WORLD METEOROLOGICAL ORGANIZATION

DATA BUOY COOPERATION PANEL

THIRTY-FIRST SESSION

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ABSTRACTS OF SCIENTIFIC AND TECHNICAL WORKSHOP

(Submitted by J. Stander & K. Herklotz)

SUMMARY AND PURPOSE OF DOCUMENT

The Scientific and Technical Workshop preceding the annual Data Buoy Cooperation Panel (DBCP) meetings has become an important forum for stimulating discussion among data buoy operators, designers, and data users. The thirty-first session of the DBCP (DBCP-31) will begin Monday, 19 October 2015 with a full day of the Technical workshop.

The theme of the DBCP-31 Workshop will be “Buoy Science, Technology, and Instrumentation”. Presentations were invited in the following areas: Sustainable Ocean Observations in support of Numerical models; Marine meteorological and oceanographic instrumentation, calibration, and traceability; Technical development; Operational Enhancements; Marine Forecast and Disaster Risk Reduction (DRR) and; Research Applications.

This document provides submitted abstracts of presentations and poster.

ACTION PROPOSED

The workshop is expected to make some recommendations to be considered by the 31th Session of the DBCP.

Appendix: A. Submitted abstracts

APPENDIX A

SUBMITTED ABSTRACTS FOR THE DBCP SCIENTIFIC AND TECHNICAL WORKSHOP (GENEVA, SWITZERLAND, MONDAY 19 OCTOBER 2015)

POSTER ABSTRACT

Large Moorings Arrays around South Africa – Development in Deep Ocean Mooring Systems

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South Africa is at a geographical advantage, ideally positioned between three large oceans – the Indian, Atlantic and Southern Oceans and bordered on the east by the Agulhas Current, the largest western boundary current in the Southern Hemisphere; a highly productive eastern boundary current to the west, the Benguela Current, and the perpetually eastward flowing Antarctic Circumpolar Current to the south.
Large arrays of moored instruments collecting *in situ* ocean current, temperature, salinity and dissolved oxygen data are the most effective way of providing long term, continuous observations and monitoring changes on daily to interannual time scales, resolving mesoscale dynamics, transport variability and the impact key oceanographic features such as the Agulhas Current and the Benguela Jet have on the Meridional Overturning Circulation – a fundamental driving force of the earths climate systems.

Two arrays have been developed and partially deployed thus far. The first in to the South Atlantic as part of the South Atlantic Meridional Overturning Circulation initiative, encompassing four tall moorings (full water column measurements) of 75 kHz ADCPs and SBE Microcats, two shelf moorings, and eight CPIES installations. These will have been deployed for one year when the maintenance cruise takes place in October 2015.

The second array in to the Agulhas Current off the east coast of South Africa, the Agulhas System Climate Array, has four of its seven tall moorings deployed thus far encompassing 75 kHz ADCPs, single point current meters and SBE Microcats and two shelf moorings. In April 2016, a maintenance cruise will service the existing array and deploy a further three tall moorings and five CPIES installations.

Given the magnitude and global importance of the arrays, the technical and scientific teams are made up of local and international researchers, across the physical, chemical and biological oceanography disciplines, thus fostering collaboration. These arrays enable monitoring and understanding of global circulation. Collaboration between South Africa, and international partners promotes local skills development necessary to establish and maintain these large arrays. The extensive datasets stemming from these long-term deployments will be used for scientific research but also for policy and decision-making with respect to impacts ranging from regional weather and severe events, to fisheries and global environmental health.

PRESENTATION ABSTRACTS

New European initiatives in support of better drifter SST for satellite validation
Anne O'Carroll (EUMETSAT, Darmstadt)
Craig Donlon (ESA ESTEC, Noordwijk)
David Meldrum (SAMS, Oban)

ESA and EUMETSAT are anticipating the launch of Sentinel-3a in late October 2015, part of a mission series that will carry a significant and sustained high-performance SST capability. In the context of SST validation for this and other satellites, and in recognition of the pioneering work by the DBCP and GHRSST to evaluate the utility of equipping drifters with high performance SST sensors, ESA and EUMETSAT are taking major steps to fund two new initiatives. These are:

1. A study of the SI traceability of historical and current drifter SST measurements, leading to the development of new best-practice guidelines;
2. A new pilot project to equip a significant number of drifters with HRSST and evaluate any eventual benefit for SST retrievals.

This paper will discuss both initiatives and seek guidance from the DBCP.

Variability of the surface circulation and associated freshwater fluxes in the Bay of Bengal
Verena Hormann and Luca R. Centurioni
Scripps Institution of Oceanography, University of California - San Diego, La Jolla, CA, USA

The near-surface circulation of the Bay of Bengal (BoB) is primarily driven by reversing monsoon winds. During the summer southwest monsoon the surface circulation is approximately anticyclonic, while it reverses into a cyclonic gyre during the winter northeast monsoon. Substantial open ocean rain and freshwater input from major rivers are important elements of the near-surface salinity budget of the BoB, but ocean processes establishing the observed sea surface salinity (SSS) distribution are only poorly quantified. The prominent seasonal variability of the surface currents is well represented by both historical and newly available drifter observations in the BoB. Along with satellite altimetry and SSS data as well as wind products, the drifter observations provide novel insights into the variability of the East India Coastal Current (EICC) and associated freshwater fluxes. Besides first results of the EICC region, preliminary findings from a most recent experiment in the BoB deploying various drifter types will be presented.

A New Global Dataset of Hourly Drifter Positions
Presenter: Rick Lumpkin
Authors: Rick Lumpkin, Shane Elipot, and Renellys Perez

Since late 2004, multisatellite service has delivered Argos positions at a mean global spacing of 1.2 hours. These data are capable of resolving high frequency motion such as inertial oscillations, tides, and submesoscale filaments and vortices. However, they are difficult to use due to their varying accuracy, quantified by location class, and their inhomogeneous spacing in time. Using a set of drifters with both Argos and GPS, various methodologies are tested to minimize differences between interpolated Argos positions and the GPS fixes, treated as truth. The best methodology is evaluated according to this and velocity-based criteria, and is used to derive a global data set of hourly drifter positions with formal error bars. Preliminary results of an analysis of these data are also presented, showing clear resolution of inertial and tidal motion throughout the global oceans.

Directional surface gravity waves properties from low-cost drifting buoys
Luca Centurioni and Lancelot Braasch

Undrogued drifting buoys equipped with low-cost, high-quality Global Positioning System (GPS) engines are used to measure the surface gravity waves. The buoys were fabricated at the Lagrangian Drifter laboratory of the Scripps Institution of Oceanography and are designed to compute and transmit the “first five:, i.e. the significant wave height and the directional spectral properties of the waves. The data are transmitted in real-time using an iridium modem. For the experiment described in this paper the buoys were moored off the Scripps pier using the configuration recommended for Datawell buoys and the data were compared with other wave measurements obtained from nearby sensors (pressure gauges and wave riders) using the Waveval tools provided by the US Army Corp of Engineers (Courtesy of Dr. Robert Jensen). The results of the investigation are promising and show that, after a drifter has lost his drogue, can effectively be used to collect high quality observations of surface gravity waves in the global ocean.

OCTOPUSEA : A new High Power Stabilized Buo
Philippe Magaldi,

OCTOPUSEA is a buoy supplying high power output plus enhanced stability. Each buoy is customized, built and delivered for full time operability in all types of offshore conditions. GEPS-Techno has developed and supplies this new solution in cooperation with IFREMER-France. Part of the innovation is the Stabilization Energy Converter (SEC), which turns the energy of stabilization into available electrical power supply. Energy can be up to 5 times higher than conventional solar panel buoys with no maintenance issues and low battery requirements The presentation will include:

- Buoy Description and main characteristics
- Description of the innovative SEC
- Stabilizer damping performances
- Permanent electrical power production with combined solar panels
- Mooring design

Evaluating new drogue detection methodology and comparing results from various manufacturers.
Erik Valdes, CIMAS

Drogue loss is evaluated using information from strain gauge, GPS, transmission frequency and downwind drift. Drogue presence is shown to vary between manufacturers. First results of the 2014 comparison study for barometer drifters from all 5 manufacturers is presented.

2015 Drifter developments at SIO
Lance Braasch, Luca Centurioni

In 2014, SIO developed a next generation microcontroller for their drifting buoy systems, which included a number of diagnostic sensors for monitoring in-hull characteristics. Since initial reporting, drifters have been deployed with the updated electronics payload. Herein, we will provide an update of these findings, as well as provide details of new technical developments, status of deployed units, and potential impacts on the scientific community.

Field Laboratory for Ocean Sea State Investigation and Experimentation: FLOSSIE

Intra-Measurement Evaluation of 6N Wave Buoy Systems
R.E. Jensen[1], T.J. Hesser[1], V.R. Swail[2], and R. H. Bouchard[3]
[1]US Army Engineer Research and Development Center
Coastal and Hydraulics Laboratory (ERDC-CHL)
[2]Environment Canada
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National Data Buoy Center (NOAA-NDBC)

The NOAA-National Data Buoy Center (NOAA-NDBC) and Environment Canada EC) have been operating a network of meteorological and wave measurement sites in the Atlantic, Pacific, Gulf of Mexico and Great Lakes for the past four decades. The platforms used by these two agencies vary from discus buoys to a standard 6-m (6N) Navy Oceanographic and Meteorological Automatic Device, or NOMAD buoy. These data sets have been instrumental in the evaluation of wave model results in a hindcast or forecasting mode, used by the satellite-based remote sensing community building algorithms estimating the significant wave height from altimeters, and SAR images, and in research efforts studying the role of surface-gravity wind waves.

Over the period of record there have been modifications to the sensor, payload (on-board analysis package) that can affect long-term records (Gemmerich et al., 2011) and have been used to assess the trends in the wave climate (e.g. Komar and Allan, 2008; Ruggerio et al., 2010; and Menéndez et al., 2008). Using altimeter data as a common reference Durrant et al., (2009) compared EC and NOAA-NDBC wave height data and found a systematic difference of 10-percent reported by EC and NOAA-NDBC. Large portions of the point-source measurements were derived from 6N buoy systems. With these results and NOAA-NDBC planning to decommission all of their NOMAD buoys it became a necessity to construct a meaningful experiment in hopes of answering some of the questions regarding these long-standing data records

In 2012, a plan for an experiment (FLOSSIE) was developed where a 6N hull would be configured with all historical sensor, and payload packages used by NOAA-NDBC during the past four decades. The data will provide a means to account for temporal changes in payloads and sensor systems by NOAA-NDBC while evaluating the accuracy of the archive data sets. In addition to the NOAA-NDBC sensor (and payload systems), AXYS™ has provided their new sensor system (TRIAXYS) and two payloads that will be used to directly assess differences between EC and NOAA-NDBC 6N buoy records.

FLOSSIE will be deployed in July 2015 in Monterey Canyon with the multiple sensor/payload systems as part of an existing Buoy Farm (multiple wave measurement platforms). The domain is populated with a Datawell™ directional waverider buoy, a NOAA-NDBC standard 3-m discuss buoy containing a HIPPY and 3DGM sensor and payload systems and AXYS™ will also deploy a TRIAXYS buoy. The entire buoy suite of payloads and systems will be evaluated using WaveEval Tools (Jensen et al. 2011). Preliminary results will be presented.

The Benefits of Real Time Metocean Data in Port Operations

Chad MacIsaac & Mark Blaseckie

Executive Summary
This abstract focuses on a case study outlining the environmental and economic success of a metocean buoy network deployed in the busy and rugged waterways off the coast of Eastern Canada. A network of 3 Metre and WatchKeeper metocean buoys transmit real-time meteorological and oceanographic data as part of the SmartAtlantic Alliance. This critical data is used to generate custom synoptic weather and sea-state forecasts to support safe and effective pilot and tanker operations.

Results
Requirement

- New Canadian ECA standards were put into effect January 1, 2015 whereby ships 400 GRT and greater operating within the NA-ECA and throughout Canadian waters south of 60°N are required to achieve SOx emissions equivalent to using fuel with a sulphur content less than 0.1% (1,000 ppm) - a 96% reduction.

Benefit of Buoys: Cutting Fuel Costs & GHG Emissions (Port of Halifax)

- *Customers using the SmartATLANTIC inshore weather buoy forecasts for Halifax winter arrivals (Nov. 01 – Apr. 30) could reduce 0.1% sulphur fuel costs by CDN $775,000 and cut GHG emissions equal to removing 535 cars from the road for one year!*

Requirement

- Find Weather Windows for Vessel & Cargo Operations

Benefit of Buoys: Minimizing the Cost & Danger of Severe Weather Delays

- *Weather-related delays cost the Halifax marine community in excess of $2.6 million annually – money that could be saved, to a large extent, by using high resolution weather and wave height forecasting to better plan port operations.*
-

Latest Technologies
Lance Curtiss, Lance Braasch, and Luca Centurioni

As with any type of fabrication, SVP platform drifter developments require constant monitoring and quality control to preserve or enhance performance across manufacturing iterations. There are technological advances outside of oceanography which, when applied to drifter construction, increase manufacturability while maintaining performance. Here, we report on some of the fabrication technologies utilized at SIO and present their impact on the manufacturability and performance of drifting buoys.

Cheap and cheerful BGC sensors: the current state of the art

Maciej Telsweski, Institute of Oceanology of Polish Academy of Sciences, Sopot, Poland
David Meldrum, Scottish Association for Marine Science, Oban, Scotland

Biogeochemical (BGC) sensors have advanced rapidly over the last five years, and are now approaching a level of stability and cost that suggests that their evaluation and gradual rollout within the operational drifter fleet is now timely and appropriate. This paper describes the current state of the art for BGC sensors and points to areas where the DBCP and other ocean platform communities might come together in developing a road-map for their widespread deployment, as called for by OceanObs'09 and others.

Projecting Oil Dispersion in the Gulf of Mexico, Straits of Florida, and Caribbean Sea Using Climatological Data from Drifting Buoys and Surface Winds
Shaun R. Dolk

Oil spills are a serious threat to coastal neighborhoods and businesses that rely on nearby marine resources, including tourism. Most existing oil spill models focus on real-time prediction to aid response efforts, but are not ideal to forecast the impact of spills from existing, or proposed exploration sites, into the future. Therefore, to improve seasonal to annual oil response preparations for potential upstream threats from oil spills in the Gulf of Mexico, Straits of Florida, and Caribbean Sea, I created an oil spill projection model using climatological records, including historical drifting

buoy and surface wind databases. Utilizing climatological data is a statistical advantage, as it provides historical perspective in the region and allows one to measure the effects of data-based ocean current and wind velocities on oil dispersion. Incorporating data from the earliest drifters in the region, December 1992 to present, strengthens the model, which better projects oil trajectories and identifies areas of concern.

STUDY ON PERFORMANCE OF SENSORS IN INDIAN MOORED BUOYS

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Indian moored Buoy systems maintained by ESSO NIOT, are equipped with meteorological, oceanographic and sub-surface sensors to collect various parameters. As buoys are being operational at Sea for more than one year, there is a never ending need to be fulfilled by the systems deployed in the ocean to show good reliability in terms of its functionality and its resistance towards the hostile environment. Thus, the performance of operating instruments for extended periods of time, the behavior of the sensors and other materials is to be studied keeping in view the deep sea science and exploration as a priority. Variety of challenges were observed in NIOT buoy systems and consequent to that, as a part of evolutionary phenomena, different strategies were employed to improve the performance of sensors and other components used in NIOT buoy systems. Few case studies are discussed here, where anti-fouling initiatives for the entire sub surface sensors and components are implemented effectively. Apart from this, validations studies on Radiation sensors, Anemometers and Relative Humidity sensors have been carried out to improve their performance. In some of the radiation sensors used at NIOT, a considerable amount of drift in data was observed. This drift is attributed to facts such as non-linearity of the voltage amplifier (capable of boosting microvolt to millivolt range) and the increase in electrical resistance due to radiation sensor's cable length. In Conductivity and Temperature (CT) sensors, located at surface below the buoy hull, various technical issues such as low battery alarm, intermittent data availability were noticed in few buoy systems. After detailed joint analysis with OEM theses iusses were sorted out and is discussed. Data request command from the buoy system to the surface CT sensor was modified and additional backup power from buoy system's main battery bank was provided along with data request command. This effort resulted in continuous availability of SST and conductivity data. Also data collection and transmission from remote buoys depends on the power source i.e., battery and practical data on performance of battery is analysed in detail and presented here. This paper describes unique experience to provide real- time, valuable, quality and continuous data from moored buoy network and could be useful to others.

DBCP – A Retrospective

Al Wallace

The Data Buoy Cooperation Panel (DBCP) is a joint body of the World Meteorological Organization (WMO) and Intergovernmental Oceanographic Commission (IOC), and is the data buoy component of the Joint Technical Commission on Oceanography and Marine Meteorology (JCOMM). The DBCP was established in 1985 and has met annually since then. This presentation will provide an overview of the DBCP, from the discussion of the requirements for such a committee before it was created, to its evolution over the past 30 years. Information will be provided on the membership of the DBCP, including leadership and technical coordinators, an overview of the financial management, its accomplishments including the contributions to the global ocean observing system, the development of regional and ocean specific action groups, the innovative implementation of focused task teams, the use of pilot projects to address issues, and its significant contributions to building awareness and capacity and sharing knowledge. The DBCP has been successful in stimulating convergence on data buoy systems and monitoring for oceanographic and meteorological prediction, services and research.
