DBCP 2007 Scientific and Technical Workshop – Program

WORKSHOP THEMES:

The Workshop is organized in sessions that address the following themes:

Technological Demands and Developments – demands for enhanced observations collection technology; innovations or developments in related marine observation systems; developments in buoys/instruments (e.g. wave measurements).

Operational Practices and Enhancements – evaluation or analysis of operational performance or trials; data communications and data assimilation; performance and efficiency benchmarking; new systems and practices.

Applications of Collected Data – research and operational data applications; case studies.

National Practices– national practices regarding partnerships, instrument quality assurance, data processing and observation quality control, metadata standards, data dissemination and satellite data telecommunications.

Presentation slots – 20 mins including 15 mins presentation + 5 mins questions / discussion (except where variation agreed)

MONDAY 15 OCTOBER

	#	TIME	TOPIC	PRESENTER / AUTHOR
Applications of Collected Data		09:00 – 09:25	Opening of Scientific and Technical Workshop	David Meldrum, DBCP Chair
		09:25 – 09:45	Technical Workshop Program (whole) 1st Session Organisation	Chair – 1st Session
	1	09:45 – 10:05	Applications of Collected Data from Argos Drifter, NOAA Satellite Tracked Buoy in the East Sea of Korea	Young-Sang Suh *(NFRDI)*
	2	10:05 – 10:25	Observation of Hurricanes from Air-Deployed Drifters	Peter Niiler *(Scripps)* Rick Lumpkin *(AOML)*
	3+4	10:25 – 11:05	Long-term comparison of drifters from four manufacturers deployed in 2006	Mayra Pazos and Shaun Dolk (*AOML*)
	5	11:05 – 11:25	Partnerships for New GEOSS Applications for the Indian Ocean Region	Sidney Thurston *(NOAA, Office of Global Programs)*
		11:25 – 11:30	Session Close Remarks & Quests + Announcements	Session Chair
Technological Demands and Developments	**#**	**TIME**	**TOPIC**	**PRESENTER / AUTHOR**
		13:00 – 13:05	Session Organisation / Introduction of Speakers	Chair – 2nd Session
	6	13:05 – 13:25	Iridium Location Quality: Is it Good Enough for Drifters?	David Meldrum *(Scottish Association for Marine Science*
	7	13:25 – 13:45	Evaluation of SVP-B Drifters Reporting Through Iridium	Jean Rolland *(Météo-France)*
	8	13:45 – 14:05	Iridium at CLS	Bill Woodward *(CLS America)*
	9	14:05– 14:25	New Generations of Iridium and Argos Drifters	Sergei Motyzhev *(Marine Hydrophysical Institute NASU)*
	10	14:25 – 14:45	Putting Argos-3, Two Way High Data Rate Capabilities into Practice	Christian Ortega *(CLS)*
	11	14:45 – 15:05	Developments in Telemetry, Data Display, Buoy Configurations and Sensors at Axys Technologies	Mark Blaseckie *(Axys Technologies Inc. Canada)*
		15:05 – 15:30	**Afternoon Break – 30 mins**	
Tech nologi	**12**	15:30 – 15:50	Drifting Instrumented Chains. New Technical Development and Applications.	Luca Centurioni *(Scripps)*

	#	TIME	TOPIC	PRESENTER / AUTHOR
	13	15:50 – 16:10	Recent Developments in Tsunami R&D and Forecast Systems	Paul Freitag *(NOAA – PMEL)* (on behalf of Chris Meinig)
	14	16:10 – 16:30	Operational Forecasting of Marine Meteorology by Model and Observation in KMA	Dr. Jang-Won Seo *(Korea Meteorological Association)*
	15	16:30 – 16:50	Preconditioning of Arctic Sea Ice for Summer Minima	Ignatius Rigor (Polar Science Center, University of Washington)
		16:50 – 17:00	Session Close Remarks & Quests + Announcements	Session Chair
		17:00	**CLOSE OF DAY**	

TUESDAY 16 OCTOBER

	#	TIME	TOPIC	PRESENTER / AUTHOR
Operational Practices and Enhancements		09:00 – 09:05	Session Organisation / Introduction of Speakers	Chair
	16	09:05 – 09:25	Tsunameter Equipment Standards	Ken Jarrott *(Aust. Bureau of Meteorology)*
	17	09:25 – 09:45	Mooring Modifications for Reduced Losses to Vandalism	H. Paul Freitag *(NOAA - PMEL)*
	18	09:40 – 10:05	Enhancements of the Arctic Buoys for the International Polar Year	Ignatius Rigor (Polar Science Center, University of Washington)
	19	10:05 – 10:25	Operation of Storm Surge Monitoring System of NORI for Coastal Disaster Prevention	Mr. Kwan-Chang LIM, *National Oceanographic Research Institute*
		10:25 – 10:30	Session Close Remarks & Quests + Announcements	Session Chair
		10:30 – 11:00	**Morning Break – 30 mins**	
National Practices		11:00 – 11:05	Session Organisation / Introduction of Speakers	Chair
	20	11:05 – 11:25	NESDIS Satellites and the Argos DCS Instruments	Chris O'Connor
	21	11:25 – 11:40	The Data Assembly Center at the U.S. National Data Buoy Center	Bill Burnett *(NOAA - DBCP)*
		11:40 – 12:00	Session Close Remarks & Quests + Announcements	Session Chair
		12:00	**WORKSHOP CLOSE**	

Backup Presentation [2]: "Eastern Australian Current Drifting Buoy Experiment - Early Results": Gary Brassington, Nicholas Summons, Graeme Ball, Lisa Cowan *(Australian Bureau of Meteorology)* – presenter Ken Jarrott

PROVISIONAL AGENDA FOR
THE SCIENTIFIC AND TECHNICAL WORKSHOP
OF THE DATA BUOY COOPERATION PANEL

VENUE: ***Jeju Grand Hotel, Jeju, Republic of Korea***
DATE : ***October 15-16, 2007***

WORKSHOP CHAIRS: Ken Jarrott ***Australian Bureau of Meteorology***
Bill Burnett ***U.S. National Data Buoy Center***

PRESENTATION ABSTRACTS

1. Applications of Collected Data from Argos Drifter, NOAA Satellite Tracked Buoy in the East Sea of Korea

Author: Young-San Suh *(Ocean Research Team, National Fisheries Research and Development Institute, South Korea)*

Abstract: Recurring eddies at the terminal end of the East Korean Warm Current have been identified in the thermal infrared imageries and ocean color data from NOAA and Orbview-2 satellites. However, it is difficult to make observation in the field regarding recurring eddies located off the Wonsan coast of North Korea. But, we could get the in situ data from an Argos satellite tracking drifter trapped in the eddy. The Argos drifter rotated 10 times for 72 days on the edge of the eddy located at 39N, 129E. The diameter of the eddy was about 100km. The horizontal rotation velocity of the recurring and anti-cyclonic eddy with cold core was 1.53 km/h (42 cm/sec). Interaction of the eddy with Argos tracked drifters, and evidence for its persistence are discussed.

Furthermore, temporal and spatial variations of the sea surface temperature differences were measured by Argos drifters between daytime and night time in the whole East Sea. The SST differences were quantified by 1,438 data set derived from 30 Argos drifters. The horizontal variations of SST differences in summer in the East Sea were higher than those in winter. The relationship between the SST differences and the half-day moving distances of Argos drifter was studied.

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2. Observations of Atlantic Hurricanes with Air-Deployed Drifters

Authors: Peter Niiler, (*Scripps Institution of Oceanography)* and Rick Lumpkin, (*Atlantic Oceanographic and Meteorological Laboratory)*

Abstract: Commencing in 2003, Atlantic Hurricanes have been targeted with C-130 aircraft deployments of drifting buoys. The technology, air crew training, operational data flow and scientific results are reviewed. Most recent hurricanes have been successfully seeded with SVP- T(z-

150m) drifters 36 hours ahead of the operationally predicted arrival of tropical storm winds. New technology for deployment of T(z) chain drifters packaged in AXBT size containers, suitable for deployment from P-3, and other, aircraft is presented. The need for “ground-truth” for wind speed in hurricane strength winds are discussed and requested from the international community of buoy operators led by NOAA, launched the research and development that resulted in Deep-ocean Assessment and Reporting of Tsunami (DART) technology and associated forecast system science. DART stations combine bottom-pressure sensing to detect the tsunami wave with acoustic linkage to a moored buoy and satellite communication with operators and researchers, feeding relevant data to NOAA’s Tsunami Warning Centers.

At the time of the devastating Indian-Ocean tsunami in December 2004, the US operated an array of 6 DART stations. These stations, of a first generation design, were only deployed in the waters of the Pacific. The data was intended to provide early warning for tsunami threats to the most exposed coastal communities of Alaska, Washington, Oregon, California, and Hawaii. Over the last two years, the US Administration provided supplemental resources to strengthen and expand the tsunami early warning and mitigation system for all US assets. As a result, NOAA accelerated the transition from research to operations of a second-generation station, DART II, which is more robust and includes 2-way communication capabilities. Funding is also being provided to continue research and development of multipurpose and easier to deploy technologies and advance the research to operations transition of the associated site-specific inundation forecast system. By early 2008, the final operational configuration of the strengthened DART II array will comprise 32 stations around the Pacific Ocean basin and 7 stations in the vicinity of the Atlantic, Caribbean and Gulf of Mexico. Combined with parallel efforts to strengthen the network of real-time sea level (tide) gauges, broad-band seismic stations, data management and communications, NOAA is establishing a durable and integrated tsunami observing system.

The new data streams provide input to NOAA’s evolving forecast capability, using real-time observations with bathymetric and historical event data, for predicting the propagation and inundation of destructive tsunamis. The National Tsunami Hazard Mitigation Program and TsunamiReady education and outreach initiatives contribute to the desired outcome of developing resilient communities within a multi-hazard approach. NOAA’s Tsunami Program achieves this goal by working closely with the United Nations Educational, Scientific, and Cultural Organization’s Intergovernmental Oceanographic Commission (UNESCO-IOC), the World Meteorological Organization (WM), and the Joint Commission on Ocean and Marine Meteorology (JCOMM) to ensure an interoperable and sustainable contribution to the Global Earth Observing System of Systems (GEOSS).

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3+4. Long-Term Comparison of Drifters from Four Manufactures Deployed in 2006

Authors: Mayra Pazos, Shuan Dolk *(Atlantic Oceanographic and Meteorological Laboratory)*

Abstract: In 2006, the Global Drifter Program deployed eight clusters of four SVP drifters, one each from Clearwater, Metocean, Pacific Gyre and Technocean, continuing a comparison study started in 2005. Preliminary results were presented in last year’s DBCP technical workshop, indicating considerable improvements from 2005 when problems were immediately evident. Now sufficient data has been collected to evaluate if these particular drifters are surviving to the design lifetime of 450 days, and to evaluate drogue detection and lifetimes. In 2008, the Global Drifter Program plans to continue this comparison study with cluster deployments at a few locations worldwide.

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5. Partnerships for New GEOSS Applications for the Indian Ocean Region

Author: Sidney Thurston (*NOAA/Office of Global Programs)*

Abstract: Partnerships for New GEOSS Applications in the Indian Ocean are being established to help build sustainable capacity in maritime regions by conducting in-country, practical, socio-economic applications training by U.S. experts to decision-makers, policy and budget administrators, scientists and end-users, in exchange for regional ship time for the deployment of new in-situ ocean observations. By building on and complementing existing capacity building programs, a sustainable capacity for the region is being achieved through the increases in both near real-time in-situ ocean observational data and information as well as the more effective applications of existing and new data. This presentation will brief on previous successes, and future implementation of capacity building and ocean observations for the Indian Ocean and surrounding rim Nations.

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6. Iridium Location Quality: Is it Good Enough for Drifters?

Author: David Meldrum *(Scottish Association for Marine Science)*

Abstract: Drifting buoy operators have traditionally relied on Argos both for the communication of sensor data and for deriving a location for the drifter. Location quality (on a scale of 0 to 3) is estimated by the Argos location algorithm, typically corresponding to fix accuracies from a few km to a few 100m. This is generally adequate for the majority of buoy studies: applications requiring higher accuracy use a GPS receiver on board the buoy. Recently there has been mounting interest in the use of Iridium as the buoy communications channel, both because of its increased bandwidth relative to Argos and its potentially lower consumption in terms of energy and cost. It has been generally assumed that locations for Iridium-equipped buoys will require the use of GPS, but recent studies have shown that this need not be the case. The Short Burst Data (SBD) messages normally transmitted by data buoys are passed to the user in the form of e-mails, each of which includes a system-derived location and error estimate. The error estimate has proved to be very reliable and may thus be used to filter out bad locations. In this way, km-scale accuracies, similar to Argos location classes 0 and 1, may be achieved. Furthermore, the time between locations may be chosen by the user, thus allowing accuracy to be improved through averaging if required. The even spacing of locations also simplifies interpolation and track reconstruction, a process that can be difficult for the rather randomly spaced Argos fixes.

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7. Evaluation of SVP-B Drifters Reporting through Iridium

Author: Pierre Blouch, Jean Rolland and Jean-Paul Jullien *(Météo-France)*

Abstract: Météo-France is actively participating in the DBCP drifter Iridium Pilot Project. In this context, two SVP-B drifters fitted with a GPS and an Iridium SBD transmitter (9601) were

ordered by Météo-France to Metocean in 2006. These drifters were first deployed in the North Atlantic in October/November.

In the beginning of 2007, three other prototypes were purchased. One was deployed in the North Atlantic in May. The two others will be put on the sea ice in the Arctic in August. In parallel, other drifters have been ordered to Metocean (third set of prototypes) and to a couple of other manufacturers.

The presentation describes the operations carried out with these drifters, the problems which have been found, the improvements which were brought to the second generation of prototypes and those which are still needed for the next generation. The main concern is presently to save energy in order to increase buoy lifetimes.

The presentation also describes how the raw data are processed and sent onto the GTS in real time: choice of the data format, use of Iridium locations as an interesting alternative to the GPS ones. Finally, the availability, the timeliness and the quality of the data sent onto the GTS for Iridium SVP-Bs are compared to those of Argos drifters.

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8. Iridium at CLS

Author: Bill Woodward *(CLS America)*

Abstract: In January 2007 CLS became an official Global Value Added Reseller of Iridium Service. This includes, among other things, providing worldwide services for science applications, such as buoy and science instrument data collection, ocean-going science vessel data collection, in-shore science data collection aboard vessels or fixed station equipment, etc. Iridium Data services available from CLS will include Circuit Switched, RUDICS and Short Burst Data communications. CLS is developing its Iridium processing capabilities to satisfy the data collection requirements of the global ocean/met research and operational communities. As with Argos processing, data delivery options are planned as well as value-added services such as data quality control, GTS processing and dissemination, etc. January 2008 is the schedule for Iridium data services to be available from CLS. Drifter data from the DBCP Iridium pilot project, as well as from Argo floats, are being inserted in the Argos processing system to validate the concept and demonstrate the capabilities.

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9. New Generations of Iridium and Argos Drifters

Authors: E. Luney, A. Kirichenko, S. Motyzhev, A. Tolstosheev, V. Yachmenev
(Marine Hydrophysical Institute NASU)

Abstract: Main area of Marlin activity for this year to progress drifter technology has been concentrated on fulfillment of Iridium Pilot Project as well as development of new generation of temperature profiling drifters. The job has been done in close cooperation with Meteo-France (France); SAMS Research Services Ltd., Dustaffnage Marine Laboratory (GB) and Marine Hydrophysical institute (Ukraine). Four new kinds of drifters have been developed to be evaluated in-situ:

- Iridium+GPS SVP-B drifter with 41-cm hull and 92-cm drogue;

- Iridium+GPS SVP-B mini drifter with 34-cm hull and 61-cm drogue;
- Argos SVP-BTC80-RTC temperature-profiling drifter with 80-m temperature chain and Real Time Clock (RTC) inserted to have samples at round hours independently of time to be switched on/off;
- Argos SVP-BTC80-GPS temperature-profiling drifter with 80-m temperature chain and increased space-time resolution of measurements.

Theoretical lifetime of Iridium drifter with large hull has to be at the latest 32 months in operation with hourly samples, data transfer and locations via GPS. This parameter for mini drifter has to be more than 24 months. 2007 generation of temperature-profiling drifters has a few novelties, which increases reliability and lifetime of the buoys. The system to have samples at round hours corresponds to the DBCP requirements about quality of weather forecasting and data processing. Temperature-profiling drifters with GPS allow an investigation of heat processes inside active layer (vertical variability, heat transfer, etc.) with mesoscale resolution, that is very important for Ocean areas with limited surface, e.g. the Black Sea, Caspian Sea, etc. The buoys should be deployed in September 2007 in the Black Sea and other areas of the Ocean.

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10. Putting Argos-3 – Two-way, High Data Rate Capabilities into Practice

Author: Christian Ortega *(CLS)*

Abstract: MetOp A is flying with an Argos-3 DCS on board featuring 4.8 kbps high data rate channel and the Argos two-way communications. These new capabilities are being tested through a number of pilot operations on drifters and ARGO floats. In parallel, the industrial PMT (Platform Messaging Terminals) prototypes have been accepted and the first batch is now being manufactured by Kenwood for delivery in early 2008. The Argos processing facilities have been upgraded to accommodate the new functions. In addition, the new processing system will deliver data as geo-located and validated observations, and integrate the GTS processing. Data will then be available either and both in “Argos message” format or observation. The observation modules are currently being validated. The launch schedule for additional Argos-3 systems will be presented. All capabilities will be available through ArgosWeb: sending commands to PMTs, retrieving PMT messages and observations, sharing the data with colleagues...

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11. Developments in Telemetry, Data Display, Buoy Configurations and Sensors at Axys Technologies Inc.

Author: Mark Blaseckie *(Axys Technologies Inc., Canada)*

Abstract: This presentation will cover recent advances, challenges addressed and technologies developed at Axys Technologies Inc. to provide buoy owners and operators with solutions for their Environmental Monitoring needs.
The current status of our GOES transmitter upgrade program will be presented. This will include failures and challenges with current systems and re-evaluation of manufacturers. Environment Canada's Marine Buoy network uses CLS Argos PTTs for data and location backup. Due to some recent hardware failures with the Argos PTTs in use, we are re-evaluating our configuration to relocate the PTT.

Axys Technologies Inc. is working with Environment Canada and the DBCP Iridium Pilot Project to investigate the feasibility of using Iridium transmitters in place of Inmarsat-C on Automatic VOS ships transiting through Canada's High Arctic region. Comparison data between Inmarsat-C and Iridium transmissions will be presented.
Axys Technologies Inc. has just completed delivery of a Water Quality Monitoring Buoy for Environment Canada in Vancouver BC. This buoy measures standard Meteorological parameters, basic Water Quality data and surface currents. Additionally, an advanced high volume SPE trace organic and refrigerated whole water sampler round out the instrumented suite. Digital Images and data will be transmitted via CDMA EVDO Cellular Network to the Internet. Details of the buoy, its deployment and data will be presented.

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12. Drifting Instrumented Chains. New Technical Developments and Applications

Authors: L. R. Centurioni and P. P. Niiler *(Scripps Institution of Oceanography)*

Abstract: In the past four years we have developed and built several GPS/Argos drifting chains equipped with thermistors and/or current meters, barometers and hydrophones. Examples of successful applications include the deployment in extreme environments such as in proximity of hurricanes in the Atlantic Ocean, to measure wind, atmospheric pressure and changes in the thermal structure of the upper ocean, and the deployment of temperature and current sensing devices in the South China Sea to study the dynamics of large amplitude non-linear internal waves. We will discuss the sampling capabilities of an array of such instruments together with technical challenges and recent developments.

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13. Recent Developments in Tsunami R&D and Forecast Systems

Author: Christian Meinig *(NOAA – PMEL)*

Abstract: NOAA's Pacific Marine Environmental Laboratory has developed and deployed next-generation DART systems in support of the tsunami monitoring research effort. The goal of the development is to provide high quality data and to significantly improve global deployment opportunities by reducing ship requirements, minimizing the need for specialized staff thereby reducing the costs of maintaining a global array. Additionally, the design includes "factory built" concepts, an integrated BPR/buoy package with multiple years endurance and includes vandal protection features. DART data ingested into the MOST model have resulted in several forecasts within the past year that have been validated against tide gauge data and other observations.

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14. Operational Forecasting of Marine Meteorology by Model and Observation in KMA

Author: Dr. Jang-Won SEO *(Global Environment Research Lab, National Institute of Meteorological Research of KMA (METRI/KMA))*

Abstract: The Korea Meteorological Administration (KMA) has equipped 5 ocean buoys to monitor ocean real-time status. The ocean buoys of KMA measure wave and wind parameters.

KMA operates buoy and wave-height meter with AWS for wave observations. Especially, wave gauge with radar type at Complex Observational stations in Gyekryel Island in Yellow Sea is used for wave observations. Until now, all buoy in Korea have been imported. But we applied domestic production and assembling of buoy with our technology. And the validation of the KMA buoy has performed using waverider buoy. In this presentation, operational marine model results were compared with the marine meteorological observation results in order to investigate the model performance.

Also, our marine research team focused on the expansion of ocean observing system by the deployment of ARGO floats and the ocean circulation model for the extensive application of ARGO data and development of operational oceanic circulation model for SST prediction. METRI operates our own website including download service and SST & current prediction results (http://argo.metri.re.kr). We provide multiple services such as vertical profile and t-s diagram, time series by handling NetCDF-formatted data.

We also found that the predictability of the CGCM using the analysis field obtained from data assimilation with ARGO data as initial condition of CGCM was considerably increased.

So these study will eventually contribute to the improvement of the long-term weather predictability and fully aware of the importance of the ocean observation data.

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15. Preconditioning of Arctic Sea Ice for Summer Minima

Author: Ignatius Rigor *(Polar Science Center, University of Washington)*

Abstract: The extent of arctic sea ice during summer has declined to record minima during the past decade. Five of the lowest minima in the last 100 years were observed during this period, with the current record minimum set in September 2007.

The decline of sea ice may be attributed to global warming (e.g. the Arctic Climate Impacts Assessment Report 2004), but this decline may also be attributed to a change in the wind driven circulation of Arctic sea ice. In a series of papers, we showed that the prior winter Arctic Oscillation (AO) conditions explained most of the trends in summer sea ice extent in the Eurasian sector of the Arctic Ocean (Rigor et al. 2002), while in the Alaskan sector the recent extreme minima may be due to the drift of younger, thinner ice towards the Alaskan coast during the recent predominance of high to moderate AO conditions (Rigor and Wallace, 2004). Since it takes a number of years for sea ice to age, and thicken, these results imply that we may be able to predict the extent of summer sea ice months in advance.

During the past two years we have observed an increased transport of the older, thicker perennial sea ice across the Arctic Ocean to be exported through Fram Strait into the Greenland Sea (Nghiem et al. 2007). This transport has left much of the Arctic Ocean covered by thinner, first-year sea ice which has less mass to survive the summer melt, especially in the Eurasian sector of the Arctic Ocean where we have observed the most dramatic decreases in summer sea ice extent.

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16. Tsunameter Equipment Standards

Author: Ken Jarrott *(Australian Bureau of Meteorology)*

Abstract: Since the catastrophic Indian Ocean tsunami in December 2004, there has been a dramatic increase in the demand for deep ocean tsunami detection systems. That has resulted in new product innovations and the entry of new suppliers. The term "tsunameter" was coined to include the one pre-existing product (the NOAA-developed DART^{TM} buoy) and new products developed by commercial suppliers or national agencies.

National and basin-wide tsunami warning systems depend on the timely access to data from tsunameters that can be assured to meet warning systems requirements, regardless of the source of the product, or the national operator.

The technical characteristics of the DART^{TM} product have been publicly available for some time, and have been the basis for other product developments. However there have not been any generally accepted or internationally endorsed performance or data interchange standards to guide tsunameter suppliers or warning systems operators. Draft standards and guidance documents have now been developed by the International Tsunameter Partnership, a group of national operators and equipment suppliers, established through the IOC / Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System. This presentation discusses the formulation and current state of these standards.

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17. Mooring Modifications for Reduced Losses to Vandalism

Authors: H. Paul Freitag, Chris Meinig, Andrew Shepherd *(NOAA/Pacific Marine Environmental Laboratory)* and Linda D. Stratton *(Joint Institute for the Study of the Atmosphere and Ocean, University of Washington)*

Abstract: Vandalism is one of the major causes of data losses in moored buoy arrays. In general, lower data return rates from tropical moorings in the Pacific (TAO), Atlantic (PIRATA) and Indian Ocean basins occur in regions that have large commercial fish populations such as the eastern-most and western-most portions of the equatorial Pacific and the Gulf of Guinea in the Atlantic. Vandalism may take several forms: incidental interaction with nets or long line which can foul and damage instrumentation, intentional attachment or displacement of the mooring to increase fish catch (sling-shotting), theft of instrumentation, and deliberate damage to instruments and mooring hardware.

Losses due to vandalism have been especially severe in the moored buoy component of the Indian Ocean Observing System (IndOOS), which is comprised of moorings maintained and supported by Japan (JAMSTEC), India (NIO), Indonesia (BPPT), France (IRD) and the United States (PMEL). While technologically new mooring systems that may decrease the exposure to vandalism are under development, PMEL is planning several near-term changes to their existing moorings in an attempt to decrease the amount of data and instrumentation lost to vandalism. To discourage vandals from boarding or attaching a line to a buoy, some will be modified to remove attachment points and flat surfaces. Initially this will require the removal of all surface meteorological sensors from the mooring. If this modification to the buoy results in an increase in mooring survivability, surface meteorological sensors with vandal-resistant packaging may be reintroduced to the sensor suite. To address the problem of theft of instrumentation, standard hardware on surface moorings will be replaced by hardware that requires special tools. To lower

the overall exposure to vandalism, the number of subsurface moorings relative to surface moorings will be increased. Subsurface moorings, which have primarily been deployed to measure upper ocean currents, will be enhanced for measurement of temperature and salinity.

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18. Enhancements of the Arctic Buoys for the International Polar Year

Author: Ignatius Rigor *(Polar Science Center, University of Washington)*

Abstract: The International Arctic Buoy Programme (IABP) has maintained a network of drifting buoys since 1979, providing the longest continuing record of observations from the Arctic Ocean. These buoys provide critical atmospheric, ice, and upper-ocean hydrographic measurements that cannot be obtained by other means, thus these observations have been one of the cornerstones for environmental forecasting and studies of climate and climate change.

The IABP is evolving to better support operations and research across the Arctic Ocean. For example, some Participants of the IABP have been deploying buoys which not only measure sea level pressure and surface air temperature, but also ocean currents, temperatures and salinity. Other buoys have been enhanced to measure ice mass balance (IMB) using thermistor strings and ultrasonic pingers aimed at the top and bottom of the sea ice. Most of these ocean and IMB buoys are deployed in close proximity to each other providing a myriad of concurrent observations. From such data time variations in other geophysical variables such as oceanic heat storage and heat flux can be estimated.

The harsh Arctic environment and changes in wind (ice circulation) make maintaining the buoy network a challenge, especially in the Eurasian sector of the Arctic Ocean. As such, the IABP welcomes new partners to help sustain the buoy network, and to develop new technology.

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19. Operation of Storm Surge Monitoring System of NORI for Coastal Disaster Prevention

Author: Mr. Kwan-Chang LIM, Oceanographic Division, *National Oceanographic Research Institute, Republic of Korea*

Abstract: not available

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20. NESDIS Satellites and the Argos DCS Instruments

Author: Chris O’Connor

Abstract: not available

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21. The Data Assembly Center at the U.S. National Data Buoy Center

Author: Bill Burnett *(NOAA / National Data Buoy Center)*

Abstract: The National Data Buoy Center (NDBC) Data Assembly Center (DAC) provides 24/7 quality control and monitoring of marine data from more than 550 platforms. Near-real-time, automated quality control is applied to meteorological, wave, and ocean data as they arrive at the National Weather Service Telecommunications Gateway (NWSTG) outside of Washington, D.C. for transmission to world wide weather services as World Meteorological Office (WMO) bulletins over the Global Telecommunications System (GTS). NDBC contributes data from over 100 buoys, 56 coastal weather stations, 55 Tropical Atmosphere and Ocean (TAO) moorings, and 32 Deep-ocean Assessment and Relay of Tsunami (DART) buoys. The DAC acquires data from 161 National Ocean Service (NOS) National Water Level Observation Network (NWLON) stations, 56 oil and gas platforms in the Gulf of Mexico, 165 Integrated Ocean Observing System (IOOS) platforms, and approximately 600 Volunteer Ocean System (VOS) ships. Additionally, the NDBC DAC provides daily human quality control for data that are assigned questionable quality flags by the automated process. The Data Analysts also provide additional quality control as the data are gathered into monthly summaries for each NDBC station and provided to the appropriate NOAA data center.

The DAC is involved in all phases of buoy operations at NDBC: engineering and testing of experimental buoys; checking the systems that make up an NDBC system; deployment of NDBC assets worldwide; and monitoring communications over a number of communications pathways. As buoys are constructed the DAC monitors individual sensors and the system to determine that the buoy is operating as expected before dismantling the system and shipping it to the deployment area. As the system is reconstructed on-site it is checked by the DAC again before it is deployed. During these operations, the DAC works closely with engineers and technicians to insure that the buoys will be operating properly when they are deployed.

ADDITIONAL BACKUP PRESENTATION – SUBJECT TO AVAILABLE TIME SLOT

22. Eastern Australian Current Drifting Buoy Experiment - Early Results

Author: Gary Brassington, Nicholas Summons, Graeme Ball, Lisa Cowan *(Australian Bureau of Meteorology)*

Abstract: The East Australian Current (EAC) is an important and complex north-to-south boundary current formed by splitting of the South Equatorial Current as it hits the Australian coast. It has high ecological and economic impact, and is the carrier of nutrients, species and energy from tropical waters down to the more temperate waters in Australia's south.

The EAC has been sporadically observed at occasional intervals of intense monitoring, and intermittently drifting buoys or Argo floats that find their way into its path. In 2006, the Australian Bureau of Meteorology's Research Centre, with support from NOAA, proposed a research program for the long term monitoring of the EAC. The program will use clusters of drifting buoys deployed annually in summer, at a time of strong current development. In early 2007 a pilot program deployed eight buoys into the path of the EAC, with a view to capturing useful information on the current, and to refining the sampling strategy for future years. The results have identified some spectacular eddy structures, and will lead to an improved deployment strategy in 2008.

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