



Joint WMO-IOC Technical Commission
for Oceanography and Marine Meteorology

JCOMM Pilot Project on Wave measurement Evaluation and Test from moored buoys

Val Swail and Bob Jensen, Co-Chairs



WMO



IOC/UNESCO

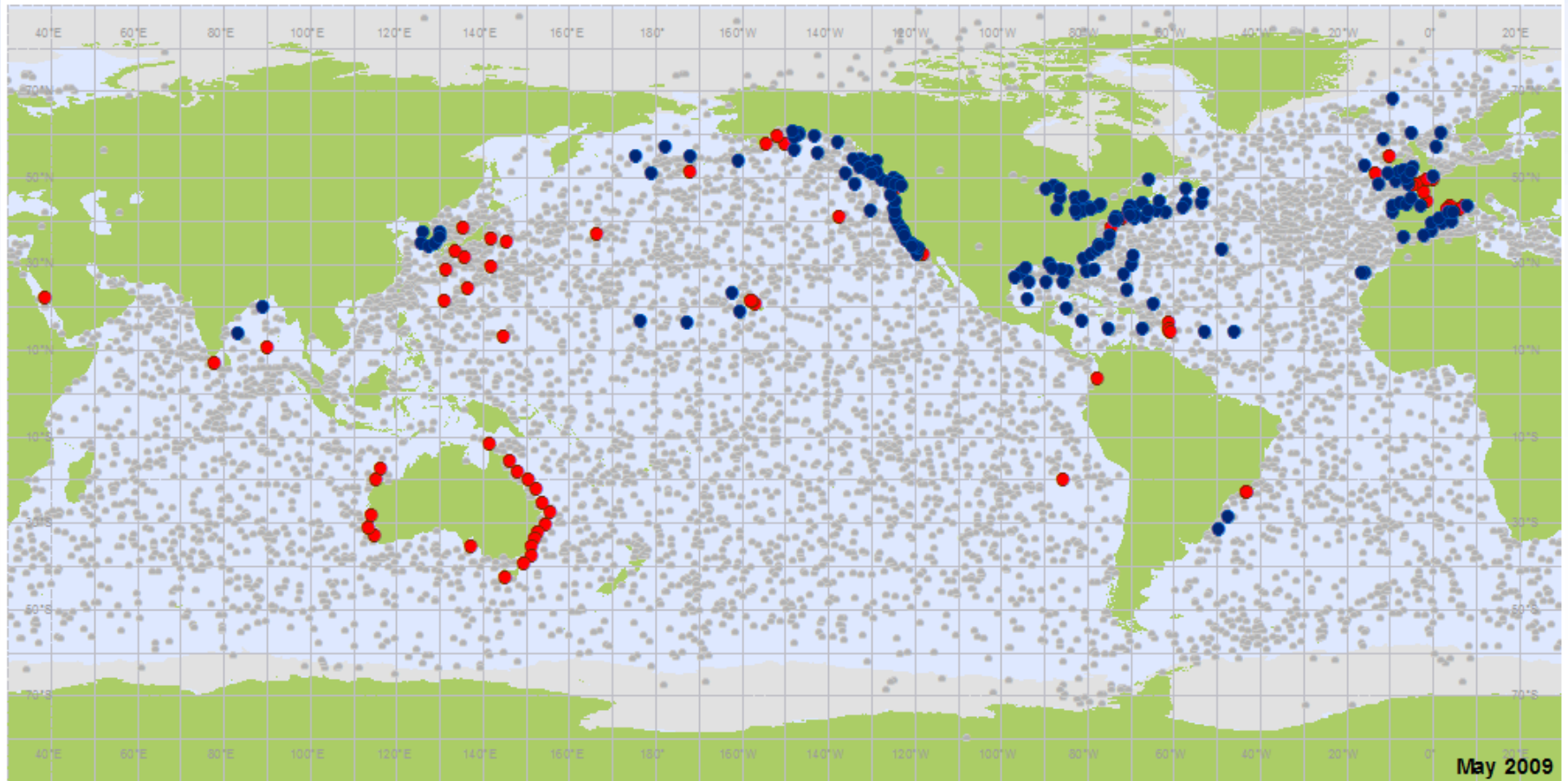


How is your wave measurement?



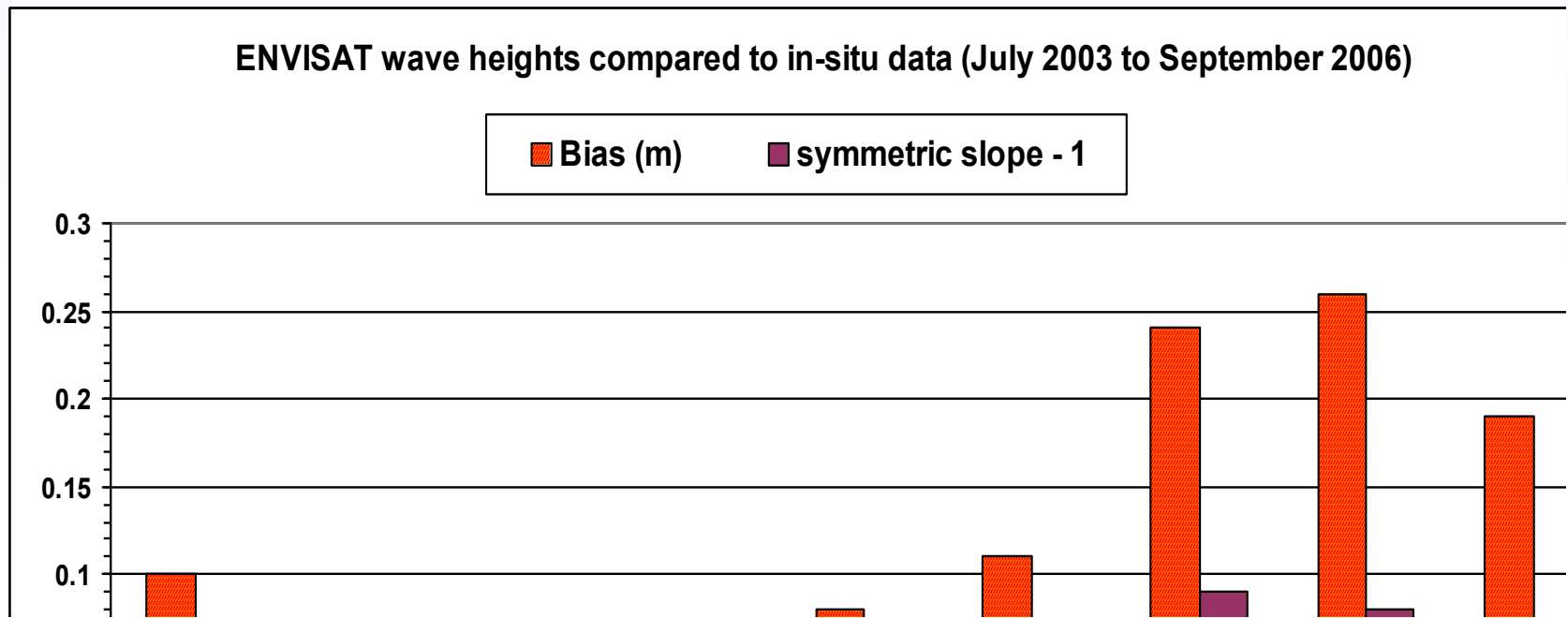
Courtesy C-C Teng

Wave Data on the GTS



- Wind & Waves (165)
- Waves (46)
- All ocean data on the GTS

Bias in wave height measurements



JCOMM Technical Workshop on Wave Measurements from Buoys

New York, 2- 3 October 2008

- www.jcomm.info/Wavebuoys



RECOMMENDATIONS FROM THE WORKSHOP

Technical Developments and Related Research

- Ensure continuity of the established buoy networks
- **Expand directional measurement capabilities**
- Improve spatial network for wave measurements
- Conduct high quality wave measurement on open ocean reference stations, collocated with other metocean measurement platforms
- **Extend intercomparison of (existing) various buoy networks, platforms, and instrumentation to develop a consensus for wave observation methods**
- **Assess the differences in buoy platforms and instrumentation as they relate to the “first 5 standard” wave measurements.**
- Ensure data availability for existing wave observations
- Expand the use of remote sensed measurements (e.g. wave radar, satellite) in assessment of new wave measuring technologies suitable for use on non wave or particle following buoys

RECOMMENDATIONS FROM THE WORKSHOP

Standards, Requirements and Best Practice

- Develop requirements for spatial/temporal coverage
- Develop/improve criteria for accuracy (in frequency domain) of wave measurement
- Identify (spatial) areas of priority for wave measurements
- Document pros/cons of different wave measurement methods (e.g. wave followers, corrected wave follower, corrected fixed platform, fixed platform) and develop appropriate transfer functions
- **Establish guidelines of best practices for wave measurements from buoys (e.g. on constructing sensors, sampling, power, telemetry needs)**
- **Develop global standards and guides based on the existing references such as US IOOS “first-five” approach**

RECOMMENDATIONS FROM THE WORKSHOP

The Future

- **Establish and implement the Wave measurement Evaluation and Test from moored buoys (PP-WET)**
 - most effective way to expand and extend the relevant parts of the US experience from the IOOS Wave Plan test and evaluation activities to an international context within JCOMM.
- *Establish and implement the Pilot Project on Wave Measurements from Drifters (PP-WMD)*
- **Coordination / Integration of the PPs' implementation and outcomes with META-T process and WIGOS**
- Identify resources (funds, in-kind supports) for Pilot Projects and following activities
- Enhance linkage with other communities (e.g. Altimeter, SAR)
- Enhance linkage with industry in sharing observing facilities and historical observing data



DBCP XXIV Cape Town 13-16 October 2008

PP-WET: Objectives

- Develop the basis for an international framework for the continuous testing and evaluation of existing and planned wave buoy measurements
- Coordinate buoy inter-comparison activities.
- Develop technical documentation of differences due to hull, payload, mooring, sampling frequency and period, processing (e.g. frequency bands & cutoff), precision, transmission
- Develop training material to educate users about how to deploy and operate wave sensors appropriately.
- Contribute appropriate material to the JCOMM Standards and Best Practice Guide
- Establish confidence in the user community of the validity of wave measurements from the various moored buoy systems

PP-WET: Methodology

- Establish a Pilot Project Steering Team comprising a wide representation from end-users, wave experts, buoy manufacturers, and buoy operators
- Draw up a work programme) that
 - Establishes standards for the intercomparison of moored buoy wave measurements
 - Documents existing procedures for moored buoy wave measurements
 - Establishes standards and contributes to development of guidelines for best practices for wave data and metadata
- Consult with buoy network operators, manufacturers and potential end users (e.g. global wave modellers, satellite operators, forecasters) potential end-users to undertake coordinated evaluations of buoy wave measurements according to the agreed-on standard.
- Engage with other operators and end-users to seek contributions (cash and in-kind)
- Present results (written reports, conference presentations, scientific publications)

PP-WET Steering Committee meeting

May 11-12, 2009 La Jolla, CA

- 1 Introduction
- 2 Review of outcomes from New York Workshop and DBCP XXIV
- 3 Review of present Work Plan
- 4 Progress against work plan objectives
- 5 Review of protocols for directional, non-directional comparisons

- 6 Discussion of logistics for comparison
- 7 Metadata issues; other considerations
- 8 Review of Steering Committee membership
- 9 Reporting to DBCP-XXV
- 10 Review of OceanObs'09 CWP on wave observations
- 11 Next Steps

PP-WET Steering Team membership

- Val Swail, Co-Chair (ETWS, EC)
- Bob Jensen, Co-Chair (USACE)
- David Meldrum (DBCP, SAMS)
- Jean Bidlot (ECMWF)
- Hester Viola (DBCP)
- Chung-Chu Teng (NOAA/NDBC)
- Bill Burnett (NOAA/NDBC)
- Julie Thomas (UCSD)
- Hans Graber (U. Miami)
- Diana Greenslade (Australian Bureau of Meteorology)
- Ian Young (Swinburne University of Technology)
- Bill O'Reilly (UCSD)
- Jon Turton (Met Office)
- Christian Meinig (NOAA/PMEL)
- Anne Karin Magnusson (NMI)
- Kevin Ewans (Shell)
- George Forristall (ForOcean)
- Dong-Young Lee (KORDI)
- Mediterranean, India (TBC)
- Secretariat support will be provided by WMO and IOC.
- Boram Lee (IOC)
- Etienne Charpentier (WMO)

PP-WET Work Plan - Year 1

- Expand and extend the relevant parts of the US experience from the IOOS Wave Plan test and evaluation activities to an international context within JCOMM;
- Develop or adapt, as necessary, test and evaluation standards and the methodology for the inter-comparisons for both directional and non-directional data;
- Establish protocols for field tests of wave measurement systems, including:
 - how the first set of system tests will be conducted, and; how results will be presented;
- Document metadata relevant to each intercomparison carried out under the Pilot Project, to be posted with each intercomparison results;
- Develop metadata for existing wave measurement systems, as contribution to existing marine metadata projects (e.g. ODAS, IODE, WIS, Meta-T PP, DBCP Task Team on Moored Buoys);
- Develop or adapt as necessary standard wave quality control guidelines;
- Contribute, as appropriate, to the JCOMM Standards and Best Practice Guides;
- Present results to DBCP-XXV and other scientific fora.

PP-WET Work Plan - Year 2

- Coordinate intercomparisons of wave measurements from different platforms, on an opportunistic basis;
- Develop a plan for a continuous testing and evaluation program;
- Identify approaches to evaluating the performance (e.g. comparisons to a currently accepted technology/approach) of current operational and pre-operational (including nautical and HF radar, ADCP, GPS sensors, and ASIS buoys) *in situ* and remote sensing technologies;
- Investigate the possibility of an alternative testing site if an ocean platform, were to be available through an industry partnership agreement; the evaluation framework would remain the same irrespective of the actual site
- Develop training material to educate users about how to deploy and operate wave sensors appropriately
- Decide if a case can be made to continue the pilot project for a further year and investigate follow-on mechanisms
- Present results to DBCP-XXVI and other scientific fora

PP-WET Results - Year 1

- DBCP approves Pilot Project – October 2008 – Cape Town
- 1st Steering Committee Meeting – May 2009 – La Jolla
- Work plan, membership revised – June 2009
- OceanObs09 CWP – September 2009 – Venice
- Presentation DBCP XXV Technical Workshop– September 2009 – Paris
- *Status report to DBCP XXV – September 2009 – Paris*
- Special Session, discussion session, side meeting at 11th International Workshop on Wave Hindcasting and Forecasting – October 2009 – Halifax

PP-WET Results - Year 1

- Contract let to CDIP/SIO to develop
 - Intercomparison web site
 - Quality Assurance standards proposal
 - Special metadata requirements for intercomparisons
 - Provide intercomparison software to partners
 - Advice on use of intercomparison methodology and web site (CB)
 - Advice on intercomparison technical issues

- Intercomparison activities –
 - US - CDIP coastal intercomparison online
 - “hurricane alley” field program Sep/Oct 09
 - NDBC procurement
 - Investigation of sampling rate and period on SWH
 - Canada – planning and procurement
 - UK – ref. Jon Turton’s regional presentation

Wave intercomparison Web site

news | contact us | home index | faq

Documentation

FAQs & Summaries

Glossary

Publications

Introduction

History and Funding

Program Goals

Wave Measurement

Wave Generation

Wave Dynamics

Irregular Waves

Spectral Analysis

Gauging Waves

Hurricane Events

Tsunami Events

Instrumentation

Instrument Types

Deployment & Use

Data Acquisition

System Organization

Hardware

Software

Data Processing

System Organization

Software

Quality Control

Data Management

Stations and Sets

Files and Storage

CDIP Products

Data Formats

Web Products

COOS Integration

QARTOD

Wave Sensor Comparisons

CDIP071012007_v_NDBC46023012007

Time Series Plots | Wave Component Plots | Scatter Plots (future) | Documentation

All Waves 0.03-0.50Hz	Forerunners 0.03-0.05Hz	Long Swell 0.05-0.08Hz	Short Swell 0.08-0.12Hz	Long Seas 0.12-0.25Hz	Short Seas 0.25-0.40Hz	Wind Chop 0.40-0.50Hz
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Hs, Tp, Dm @ Tp

Freq Peak & Centroid

a1,b1 Mean Dir & Spread

a2,b2 Mean Dir & Spread

Skewness & Kurtosis

CDIP071012007 (blue) vs. NDBC46023012007 (red) | Frequency Range: 0.03 – 0.5 Hz

Find: line Next Previous Highlight all Match case

PP-WET Work Plan - Year 1

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 - ✓ how the first set of system tests will be conducted, and; how results will be presented;
- ✓ Document metadata relevant to each intercomparison carried out under the Pilot Project, to be posted with each intercomparison results;
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- ✓ Develop or adapt as necessary standard wave quality control guidelines;
 - o Contribute, as appropriate, to the JCOMM Standards and Best Practice Guides;
- ✓ Present results to DBCP-XXV and other scientific fora.

Plans PP-WET Work Plan - Year 2

- Session on wave measurement AGU Ocean Sciences Conference – February 2010 – Portland OR
- Planning for 2nd Steering Committee Meeting – April 2010 – Paris
- Coordinate intercomparisons of wave measurements from different platforms, on an opportunistic basis
 - Assist participants where appropriate
- Develop a plan for a continuous testing and evaluation program
- Contribute, as appropriate, to the JCOMM Standards and Best Practice Guides
- Present results to DBCP-XXVI and other scientific fora
- Decide if a case can be made to continue the pilot project for a further year and investigate follow-on mechanisms