



WORLD METEOROLOGICAL ORGANIZATION

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INTERGOVERNMENTAL OCEANOGRAPHIC  
COMMISSION (OF UNESCO)

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# **THIRD JCOMM MARINE INSTRUMENTATION WORKSHOP FOR THE ASIA PACIFIC REGION**

Tianjin, China  
22-25 July 2013

**FINAL REPORT**

JCOMM Meeting Report No. 108

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## **NOTES**

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#### **WMO Regulation 42**

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

#### **WMO Regulation 43**

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation on behalf of the constituent body when the matter is, in his opinion, urgent, and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organization for action in accordance with Regulation 9(5).

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## EXECUTIVE SUMMARY

The third JCOMM Marine Instrumentation Workshop for the Asia Pacific Region was held in Tianjin, China, from 22 to 25 July 2013 at the kind invitation of the State Oceanic Administration (SOA) and the National Centre of Ocean Standards and Metrology (NCOSM) of China. About 43 participants from 17 Members/Member States and international Organization attended the workshop.

The workshop recalled the importance of ocean observations to achieve socio-economical benefits at the global, regional, national, and local (e.g. Tianjin city) levels by addressing the requirements of WMO and IOC Applications, including the Global Framework for Climate Services (GFCS), and working in the multi-disciplinary frameworks of the IOC-WMO-UNEP-ICSU Global Ocean Observing System (GOOS) and the WMO Integrated Global Observing System (WIGOS).

The participants received training on the theory, standards, methods, procedure, practice and data processing of the calibration of marine instruments (wave observations in particular), aiming at improving participants' capacity of applying wave measuring instruments, therefore improving the data quality of such observations on a regional basis.

The workshop issued 14 recommendations detailed in [Annex III](#). The updated RMIC/AP workplan for 2013/2014 is also provided in [Annex III](#).

The workshop thanked China, SOA, and the NCOSM for providing such excellent facilities to the countries of the Asia Pacific Region and to their strong commitment to operate the RMIC/AP.

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## WORKSHOP REPORT

### 1. Introduction

1.1 The WMO-IOC Regional Marine Instrument Center for the Asia-Pacific Region (RMIC/AP) was established by the World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO through WMO Congress Resolution 9 (Cg-XVI) and IOC Resolution XXVI-9. The RMIC/AP holds activities in support of the Observation Programme Area (OPA), under the auspices of the Joint WMO-IOC Technical Commission for the Oceanography and Marine Meteorology (JCOMM).

1.2 In accordance with its Terms of Reference (JCOMM-III Recommendation 1), the goals of the RMIC/AP are: (i) to assist WMO Members/IOC Member States within its region in calibrating their national meteorological standards and related oceanographic monitoring instruments according to the RMIC capabilities; (ii) to organize training workshops; and (iii) to organize marine instrument inter-laboratory comparisons. It should be noted that recently, the RMIC/AP has begun to offer calibration services (seawater conductivity/salinity, seawater temperature, seawater depth, tide, wave) to WMO Members/IOC Member States.

1.3 The Third Workshop on Marine Instrumentation for the Asia-Pacific Region was held at the RMIC/AP in Tianjin, China, from 22 to 25 July 2013, at the kind invitation of the National Center of Ocean Standards and Metrology (NCOSM), China State Oceanic Administration (SOA). The First and Second Workshops on Marine Instrumentation for the Asia-Pacific Region were also held at the RMIC/AP in Tianjin, China, in July 2011 and December 2012 respectively (see JCOMM Meeting Reports No. 87<sup>1</sup> and 95<sup>2</sup>) and focused on metrological instrumentation technology, and CTD measurements respectively. This Third workshop focused on wave observations.

1.4 About 43 participants from 17 Members/Member States and international Organization attended the workshop. They included scientists, experts, researchers, engineers and government managers involved in the fields of oceanography and marine meteorology from Member countries of WMO and IOC of the Asia-Pacific region, as well as members of RIMCs. The list of participants is provided in Annex II.

1.5 The objectives of the third Workshop were (i) to enhance the Members/Member States capability with regard to wave buoy operations; (ii) to facilitate the calibration and maintenance of marine instruments (wave buoy in particular); and (iii) to improve the data quality control of marine observations.

1.6 All information related to the Workshop, including this report, and the presentations delivered during the workshop are available on the JCOMM website<sup>3</sup>.

1.7 Opening statements were delivered by (i) Mr. Fei WANG, Deputy Director of SOA, (ii) Mr. Changyun SHU, Deputy Secretary-General of Tianjin Municipal Government, (iii) Mr. Wenjian ZHANG, Director of Observing and Information Systems Department, World Meteorological Organization (WMO), (iv) Mr. Thomas Floyd GROSS, Intergovernmental Oceanographic Commission (IOC) of UNESCO Secretariat, and (v) Prof. Aina WU, Executive Director of the RMIC for the Asia-Pacific region. In the opening remarks, the following was noted:

- Ocean is highly emphasized by the United Nations and relevant international organizations, which strongly urge all countries to place a high value on the sustainable development, utilization and protection of marine area;

1 <ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-MR/JCOMM-MR-87-Rev2-RMIC2.pdf>

2 <ftp://ftp.wmo.int/Documents/PublicWeb/amp/mmop/documents/JCOMM-MR/JCOMM-MR-95-RMIC-RA-II-2.pdf>

3 [www.jcomm.info/rmic3-ra2](http://www.jcomm.info/rmic3-ra2)

- Ocean observation serves as the base for the human being to research, recognize, explore and utilize the marine area while standardization, instrument calibration and quality control are the key to compare and share the ocean observation data as well as to establish a global ocean observation system;
- As the authoritative international organization of ocean observation, data and information management service, WMO and IOC play their important roles in formulating observation standards, professional marine instrument test and calibration, data comparison and establishing a quality assurance system for ocean observation by promoting the establishment of RMICs over the world. This is undoubtedly the fundamental and significant technical work that benefits both the global environment and human's long-term and sustainable development;
- As the administrative organization, SOA has been giving all-rounded support to the capacity building and sustainable development of RMIC/AP, and is exerting an important role in advancing the RMIC/AP to be a leading regional technical agency of marine standards, metrology and quality control as well as in improving the global quality of ocean observation and sharing of observed data and resources;
- As the largest opened coastal city and international shipping center in North China, Tianjin has made marine economy and marine industry as an important integral part in its general development strategy, which enjoys an increasingly prominent position in the socio-economic development in Tianjin. Tianjin municipal government is fully supporting the establishment and operation of RMIC/AP, and to provide great guarantee to the development of RMIC/AP;
- With the implementation of the WMO Integrated Global Observing System (WIGOS), WMO is making efforts to establish an integrated, comprehensive and coordinated observing system that satisfies in a cost-effective and sustain manner the evolving observing requirements of WMO programmes, like Global Framework for Climate Services (GFCS) and WMO co-sponsored programmes like GOOS. In this regard, RMICs help improving adherence and traceability of ocean observations and associated metadata to high-level standards for instruments and methods of observations on a regional basis. The RMIC for the Asia-Pacific region is providing a key facility in that regard;
- The Asia-Pacific region is a key engine for the global economy. Ocean observations have proved very successful and useful for marine weather forecasting, safety and climate applications. Through the joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), the Members of WMO and Members States of IOC are contributing to this strategic area by providing the *in situ* and satellite observations required by WMO and IOC applications, including new emerging challenges and issues, especially on Disaster Risk Reduction, Coastal Management and climate services;
- The RMIC/AP has become an important platform for the exchange of information on marine instrumentation testing technology among WMO Members and IOC Member States in the Asia-Pacific Region. The workshop is a grand gathering in the field of international marine instrumentation testing and effectively promotes learning and experience sharing between participants. It plays an important role in promoting the development of marine standard, metrology and quality control, as well as in fostering excellent marine instrumentation testing technicians.

## **2. Main Activities of RMIC for the Asia-Pacific Region since the second workshop (i.e. December 2012)**

2.1 The RMIC/AP recalled the main activities of the centre since the second workshop in December 2012. In particular, the workshop noted with appreciation the following achievements:

- SOA has established management and consultative committees for the RMIC/AP;
- A Liaison Group for Marine Instrumentation in the Asia Pacific (LGMI/AP) is being established;
- The RMIC/AP has provided marine observation instrument calibration and evaluation to a number of Members/Member States, and the China Marine Observation Standard and Criterion will be translated and made available to Members/Member States;
- The RMIC/AP has now completed the translations into English of the Verification Regulation for Gravitational Acceleration Wave Buoys (*Annex IV*). These are made available to Members/Member States in the region; and
- Preparations are underway for the RMIC to assist with regard to intercomparison activities in the future.
- RMIC/AP has initiated establishment of the RMIC/AP website (in English, [www.rmicap.org.cn](http://www.rmicap.org.cn)). The goal is to complete it by January 2014

## **3. Training delivered to participants**

3.1 The Workshop was conducted through class sessions, hands-on exercises and discussions.

3.2 The programme for the workshop is provided in *Annex I*.

3.3 The participants acknowledged the importance of standards and quality management on marine meteorology and oceanographic measurements, and thereby received comprehensive information for realizing the integration of ocean observations in the GOOS and WIGOS frameworks, and achieving the WMO and IOC Applications requirements. The Workshop was conducted through class sessions, hands-on exercises and discussions. Training was provided on the following aspects:

- ✓ Best practices in operating and handing calibration of wave buoys;
- ✓ Training on calibration and troubleshooting techniques;
- ✓ Hands on operation and calibration of wave buoys;
- ✓ Information sharing and networking among the countries within and outside the region;
- ✓ Training on data quality control of marine observation;
- ✓ Training and discussion on the methods and procedures of international salinity inter-comparisons.

3.4 While focusing on wave observations, the workshop also served as a platform for discussions on methods, procedures and techniques of the Global Salinity Inter-Comparisons, which will be organized in the future.

3.5 In addition, a visit of the RMIC for the Asia-Pacific region was organized on 24 July 2013. This included a visit of the laboratories, including the wave calibration facilities.

3.6 In order to provide the participants with an access to the ocean observation activities for experience exchanges, the workshop also provided a study tour of the Qinhuangdao Marine Environmental Monitoring Central Station of SOA on 25 July 2013 as one of the important components.

3.5 Training materials and presentations of the workshop are available on the event's website<sup>3</sup>. RMIC for Asia Pacific Verification Regulation for Gravitational Acceleration Wave Buoys are provided in Annex IV.

#### **4. Workshop recommendations and RMIC/AP updated workplan for 2013/2014**

4.1 The workshop reviewed and agreed on series of recommendations which are detailed in Annex III. The updated RMIC/AP workplan for 2013/2014 is also provided in Annex III.

4.2 The workshop participants were also requested to provide feedback in writing. In average, it appears that the workshop met the participants' expectations. Findings from this feedback has been included within the recommendations of the workshop in Annex III.

4.2 The workshop expressed deep appreciations to the Tianjin Municipal People's Government, the State Oceanic Administration (SOA) of China, and the National Centre for Ocean Standards and Metrology of SOA (NCOSM) for the high vision, leadership and strong political and resource support to the RMIC/AP, as well as for hosting and organizing the third workshop with such pleasant facilities.

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## ANNEX I

**PROGRAMME OF THE THIRD JCOMM MARINE INSTRUMENTATION WORKSHOP  
FOR THE ASIA-PACIFIC REGION  
(Tianjin, China, 22-25 July 2013)**

**22 JULY 2013 (09:00 – 17:15)**

**Morning Session (09:00 – 12:00)**

<i>Time</i>	<i>Speakers</i>	<i>Title</i>	<i>Moderator</i>
09:00 (5 min)	Ms. CHEN Yue Deputy Director of International Cooperation Department of SOA	Opening of the workshop	Ms. CHEN Yue
09:05 (10 min)	Mr. WANG Fei Deputy Director of SOA	Opening remarks	
09:15 (10 min)	Mr. SHU Changyun Deputy Secretary-General of Tianjin Municipal Government	Opening remarks	
09:25 (10 min)	Mr. ZHANG Wenjian Director of Observing and Information Systems Department, WMO,	Opening remarks	
09:35 (10 min)	Mr. Thomas Floyd Gross IOC/UNESCO Secretariat	Opening remarks	
09:45 (10 min)	Prof. WU Aina Executive Director of RIMC for Asia-Pacific	Welcome remarks	
<b>09:55 - Tea break and group photo(35 min)</b>			
10:30 (45 min)	Mr. Etienne Charpentier WMO Secretariat	Ocean observations and JCOMM contribution to the WMO Integrated Global Observing System (WIGOS) framework implementation	Mr. Thomas Gross
11:15 (45 min)	Mr. Thomas Gross IOC/UNESCO Secretariat	GOOS and JCOMM/DBCP Wave Modeling and Measurement Pilot Programmes	

**Afternoon Session (14:00 – 17:15)**

<i>Time</i>	<i>Speakers</i>	<i>Title</i>	<i>Moderator</i>
14:00 (90 min)	Mr. David Meldrum Vice-Chair JCOMM/OCG	Ocean waves: theory, measurement and current best practice	Mr. Etienne Charpentier
<b>15:30 - Tea break (15 min)</b>			
15:45 (90 min)	Dr. NING Chunlin Staff of The First Institute of Oceanography, SOA	Bailong buoy and Atmospheric Weather Stations's Technology	

**23 JULY 2013 (09:00 – 17:15)****Morning Session (09:00 – 12:00)**

<i>Time</i>	<i>Lead/speaker</i>	<i>Title</i>	<i>Moderator</i>
09:00 (120 min)	Dr. FU Qiang Staff of China National Institute of Standardization	International Standardization	Mr. Thomas Gross
<b>11:00 - Tea break (15 min)</b>			
11:15 (45 min)	Prof. YAO Yong Deputy Director of RIMC for Asia-Pacific	Current Development Situation of China Marine Observation Standardization	

**Afternoon Session (14:00 – 17:15)**

<i>Time</i>	<i>Speakers</i>	<i>Title</i>	<i>Moderator</i>
14:00 (120 min)	Dr. YU Jianqing Engineer of RIMC for Asia-Pacific	The Laboratory Calibration of the Wave Height and Period Measurements from the Gravitational Acceleration Wave Buoys	Mr. Etienne Charpentier
<b>16:00 – Tea break (15 min)</b>			
16:15 (30min)	Mr. Kurtz Karl F International Product Manager PCAL of Fluke Corporation	High Accuracy of Pressure Test and the Calibration	
16:45 (30 min)	Dr. Ding Rong Senior Scientist of Fluke Corporation,	Platinum Resistance Thermometers and the Calibration	

**24 JULY 2013 (08:30 – 17:30)****Morning Session (08:30 – 11:00)**

<i>Time</i>	<i>Content</i>	<i>Moderator</i>
08:30 (30 min)	Meet at the hotel lobby and transport to RMIC for Asia-Pacific Region	
09:00 (60min)	Visit the Laboratories at the Center & Hands on calibration of wave buoy	
10:00 (30 min)	Return to the Hotel	
10:30 (30 min)	General discussions	Mr. Etienne Charpentier

**Afternoon Session (12:00 – 17:30)**

<i>Time</i>	<i>Content</i>	<i>Moderator</i>
12:00	Meet at the hotel lobby and transport to Qinhuangdao	
16:00 (90min)	Visit the Qinhuangdao Marine Environment Monitoring Central Station, SOA	Ms. LIN Shaohua

**25 JULY 2013 (09:00 – 18:00):**

<i>Time</i>	<i>Content</i>
09:00	Field trip (Visit of the Qinhuangdao Marine Environmental Monitoring Central Station of SOA)
14:00	Return to Tianjin

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## ANNEX II

## LIST OF PARTICIPANTS

## 1. LEADERS, INTERNATIONAL OFFICIALS, AND LECTURERS

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## ANNEX III

### RECOMMENDATIONS FROM THE WORKSHOP AND RMIC WORKPLAN FOR 2013/2014

#### 1) Recommendations from the workshop

The workshop agreed on the following recommendations:

1. The Recommendations from the first and second JCOMM Marine Instrumentation Workshops for the Asia-Pacific region (Tianjin, China, July 2011 and December 2012) are still valid (see Annex V of JCOMM MR No. 87, Rev. 2<sup>1</sup>, and Annex III of JCOMM MR No. 95<sup>2</sup>);
2. GOOS Regional Alliances (GRA) capacity should be enhanced in the Asia Pacific region, and the RMIC/AP should play a role in this regard. In particular, Quality Control and Quality Assurance procedure and information should be shared, and best practices developed for the region through workshops, capacity building activities, and encouraging an enhanced dialogue between countries in the Asia Pacific region;
3. Participants are invited to review international documentation on observational user requirements and benefits of making ocean and marine meteorological observations. Such documentation can be found on the following websites:
  - Design, planning and optimized evolution of WIGOS component observing systems, including the WMO Rolling Review of Requirements (RRR) – <http://www.wmo.int/pages/prog/www/wigos/wir/osde.html>
  - Global Ocean Observing System (GOOS) – <http://www.ioc-goos.org/>
4. Members/Member States are invited to investigate the use of cost-effective GPS, and/or nine degree of freedom (9DOF) MEMS<sup>4</sup> sensors for developing new types of wave observing platforms, and to use the RMIC/AP for evaluating the performances of such platforms;
5. Mechanisms should be proposed for enhancing the communication between Members/Member States, and the RMICs;
6. Liaison Group for Marine Instrumentation in the Asia Pacific region (LGMI/AP): Workshop participants invited to consider communicating nationally through their home institutions in the view to either propose themselves for being nominated as members of the LGMI/AP, or to seek appropriate national nomination. The members of the LGMI/AP shall be nominated by either the Permanent Representative of their Country with WMO, or the IOC Action Addressee in their Country by mean of a letter to WMO Secretary General, or the IOC Executive Secretary respectively. The Pacific Islands GOOS Regional Alliance (PI-GOOS) should be represented in the LGMI/AP. The LGMI/AP shall be activated in January 2014;
7. The Next JCOMM Marine Instrumentation workshop should be organized in Tianjin in October 2014 with the following guidance:
  - The workshop programme should be made available at least two months before the workshop, possibly with the invitation letters;
  - Consideration should be given to extend the workshop to 5 days;
  - The candidate participants will be requested to submit national report as part of their application form (e.g. what observations are made; what calibration facilities & activities are used), and to make suggestions on requirements and activities to be organized during the workshop;
  - National reports session should be organized during the workshop to promote exchange of information between participants, and networking. It is also proposed to collect individual pictures of the candidates, in the view to include them in the list of participants to be annexed to the workshop's report (e.g. application forms to include candidates' pictures);
  - While noting that focusing on one particular measured variable is useful and helps to received in depth training on related aspects, consideration should be given to

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<sup>4</sup> MEMS: Microelectromechanical systems

- provide more information on (i) traceability to standards, (ii) standards and best practices, (iii) ISO 9001 and/or 17025 QMS accreditation procedures, and (iv) ADCP;
- Shorter presentations, and more group discussions should be encouraged;
  - Consideration should be given to provide more practical activities;
8. The RMIC/AP is invited to submit a concept paper on marine instrumentation intercomparison activities at the forthcoming JCOMM Observations Coordination Group meeting (OCG-5, Silver Spring, USA, 5-7 September 2013). The proposal shall be based on WMO & IOC experiences and models in this regard, and the roles and procedures for such activities clearly defined. For example, for each intercomparison campaign, an international organizing committee should be established; and manufacturers shall only be allowed to quote the full intercomparison report once published. The OCG is invited to establish a task team to refine the proposal in the next 6 months. The RMIC/AP will be invited to propose and plan intercomparison activities on the basis on the concept paper once approved by OCG (dates of the first such activity to be decided).
  9. China is invited to update and finalize the Chinese version of the « Specification for the Marine Observation » during 2013/2014, and then to translate it in English and provide it to Members/Member States upon request if needed. Once translation is complete, whole or parts of this document should be promoted internationally for inclusion in appropriate JCOMM Technical Report(s).
  10. Countries making wave observations, and noticing extreme wave events are encouraged to submit the data of such events to the JCOMM Extreme Wave Database via JCOMMOPS ([support@jcommops.org](mailto:support@jcommops.org));
  11. The RMIC/AP should establish a website for delivering information on RMIC/AP activities (Background information, Terms of Reference, planned Events, workplan, reports of past workshops, standards, QA/QC procedures, etc.). Once established, a link from the JCOMM website to the RMIC/AP website should be added;
  12. Countries making wave observations, which have no calibration facilities are encouraged to use the RMIC/AP facilities for the calibration of their instruments;
  13. Countries making wave observations, which have calibration facilities, are invited to engage a dialogue with the RMIC/AP in the view to intercompare their standards and seek harmonization;
  14. RMIC/AP is invited to investigate how customs clearing procedures could be simplified and made cost-effective so that Countries in the region can easily ship instruments to the RMIC/AP for calibration purposes. The RMIC/AP should report on the outcome of such investigations, and produce a document summarizing the proposed procedures, including information on [customs related] costs.

## 2) Updated Work Plan of RMIC for the Asia-Pacific Region for 2013/2014

No.	Activity	Lead	Time frame / Status
1	To draft Terms of Reference of the Liaison/Coordination group for ocean instrumentation in the Asia Pacific region and submit to the Secretariat	RMIC/AP	Done
2	To consider establishing such groups in other regions	JCOMM OCG	Sept. 2013
3	To issue WMO/IOC letters to Members/Member states in the Asia Pacific region (and beyond if such groups have to be established in other regions), requesting them to nominate national focal point for participating in the Liaison/Coordination group	Secretariat	Done
4	Members/Member States to nominate focal points for participating in the Liaison/Coordination group	Members/Member States	Incomplete (5 Members nominated)
5	to consider communicating nationally through their home institutions in the view to either propose themselves for being nominated as members of the LGMI/AP, or to seek appropriate national nomination.	Participants at the 3 <sup>rd</sup> workshop	ASAP
6	To provide to Members/Member States calibration services for seawater temperature, conductivity, pressure, tides and waves instruments	RMIC/AP	Ongoing
7	To encourage Members and Members States of the Asia Pacific region to send marine meteorological and oceanographic measuring instruments to the RMIC/AP for calibration and test purposes (calibration service to be provided free of charge in 2013)	WMO/IOC Secretariats	Ongoing
8	To organize the first meeting of the regional Liaison/Coordination group and the fourth Marine Instrumentation Workshop of the RMIC for the Asia-Pacific Region. The meeting will discuss how to carry out researches and practice on the marine standards, metrology and quality assurance in their own country, and gradually set up relevant management information database in the respective countries. National reports session should be organized during the workshop to promote exchange of information between participants, and networking	RMIC/AP	Oct. 2014
9	To organize Global Salinity Inter-comparison (with support/coordination by WMO/IOC Secretariat). RMIC/AP will particularly receive the information of the Inter-comparison and provide the summary of the activities to the following workshop	RMIC/AP	TBD
10	To participate in the planned inter-comparison of salinity measurements that will be organized in the future by the RMIC/AP	Members/Member States	TBD
11	To promote GOSS GRA capacity in the Asia Pacific region	IOC Secretariat	Ongoing
12	To review international documentation on observational user requirements and benefits of making ocean and marine meteorological observations (see list in the Recommendations section above)	Members/Member States	Oct. 2014
13	to investigate the use of cost-effective GPS, and/or nine degree of freedom (9DOF) MEMS sensors for developing new types of wave observing platforms, and to use the RMIC/AP for evaluating the performances of such platforms	Members/Member States	Ongoing
14	to submit a concept paper on marine instrumentation intercomparison activities at the forthcoming JCOMM Observations Coordination Group meeting (OCG-5, Silver Spring, USA, 5-7 September 2013)	RMIC/AP	Sept. 2014
15	to propose mechanisms for enhancing the communication	JCOMM OCG	Sept. 2014

<b>No.</b>	<b>Activity</b>	<b>Lead</b>	<b>Time frame / Status</b>
	between Members/Member States, and the RMICs		
16	To establish a website for the RMIC/AP	RMIC/AP	Oct. 2014
17	To collect information on ocean observation programmes existing in the Asia Pacific region, and to make this information available to all through the RMIC website	RMIC/AP	Ongoing
18	To approach the manufacturers and encourage them to use the recommended terminology and practices regarding the uncertainty of measurements (i.e. GUM guide)	WMO/IOC Secretariats	Oct. 2014
19	To develop training material (e.g. powerpoint presentations, videos), and make them available through the RMIC website	RMIC/AP	End 2014
20	To contribute to the translation of such materials in their local own languages, and make the translated materials available to the RMIC for publication via the RMIC website	Members/Member States in the Asia Pacific region	Ongoing
21	To translate additional national marine standards and specifications of China calibration practices, and share them with Members/Member States in the Asia Pacific region	RMIC/AP	2014
22	To update and finalize the Chinese version of the « Specification for the Marine Observation » during 2013/2014, and then to translate it in English and provide it to Members/Member States upon request if needed. Once translation is complete, whole or parts of this document should be promoted internationally for inclusion in appropriate JCOMM Technical Report(s).	RMIC/AP	End 2014
23	Countries making wave observations, and noticing extreme wave events are encouraged to submit the data of such events to the JCOMM Extreme Wave Database via JCOMMOPS ( <a href="mailto:support@jcommops.org">support@jcommops.org</a> )	Members/Member States	Ongoing
24	Countries making wave observations, which have no calibration facilities are encouraged to use the RMIC/AP facilities for the calibration of their instruments	Members/Member States	Ongoing
25	Countries making wave observations, which have calibration facilities, are invited to engage a dialogue with the RMIC/AP in the view to intercompare their standards and seek harmonization	Members/Member States	Ongoing
26	to investigate how customs clearing procedures could be simplified and made cost-effective so that Countries in the region can easily ship instruments to the RMIC/AP for calibration purposes. The RMIC/AP should report on the outcome of such investigations, and produce a document summarizing the proposed procedures, including information on [customs related] costs	RMIC/AP	Oct. 2014



**ANNEX IV**

**Ocean Metrological Verification Regulation of  
the People's Republic of China**

JJG (Ocean) 04-2003

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**Gravitational Acceleration Wave Buoys**

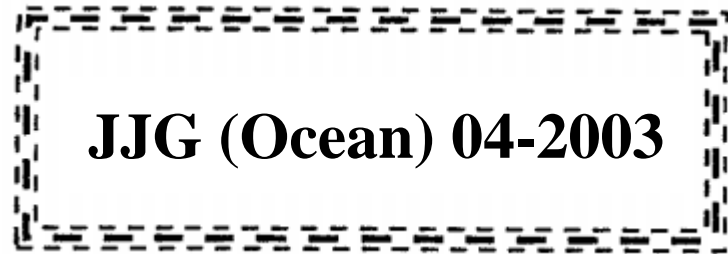
**Issued on Feb. 20, 2004**

**Implemented from Mar. 01, 2004**

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Issued by State Oceanic Administration

## ***Verification Regulation for Gravitational Acceleration Wave Buoys***



This Regulation was approved by State Oceanic Administration on Feb. 20, 2004 and implemented from Mar.01, 2004.

**Approved by:** National Ocean Metrology Station

**Drafted by :** National Ocean Metrology Station

The National Ocean Metrology Station is responsible for the interpretation of this regulation .

**The drafters :**

**Sui Jun** (National Ocean Metrology Station)

**Zhang Yanpu** (National Ocean Metrology Station)

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# **Verification Regulation for Gravitational Acceleration Wave Buoys**

## **1. Scope**

This Regulation applies to the verification of metrological performance of gravitational acceleration wave buoys newly manufactured, being used or after repair, and also applies to the verification of gravitational acceleration wave buoy sensors being used or after repair when the whole metrological performance of a buoy is not affected by its shell.

## **2. Overview**

The gravitational acceleration wave buoy is an instrument for oceanographical monitoring. All the gravitational acceleration sensor, data acquisition processor, signal transmitter and power source are installed inside the buoy shell. In operative state, a buoy will fluctuate along with the the sea surface waves, and the gravitational acceleration sensor will generate vertical acceleration signals corresponding to the motion of the waterparticle. The vertical shift of the waterparticle can be caculated after quadratic integral. In the control of the data acquisition processor, a series of fluctuation data of sea surface in the measuring process will be obtained. The measuring data of the buoy will be transmitted to the receiving processor of shore station by the wireless communication device, and therefore the surface wave height value and wave period value of the buoy layout point can be obtained.

The gravitational acceleration wave buoy is mainly composed of the buoy body and its anchor device, receiving processor of shore station, etc.

## **3. Requirements for metrological performance**

The metrological performance of a gravitational acceleration wave buoy shall

meet the following requirements:

The measuring range of wave height: 1m to 6m ;

The indication error of wave height:  $\pm 3\%$  measured value, m.

The measuring range of period: 2s to 40s;

The indication error of period:  $\pm 0.5$ s

The working frequency range of transmitter: 27MHz to 175MHz ;

The measurable diameter range of buoy: 0.5m to 1.0m ;

The weight of buoy:  $m \leq 180$ kg.

The applicable environment of buoy:

The maximum water depth: 50m ;

The maximum current speed: 2m/s .

#### **4. General technical requirements**

4.1 Appearance inspection: visually inspect whether there is any obvious impact marks or attached marine organisms on the surface of the buoy shell ; whether the transmitting antenna or the anchor lamp is broken down; whether the parts or batteries etc in the shell are complete; and whether the instrument number is complete.

4.2 Power-up inspection: switch on the power supply of buoy and the power supply of receiver at the same time to inspect whether the system is working normally.

4.3 Sloshing test: shake the buoy when both the buoy and receiver are in the power-up state to inspect whether the signal received by the receiver is changed.

After confirming both the buoy and receiver are working normally by appearance inspection, mount the buoy at the verification point of the truss according to the the installation and operation regulation of wave buoys.

## 5. Verification conditions

### 5.1 Standard devices

#### 5.1.1 Level-II steel tape

Measuring error:  $\pm(0.3+0.2L)$ mm, (L is the integer part of the measuring length.)

5.1.2 Frequency meter: The frequency stability is better than  $5 \times 10^{-6}/d$ .

#### 5.1.3 Electronic stopwatch

Measuring error:  $\pm 0.1$ s

### 5.2 Supporting equipments

5.2.1 Verification device for wave buoys: The device shall meet the following technical requirements:

The simulated wave height: 1m ~ 6m, indication error:  $\pm 0.2\%$ F.S;

The simulated wave period: 2s~ 40s, indication error:  $\pm 0.2$ s;

The maximum load carrying capacity: 180kg (when the simulation wave height is 6m);

### **5.3 The environmental conditions for verification**

5.3.1 Indoor temperature:  $5^{\circ}\text{C} \sim 35^{\circ}\text{C}$  .

5.3.2 Indoor relative humidity:  $RH \leq 85\%$  .

### 5.4 The monitoring equipment for verification environment

5.4.1 Indoor temperature: Thermo-hygrometers.

5.4.2 Indoor relative humidity: Thermo-hygrometers.

## 6. Verification items

6.1 Wave height

6.2 Wave period

6.3 Appearance

## 7. Verification method

### 7.1 Setting of verification points

7.1.1 The verification points of wave height: 1.0m, 3.0m, 6.0m;

7.1.2 The verification points of wave period: take 7 wave period values at each verification point of wave height according to the principle of even frequency-point distribution within the period range of the buoy verified, then the wave period value can be calculated using the formula:

$$T_0(i) = \frac{6T'_{\max} \cdot T'_{\min}}{i \cdot T'_{\max} + (6-i) \cdot T'_{\min}} \quad (1)$$

In the formula:

$T_0(i)$  - wave period corresponding to the verification point of wave height, s;

$T'_{\max}$  - the maximum wave period indicating value of the verified wave buoy, s;

$T'_{\min}$  - the minimum wave period indicating value of the verified wave buoy, s;

$i = 1, 2, 3, \dots, 6$ .

Note:

(1) For the calculation results, keep one decimal place according to the rounding off principles.

(2)  $T'_{\min}$  is calculated according to the following formula:

$$T'_{\min} \geq \sqrt{\frac{21\pi \cdot H_0}{g}}$$

In the formula:

$H_0$  – the wave height corresponding to the verification point, m;

$g$  – the local gravitational acceleration value, m.s(-2).

Under general sea state:

When  $H_0 = 1.0\text{m}$ ,  $T'_{\min} = 2.6\text{s}$

When  $H_0 = 3.0\text{m}$ ,  $T'_{\min} = 4.5\text{s}$

When  $H_0 = 6.0\text{m}$ ,  $T'_{\min} = 6.4\text{s}$

### 7.2 Verification steps

7.2.1 Accurately determine the mounting point on the radial arm of the verification device according to the requirements for the verification point of wave height.

7.2.2 Mount the wave buoy to the buoy-fastener on the radial arm of the verification device, and adjust the tension of chain wheel reasonably, so as to make the chain tightly engaged with the gear.

7.2.3 Increase/decrease the counterweight to regulate the balance of the device truss.

7.2.4 Set the verification standard period and rotate the truss.

7.2.5 Start to perform measurement when the truss rotates at a constant speed .

7.2.6 Record the standard wave height value  $H_0$ , standard period value  $T_0$  of the verification point, and the corresponding wave height and wave period of the buoy being verified.

### 7.3 Data processing

#### 7.3.1 Measuring error

7.3.1.1 The measuring error of wave height  $\Delta H$  can be calculated using to Formula (2):

$$\Delta H = H - H_0 \quad (2)$$

In the formula:

$H$  – the significant wave height measured (i.e.  $H_{1/3}$  in Annex A) corresponding to  $H_0$  of the buoy being verified, m.

7.3.1.2 The measuring error of wave period,  $\Delta T$ , can be calculated using the formula (3):

$$\Delta T = T - T_0 \quad (3)$$

In the formula:

$T$  - the significant wave period measured (i.e.  $T_{1/3}$  in Annex A) corresponding to  $T_0$  of the buoy being verified, s.

7.3.2 The amplitude-frequency characteristic chart (provided on client's request)



7.3.2.1 Regarding  $H/H_0$  as the vertical axis and  $f$  as the horizontal axis, connect the various measuring points with a broken line. Draw the amplitude-frequency characteristic chart at given  $H_0$  value. Wherein  $f$  is the reciprocal of  $T_0$ , the period value of the measuring point. Keep two decimal places for  $H/H_0$  and  $f$  according to the digital rounding off principles.

7.3.2.2 The nonuniformity of frequency band is calculated using formula (4):

$$\Delta = \frac{H_{\sigma \max} - H_{\sigma \min}}{H_0} \quad (4) \quad (5)$$

In the formula:

$H_{0\max}$  - The maximum value of the effective wave heights measured corresponding to  $H_0$  of the buoy being verified, m.

$H_{0\min}$  - The minimum value of the effective wave heights measured corresponding to  $H_0$  of the buoy being verified, m.

## 8. Verification result processing and verification period

### 8.1 Verification result processing

After the verification is completed, issue the verification certificate for those qualified ones, and issue the notice of verification result for those unqualified.

### 8.2 Verification period

The verification period of gravitational acceleration wave buoys and gravitational acceleration wave buoy sensors is one year.

## Annex A

### Verification Data Record Table for Wave Height and Wave Period of Wave Buoy

Client: \_\_\_\_\_ Name and Model of Instrument: \_\_\_\_\_ Record Table No.: \_\_\_\_\_

A	Verification point value	$H_0(m)$								Remarks:
		$T_0(s)$								
	Measuring value of buoy	$H_{1/3}(m)$								
		$T_{1/3}(s)$								
		$H_{1/10}(m)$								
		$T_{1/10}(s)$								
		$H_{max}(m)$								
		$T_{max}(s)$								
		$H_{0min}(m)$								
	$T_{0min}(s)$									
difference	$\Delta H(m)$									
	$\Delta T(s)$									
B	Verification point value	$H_0(m)$								Remarks:
		$T_0(s)$								
	Measuring value of buoy	$H_{1/3}(m)$								
		$T_{1/3}(s)$								
		$H_{1/10}(m)$								
		$T_{1/10}(s)$								
		$H_{max}(m)$								
		$T_{max}(s)$								
		$H_{0min}(m)$								
	$T_{0min}(s)$									
Difference	$\Delta H(m)$									
	$\Delta T(s)$									
C	Verification point value	$H_0(m)$								Remarks:
		$T_0(s)$								
	Measuring value of buoy	$H_{1/3}(m)$								
		$T_{1/3}(s)$								
		$H_{1/10}(m)$								
		$T_{1/10}(s)$								
		$H_{max}(m)$								
		$T_{max}(s)$								
		$H_{0min}(m)$								
	$T_{0min}(s)$									
Difference	$\Delta H(m)$									
	$\Delta T(s)$									
<p>Note: 1. The test data grouped according to the wave height, is marked with A, B and C. After the confirmation of the wave height, each wave period shall correspond to the output value of a group of tested buoys.</p> <p style="text-align: center;">2. <math>\Delta H = H_{1.3} - H_0</math>, <math>\Delta T = T_{1.3} - T_0</math></p>										

room temperature: \_\_\_\_\_ °C    relative humidity: \_\_\_\_\_ %

Tested by: \_\_\_\_\_ Checked by: \_\_\_\_\_ Year Month Date

## Annex B

### Amplitude-frequency Characteristic Chart of Wave Buoy

This page is related to \_\_\_ of data record table.

A	Nonuniformity of frequency band: ___%
B	Nonuniformity of frequency band: ___%
C	Nonuniformity of frequency band: ___%
<b>Note:</b> <ol style="list-style-type: none"><li>1. The table is used in conjunction with the "Verification Data Record Table for Wave Height and Wave Period of Wave Buoy" and it is necessary to identify the corresponding "record table" number.</li><li>2. The amplitude-frequency characteristic curve is related to the data of the identical group number (A, B, C) in the "Data Record Table".</li></ol>	

Drawn by:

Checked by:

Year Month Date

## Annex C:

### Front Form of Verification Certificate

Organization Name (English Name of Organization)      Address and Name of Organization (Address and Name of the Organization in English)      Tel:      Post Code:      Fax:

---

## VERIFICATION CERTIFICATE

Certificate No.: GHJ ( ) Verification No.

Client: \_\_\_\_\_

Instrument: \_\_\_\_\_

Manufacturer: \_\_\_\_\_

Type: \_\_\_\_\_

Serial No.: \_\_\_\_\_

Verification conclusion: \_\_\_\_\_

(Stamp)      Approved by \_\_\_\_\_  
Checked by: \_\_\_\_\_  
Verified by: \_\_\_\_\_

Date of verification:      Year      Month      Day

Due Date Date of expiry:      Year      Month      Day

---

(Qualification of legal metrological verification institution)

## Annex D

### Back Form of Verification Certificate

Organization Name \_\_\_\_\_ Verification certificate \_\_\_\_\_ Certificate No. \_\_\_\_\_  
 (English Name of Organization)

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#### Public Standards of measurement used for this verification

Name of the public standards of measurement

Certificate No. of the public standards of measurement

Date of expiry of the certification of the public standards of measurement

#### Verification environment

Ambient temperature:    °C            Relatively humidity:    %    Others

Verification Regulation

#### Verification results

Standard value	<i>H</i> o(m)							
	<i>T</i> o(s)							
Measuring valve	<i>H</i> (m)							
	<i>T</i> (s)							
Difference	$\Delta H$ (m)							
	$\Delta T$ (s)							
Standard value	<i>H</i> o(m)							
	<i>T</i> o(s)							
Measuring valve	<i>H</i> (m)							
	<i>T</i> (s)							
Difference	$\Delta H$ (m)							
	$\Delta T$ (s)							
Standard value	<i>H</i> o(m)							
	<i>T</i> o(s)							
Measuring valve	<i>H</i> (m)							
	<i>T</i> (s)							
Difference	$\Delta H$ (m)							
	$\Delta T$ (s)							

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**ACRONYM LIST**

9DOF	Nine degree of freedom
AIC	Argo Information Center
AP	Air Pressure
AQSIQ	General Administration of Quality Supervision, Inspection, and Quarantine (China)
Argo	Argo International Profiling Float Programme
AS	Andaman Sea
AST	Argo Steering Team
ATLAS	Autonomous Temperature Line Acquisition System
BoB	Bay of Bengal
BUFR	FM 94 BUFR GTS format: Binary Universal Form for Representation of meteorological data
BUOY	FM 18 BUOY GTS format: Report of a buoy observation
CB	Capacity-Building
CBS	Commission for Basic Systems (WMO)
Cg	Congress (WMO)
CIMO	Commission on Instruments and Methods of Observation (WMO)
CONOPS	WIGOS Concept of Operations
CTD	Conductivity, Temperature, and Depth measurement
DAR	Data Discovery, Access and Retrieval service (WMO WIS)
DB	Data Buoy
DBCP	Data Buoy Co-operation Panel (WMO-IOC)
DCPC	Data Collection and Production Centres (WMO WIS)
DMCG	Data Management Coordination Group (JCOMM)
DMPA	Data Management Programme Area (JCOMM)
DO	Dissolved Oxygen
EC	Executive Council
ET/DRC	CBS Expert Team on Data Representation and Codes (WMO)
ETDMP	Expert Team on Data Management Practices (JCOMM)
ETMC	Expert Team on Marine Climatology (JCOMM)
ETWS	Expert Team on Wind Waves and Storm Surge (JCOMM)
FG	First Guess Field
GCC	Global Collecting Centre (of MCSS)
GCOS	Global Climate Observing System (WMO, IOC, UNEP, ICSU)
GDAC	Global Data Assembly / Acquisition Centre
GDP	Global Drifter Programme
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GFCS	Global Framework for Climate Services
GHRSSST	Group for High-Resolution SST
GISC	Global Information System Centres (WMO WIS)
GLOSS	Global Sea-level Observing System (JCOMM)
GOOS	Global Ocean Observing System (IOC, WMO, UNEP, ICSU)
GOS	Global Observing System (WMO)
GPS	Global Positioning System
GRA	GOOS Regional Alliance
GTS	Global Telecommunication System (WWW)
GUM	Guide to the Expression of Uncertainty Measurement
HF	High Frequency
HFSWR	HF Surface Wave Radar
HMEI	Association of Hydro-Meteorological Equipment Industry
ICG-WIGOS	Inter Commission Coordination Group on WGOS
ICOADS	International Comprehensive Ocean-Atmosphere Data Set (USA)
ICSU	International Council for Science
I-GOOS	Intergovernmental IOC-WMO-UNEP Committee for GOOS
InaGOOS	Indonesian Global Ocean Observing System

IndOOS	Indian Ocean Observing System
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IOCCP	International Ocean Carbon Coordination Project
IOCINDIO	IOC Regional Committee for the Central Indian Ocean
IODE	International Oceanographic Data and Information Exchange (IOC)
IOGOOS	Indian Ocean GOOS
ISDM	Integrated Science Data Management (formerly MEDS, Canada)
ISO	International Organization for Standardization
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
JCOMMOPS	JCOMM <i>in situ</i> Observations Programme Support Centre
LGMI/AP	Liaison Group for Marine Instrumentation in the Asia Pacific region
MAN	JCOMM Management Committee
MCSS	Marine Climatological Summaries Scheme
MDCS	Marine Climate Data System
MEMS	Microelectromechanical systems
MOMSEI	Monsoon Onset Monitoring and its Social & Ecosystem Impacts
NC	National Centres (WMO WIS)
NCOSM	National Centre of Ocean Standards and Metrology (China)
NDBC	NOAA National Data Buoy Center (USA)
NEAR-GOOS	North East Asian Regional GOOS
NMDIS	National Marine Data and Information Service (China)
NOAA	National Oceanic and Atmospheric Administration (USA)
NOTC	Ocean Technology Center (China)
NWP	Numerical Weather Prediction
OceanSITES	OCEAN Sustained Interdisciplinary Timeseries Environment observation System
OCG	Observations Coordination Group (JCOMM)
ODAS	Ocean Data Acquisition Systems
ODASMS	ODAS Metadata Service (operated by China on behalf of JCOMM)
ODP	Ocean Data Portal (IODE)
OOPC	Ocean Observations Panel for Climate (GCOS-GOOS-WCRP)
OPA	Observations Programme Area (JCOMM)
PA	Programme Area (JCOMM)
PANGEA	Partnerships for New GEOSS Applications
PI-GOOS	Pacific Islands GOOS GRA
PMO	Port Meteorological Officer
PP-WET	DBCP-ETWS Pilot Project on Wave measurement Evaluation and Test from moored buoys
QA	Quality Assurance
QC	Quality Control
QMF	WMO Quality Management Framework
QMS	Quality Management Systems
RAMA	Indian Ocean Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction
RMIC	IOC-WMO Regional Marine Instrument Centre
RMIC/AP	RMIC for the Asia Pacific region
RNODC	Responsible Oceanographic Data Centre (IODE)
RNODC/DB	RNODC for Drifting Buoys
RRR	WMO Rolling Review of Requirements
RTMC	VOSclim Real-Time Monitoring Centre
SAC	Standardization Administration (China)
SAMS	Scottish Association for Marine Science
SCG	Services Coordination Group (JCOMM)
SeaDataNET	Pan-European infrastructure for Ocean & Marine Data Management
SEA-GOOS	South East Asian Regional GOOS



SFSPA	JCOMM Services and Forecasting Systems Programme Area
SLP	Sea Level Pressure
SOA	State Oceanic Administration (China)
SOC	Specialized Oceanographic Centre (JCOMM)
SOOP	Ship-Of-Opportunity Programme
SOOPIP	SOOP Implementation Panel (JCOMM)
SOT	Ship Observations Team (JCOMM)
SPA	JCOMM Services Programme Area (now SFSPA)
SST	Sea-Surface Temperature
TAO	Tropical Atmosphere Ocean Array
TC	Technical Committee
TD	Technical Document
TIP	Tropical Moored Buoys Implementation Panel
TT	Task Team
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	UN Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USA	United States of America
VOS	Voluntary Observing Ship scheme (JCOMM)
VOSclim	VOS Climate class ship of the VOS fleet
WCRP	World Climate Research Programme
WCC-3	World Climate Conference 3
WDIP	WIGOS Test of Concept Development and Implementation Plan
WDIS	WIGOS Development and Implementation Strategy
WESTPAC	IOC Sub-Commission for the Western Pacific
WIGOS	WMO Integrated Global Observing System
WIS	WMO Information System
WMO	World Meteorological Organization (UN)
WTO	World Trade Organization
WWW	World Weather Watch (WMO)
XBT	Expendable BathyThermograph

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