and 2 are presently operating) and producing sustained subsurface measurements, an adequate method of inhibiting vandalism upon surface met sensors has not yet been found;
- The NOAA/NWS National Data Buoy Center is implementing an Ocean Sensor Calibration Laboratory to calibrate conductivity sensors and sub-surface temperature sensors (see also agenda item 6.2);
- The United Kingdom using both Iridium and DCP data telecommunication, and investigating using high data rate digital Meteosat DCPs in the future;
- The United Kingdom now using dual Gill Windsonic anemometers on all new replacement buoy deployments;
- The United Kingdom operating a Triaxys wave system on the K5 buoy, and plans to introduce this system on other buoys. Recommendations from the PP-WET with regard to the transmission of the “first-5 parameter” are being considered.
- A new OceanSITES buoy (WMO#62442, PAP) was deployed by the UK and is based on the K-series design modified to accommodate sub-surface data.

6.3.6 The Panel requested the Team to continue to follow these developments.

6.3.7 The Panel thanked Mr Turton and members of the Task Team for their efforts. The full report of the Task Team is provided in Appendix A and will be included in the CD-ROM that will be distributed with the Session final report.

Appendices: 2

APPENDIX A

REPORT BY THE TASK TEAM ON MOORED BUOYS

(Submitted by Jon Turton, TT Leader)

This report details activities and progress made during the inter-sessional period since DBCP-25.

Moored buoy metadata

The initial priority for the Task Team has been on defining the comprehensive metadata on moored buoy systems that needs to be collected. At present there is little or no collection of the relevant information (metadata) on the various moored buoy systems. Information is needed detailing the systems and what parameters they measure. Such information is needed by data users (e.g. who need to know heights (and depths) of measurements and whether corrections have been made) and moored buoy operators (who have an interest in the sensors and systems being used). Collecting and sharing such information could help everyone to adopt best (and hopefully more consistent) practices.

During the period the details of the metadata needing to be collected were refined (i) by having consistency with agreed OceanSITES metadata, (ii) defining Meta-T categories (which indicate whether the information should be distributed with the observation report), (iii) better specification of sampling/reporting times. Further a metadata validity record is included thus enabling a new metadata record to be specified when details (e.g. sensors) change. Version 5.a. of the draft metadata specification was circulated in early July 2010 with the aim of a final iteration to agree an initial specification. Environment Canada and UK Met Office have subsequently compiled much of the metadata (via an Excel spreadsheet and convertible to csv format) that would be required.

Particular attention has been paid to the metadata needing to be reported for wave measurements in connection with the JCOMM ETWS/DBCP Pilot Project on Wave measurement Evaluation and Testing (PP-WET).

It is also worth noting several outcomes from the 4th session of the JCOMM Data Management Coordination Group (DMCG-4) meeting in April 2010 that may impact DBCP and the TT-MB. It was proposed that DBCP take on responsibility for metadata from automated rigs and platforms (and SOT for manual observations from rigs and platforms), this may require some further changes to the metadata specification to accommodate this. DMCG-4 reiterated the need for JCOMMOPS to make sure metadata are routinely collected and regularly submitted to the appropriate archive. Recognising that the ODAS terminology, while defined (very broadly) by UNESCO in 1972, is not widely understood, DCMG-4 also proposed to rename the existing ODAS metadata format into “Required ocean observing platform platform/instrument metadata content” and recommended that JCOMM Observation Panels address the specific formats required for exchanging metadata reports for specific platform types. DCMG-4 recognized the work being done on metadata by the TT-MB and encouraged the DBCP to continue the work.

Publications

During the period members of the Task Team provided inputs to, and comments on, the update to Section 4.3 (Moored Buoys) of WMO Publication No. 8 (Guide to Meteorological Instruments and Methods of Observation), Part II (Observing Systems), Chapter 4 (Marine Observations).

Technical developments

<u>Environment Canada Moored Buoy Network</u>

Environment Canada continues to operate a network of 47 moored buoys, with 21 buoys deployed on a seasonal basis (in-land Lakes, or Ocean areas affected by ice). All Environment Canada buoys continue to utilize the Watchman100 “payload” provided by AXYS Technologies Inc. Network availability has been good over the past 12 months, with 92% of expected observations received in real-time (composite average for the network).

The main technical developments for the EC moored buoy network are related to improvements and/or enhancements to the existing satellite telemetry onboard the buoys. All EC buoys utilize GOES telemetry for delivery of weather and wave data via NOAA NESDIS. The existing GOES HDR transmitters supplied by Cobham (formerly Seimac) are no longer supported by the manufacturer, nor procurable. Following an extensive evaluation of options (including use of alternate satellite networks), EC has begun the procurement and integration of SUTRON SatLink2 GOES transmitters. The SatLink2 provides a higher power (40W) transmitter, ensuring reliable data transmission at higher data rates (300 or 1200 bps) with the existing omni directional antenna (Harsh 14A). The SatLink2 transmitters have already been integrated into 3 buoys, with an additional 4-6 expected to be completed this fall/winter.

We are also evaluating options to increase the reliability of the Harsh antennas, as these components have been identified as weak point in our data communications. The antennas are prone to water intrusion, and are often the cause of missing, or intermittent data transfers. We have begun work to improve the water sealing (via use of polyurethane foam to fill the bottom of the antenna unit) and are also examining the solution develop by NDBC to cover the entire antenna) in a PVC cover. The PVC cover has been shown to provide a solution for water intrusion, and also reduces risk of damage to the antenna during deployment, while not attenuating the signal to the GOES satellite.

Environment Canada has also deployed 2 Datawell MarkIII wave rider buoys in support of the PP-WET project. In addition to a direct comparison to the operational wave sensor on EC buoys (“strap-down” accelerometer), the moored buoys at Northeast Burgeo Bank (6M NOMAD 44255) and South Hecate Strait (3MD 46185) have been equipped with a TRIAXYS sensor (provided by AXYS Technologies). All resulting data from the wave observation inter-comparison will be delivered to CDIP for analysis as outlined in the PP-WET project plan.

PMEL’s Tropical Moored Buoy Array

Over the past several years the Tropical Atmosphere Ocean (TAO) - Pacific Ocean Array has been undergoing a complete enhancement effort. The shore-side software for processing, data quality control, data and metadata databasing, web site, and dissemination software have been completely enhanced. The web side of the TAO array has also been refreshed due to the obsolete electronic components; thereby, ensuring the ongoing continuity of the TAO array. The major refreshed components include the data logger, subsurface conductivity/ temperature (CT) sensors, and the compass for measurement of wind direction. Meanwhile, to increase the transmission frequency and transmitted data volume, NDBC determined that the Iridium communication system was ideal for the refreshed TAO system so that high temporal resolution data could be transmitted to NDBC each hour in near real-time. Accordingly, the shore-side data system for data ingest, processing, quality assurance/quality control (QA/QC), and display were modified and enhanced.

To ensure the continuity and supportability of long-term ocean climate data, the TAO operations and refresh efforts follow the ten Climate Principles. NDBC designed, fabricated, integrated, and deployed several refreshed TAO buoy system to ensure sustained and smooth operations of the TAO array. To make sure that the refreshed TAO system can provide equal or better data quality from the refreshed TAO buoy system, various lab and field tests were conducted so far: (1) A lab test was conducted at NDBC by comparing the existing TAO and the refreshed TAO systems; (2) Two refreshed TAO buoys were deployed in the Gulf of Mexico for field testing; and (3) this year,

eleven refreshed TAO buoys were deployed in the Pacific Ocean next to existing TAO buoys for inter-comparison testing in the field. These real time data sets are currently being distributed over the Global Telecommunication System (GTS) every hour. In addition to the Climate Principles and following all of the above parallel testing, NDBC also followed its internal process for "Commissioning New Buoys". The additional Commissioning Process addresses supportability and performance aspects of the refreshed TAO system. The goal is to ensure successful and sustainable network operations.

Damage to buoys and theft of instrumentation reduces data return, especially at sites near areas of intense fishing activity such as the eastern equatorial Pacific, the Gulf of Guinea and equatorial Indian Ocean. Some ATLAS moorings in RAMA have been modified to inhibit vandals from boarding the buoy. While proving successful at keeping moorings in place (3 of 4 moorings deployed have been recovered and 2 are presently operating) and producing sustained subsurface measurements, an adequate method of inhibiting vandalism upon surface met sensors has not yet been found.

An electronics system first used on Ocean Climate Stations in higher latitudes is being redesigned for use on tropical moorings. The system is intended for use both in RAMA and the Indonesian Global Ocean Observing System (InaGOOS). The system will telemeter hourly surface and subsurface data via Iridium. First deployments, scheduled for the coming year, will be next to ATLAS moorings in RAMA.

Supplementary information from PMEL on FLEX mooring (reproduced from TT-IBPD report)

The ATLAS mooring will be replaced by the FLEX mooring designed at PMEL (Meinig et al). FLEX is being tested for OceanSITES – KEO and PAPA which have both FLEX and ATLAS concurrently. This offers more ports and subsurface (Seabird) inductive hourly time-series, stores met data and telemeters the data via Iridium (data uploaded every six hours with more parameters such as wind gusts, solar radiation, longwave, subsurface T/S, pressure currents, barometric pressure, and wind speed/direction). This raises the issue with data sharing as there is currently no pathway to the GTS from the FLEX data stream so discussions are underway between PMEL and Iridium providers.

NDBC

The NOAA/NWS National Data Buoy Center upgraded firmware has been installed at all 39 U.S. DART stations.

The NOAA/NWS National Data Buoy Center installed diodes on CPU batteries to reduce voltage and making the CPU less susceptible to interrupts; conducted additional testing of CPU boards to identify those boards more susceptible to interrupts.

The NOAA/NWS National Data Buoy Center replaced plastic coated wire rope in the mooring with a fish bite resistant synthetic rope to increase mooring reliability.

The NOAA/NWS National Data Buoy Center added a pressure-activated strobe light to the Bottom Pressure Recorder (BPR) to aid in recovery at night.

The NOAA/NWS National Data Buoy Center is implementing an Ocean Sensor Calibration Laboratory to calibrate conductivity sensors and sub-surface temperature sensors. This laboratory will support the NDBC Tropical Atmosphere Ocean (TAO) Project and the ocean sensors deployed on the NDBC Weather Buoy Program.

The NOAA/NWS National Data Buoy Center hosted the first ever Joint World Meteorological Organization-Intergovernmental Oceanographic Commission Technical Commission for

Oceanography and Marine Meteorology (JCOMM) Regional Marine Instrument Center training workshop April 13 to 15, 2010. The workshop was the JCOMM Pilot Project for the creation of Regional Marine Instrument Centers (RMIC) that would provide facilities for the calibration and maintenance of marine instruments, the monitoring of instrument performance, provide assistance with regard to instrument intercomparisons, and serve as training facilities. Based on the successful workshop the JCOMM has decided to move forward with the RMIC concept.

UK moored buoy network

As the buoys are replaced (nominally every 2 years) upgrades are being rolled out into the network. All the buoys have dual sensors (other than the wave sensor), dual control electronics and dual satellite transmitters, cross-linked for maximum resilience. The ageing Meteosat DCPs are becoming increasingly unreliable and difficult to maintain, replacing one of the DCPs with Iridium has provided greater reliability and the data return through Iridium has been very good. Currently all buoys (except K1) have a Meteosat DCP and an Iridium transmitter. In the future we plan to investigate the use of the new high data rate digital Meteosat DCPs.

Following a trial of Gill WindSonic anemometers we are now introducing dual WindSonics on all new replacement buoy deployments. At present we have a single WindSonic alongside a single Vector Instruments cup and vane system on K2, K4, K5, Aberporth and Turbot Bank buoys. K7, Brittany and Gascogne have all been replaced in 2010 and now have dual WindSonics. K1 (which is due to be replaced) still has dual Vector systems.

A Triaxys spectral wave system has been operated on K5 since August 2008, returning data via Iridium, although its sampling is not optimal. Plans are to introduce further Triaxys spectral wave systems across the network; K7, K1 or K2 and with systems purchased by Meteo-France for Brittany and Gascogne. Discussions with Axys are ongoing as to configuration of future Triaxys systems, to enable hourly transmission of the ‘first-5’ parameters (as recommended by PP-WET) over a reduced number of frequency bands, with additional systems to be ordered.

A new surface moored buoy was deployed on 1st June 2010 in collaboration with the National Oceanography Centre (NOC) at the OceanSITES Porcupine Abyssal Plain (PAP) site (WMO#62442). The buoy is a modified K-series buoy with a single meteorological system alongside a NOC designed system to return sub-surface in real-time from an instrument frame on the mooring at 30 m below the surface. These data are made available in WMO TESAC format as well as through the PAP mooring web-site (http://www.noc.soton.ac.uk/pap/).

APPENDIX B

TERM OF REFERENCE OF THE TASK TEAM ON MOORED BUOYS

(as adopted at DBCP-XXIV)

The DBCP Task Team on Moored Buoys shall:

1. Review and document operational moored buoy systems and their underlying requirements;
2. Liaise with the different communities deploying moorings, including TIP, OceanSITES, seabed observatories, as well as national moored buoy programmes (coastal and global), and promote the development of multi-disciplinary mooring systems;
3. Liaise with the GOOS Scientific Steering Committee (GSSC) and its technical sub-panel for Integrated Coastal Observations (PICO) to facilitate synergy between advances in GOOS implementation and the development of operational capabilities, in particular, for sustained coastal observations, analysis and related services by using mooring systems;
4. Liaise with the JCOMM Expert Team on Wind Waves and Storm Surges (ETWS) regarding the need for in situ wave observations;
5. Compile information on opportunities for the deployment and / or servicing of moored buoys;
6. Monitor technological developments for moored data buoys and liaise with the Task Team on Technological Developments on satellite data telecommunication aspects;
7. Review all relevant WMO and IOC Publications on Instrument Best Practices (e.g., JCOMM, CIMO) to make sure they are kept up to date, address WIGOS issues, and comply with Quality Management terminology;
8. Provide the DBCP Executive Board or the DBCP with technical advice needed for developing moored buoy programmes, including the issues above; and
9. Report to the DBCP Executive Board and the DBCP at its biennial Sessions, with periodically updated Workplans supporting implementation.

Membership:

The membership is open to all Panel members. The Chairperson, appointed by the Panel , has selected the following team members:

- Mr Jon Turton, UK Met Office (TT Chairperson);
- Dr Bill Burnett, NOAA / NDBC;
- Mr Richard L. Crout, NOAA / NDBC;
- Mr Paul Freitag, NOAA / PMEL;
- Mr Ken Jarrott, BOM;
- Dr Robert Jensen, USACE;
- Mr Chris Marshall, Environment Caada;
- Mr Chris Meinig, NOAA / PMEL;
- Dr V. Rajendran, NIOT;
- Mr Ariel Troisi, SHN;
- Mr Al Wallace, MSC, and;
- Dr Uwe Send, SIO.