



**Intergovernmental Oceanographic Commission**  
*Reports of Meetings of Experts and Equivalent Bodies*

## **Fourth WESTPAC Technical Workshop on SEAGOOS Ocean Forecasting System (WESTPAC/SEAGOOS-OFS-IV)**

Jakarta, Indonesia  
5-6 March 2013

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IOC/WESTPAC/SEAGOOS/OFS-IV

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English only

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For bibliographic purposes this document should be cited as follows:

Fourth WESTPAC Technical Workshop on SEAGOOS Ocean Forecasting System (WESTPAC/SEAGOOS-OFS-IV), 5-6 March 2013. Paris, UNESCO, ??pp. 2013. (IOC GOOS Report No.204) (English)

Printed in 2013  
by the United Nations Educational, Scientific  
and Cultural Organization  
7, place de Fontenoy, 75352 Paris 07 SP

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Printed in France



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## EXECUTIVE SUMMARY

The fourth WESTPAC Technical Workshop on SEAGOOS Ocean Forecasting System (OFS) took place in Jakarta, Indonesia, 5-6 March 2013. The meeting reviewed with great appreciation the achievements of SEAGOOS OFS in its first phase- demonstration phase (June 2010 - May 2012), and present workplans and activities of participating countries for the OFS Project in its second phase even beyond, with a view to finalizing one project document and road map for its second phase.

The meeting highlighted the considerable progress in the first phase as: i. the establishment of regional expert network on ocean numerical modeling; ii. improved regional capacity on ocean numerical modeling; iii. development of an ocean forecasting demonstration system for the Peninsular Malaysia eastern shelf and Gulf of Thailand; and iv. operation of the web-portal based 12.5km resolution WESTPAC/SEAGOOS Ocean Forecasting Demonstration System (OFDS) for Southeast Asian Seas ([http://221.0.186.5/IOC-WESTPAC\\_OFDS/index.jsp](http://221.0.186.5/IOC-WESTPAC_OFDS/index.jsp)) with 3 days forecast products and downloadable archived data provided on surface wave height (Hs), wind, current, sea temperature and salinity.

The meeting decided to concert efforts from all participating members and members interested to join in the following key areas of work:

- extension of OFS geographic coverage to cover the region of (20°S-20°N, 80°E-145°E), including the Indonesian Seas, eastern part of Malaysia, Andaman Sea, Bay of Bengal, and South China Sea, and eastern Indian Ocean with horizontal resolutions no less than  $(1/6)^{\circ} \times (1/6)^{\circ}$ ;
- development of higher-resolution models ( with horizontal resolutions of 2-4 km), in a couple of selected sub-domains, subject to the request of participating countries;
- data collection for model validation from joint cruise in late 2012, 2013 and 2014, as well as 13 HF radar stations along the Gulf of Thailand, Argo buoys and other sources;
- improvement of current OFDS Web Portal on accessibility and model forcing and boundary conditions downloadable, and online analysis tools;
- scientific issues to be investigated, including water exchange between the Gulf of Thailand and the South China Sea; Compensation bottom current in the Gulf of Thailand in SW monsoon; Role of diluted water from the inner Gulf of Thailand and the Mekong River; Trend of surface wave heights and its effects on coastal erosion; Water exchange through straits; Relationship between upwelling and fishery; Connection between model forecasted results and ecosystem e.g. coral reef; East Malaysia bottom water and mixing; Eddy generation and mechanism; and Particle tracking e.g. oil spill;
- Funding and capacity building with funding for cruises to be sought from respective national agencies through available bilateral and national channels, and training opportunities to be provided through the regular trainings at the UNESCO/IOC Regional Training and Research Center on Ocean Dynamics and Climate and two technical workshops to be organized by WESTPAC.

The meeting agreed on Prof Fredolin's suggestion by acclamation to designate Prof. Fangli Qiao (First Institute of Oceanography, China) as Co-Project Leader, welcomed indonesia as member of SEAGOOS OFS project, and considered identifying one capable project assistant to coordinate the implementation, provide technical assistance, and develop and/or prepare relevant meeting and project documents for the SEAGOOS OFS development on a daily

basis. The meeting also considered developing a joint proposal for China-ASEAN Cooperation Fund to support the further development of SEAGOOS OFS, built on its past current achievements and high demands of participating numbers.





## 1. OPENING

1. The fourth WESTPAC Technical Workshop on Ocean Forecasting System (OFS) was held on 5-6 March 2013 in Jakarta, Indonesia. This workshop was organized by the IOC Regional Office for the Western Pacific (WESTPAC Office), and hosted by the Research and Development Center for Marine and Coastal Resources (RDCMCR), Research and Development Agency for Marine and Fisheries Research, Ministry of Marine Affairs and Fisheries of the Republic of Indonesia. This workshop was designed to provide an opportunity for all participating members to present their plans and activities for the OFS Project with a view to finalizing the project document of OFS over its second phase.
2. Dr Budi Sulistiyo, Head of RDCMCR, opened the meeting by welcoming all participants to Jakarta on behalf of the local host. He congratulated on the notable achievement over the first phase in the development of an ocean forecasting demonstration system and looked forward to a greater success in the second phase.
3. Dr Somkiat Khokiattiwong, Chairperson of the IOC Sub-Commission for the Western Pacific (WESTPAC) thanked the RDCMCR for hosting this workshop, appreciating the leadership of Prof Fredolin Tangang, Prof Fangli Qiao and full support of Mr Wenxi Zhu in the development of the Ocean Forecasting System. He welcomed Indonesia as a new member of the OFS and expected this pilot project could attain its objectives in the second phase.
4. Mr Wenxi Zhu, Head of IOC Regional Office for the Western Pacific (WESTPAC Office) highlighted the timeliness for the development of the Ocean Forecasting System in view of the fact that marine scientific research and observations has been given unprecedented attention by international communities over past 20 years. He underscored the importance of such an ocean forecasting system providing essential information to serve the needs of a variety of human activities, and expected the meeting could set out a clear strategic vision of this system, with feasible shorter and long time objectives, and develop action plan to guide joint efforts.
5. The Agenda, Concept Paper and List of Participants for this workshop are attached to this report as Annex I, II and III, respectively.



## **2. PROJECT INTRODUCTION: PROGRESS & LESSONS LEARNT**

6. Prof Fredolin Tangang, Project Leader of the OFS reviewed the achievement and lessons learnt of OFS in its demonstration phase or first phase (June 2010 and May 2012). He informed the meeting that there were 3 countries initially involved in its first phase, including Malaysia, Thailand and China. Indonesia, the newest member, has joined the project during the third OFS workshop in Qingdao on 23 July 2012. Prof Fredolin highlighted the need for the establishment of the project in the Southeast Asian seas in consideration of the lack of understanding on oceanographic process, lack of research in regional ocean numerical modeling, no operational ocean forecasting system, and lack of regional collaboration on ocean modeling.
7. During the first phase, a number of activities have been carried out, particularly on the establishment of the operational OFS website that is currently operated by the First Institute of Oceanography (FIO), China. This website was successfully launched by Dr Wendy Watson-Wright, Executive Secretary of IOC during the 9th Intergovernmental Session of the IOC Sub-Commission for the Western Pacific (WESTPAC-IX, 9-12 May 2012, Busan, Korea). Several joint cruises have been conducted with oceanographic data collected for understanding key oceanographic processes in the region and model validation. As part of capacity building, participants from member countries also participated in two IOC Training Courses on Ocean Models. A total of four workshops including this workshop have been organized. Overall Prof. Fredolin concluded up to this point this project has been very successful despite challenges.
8. Despite the progress, he further pointed to several key issues to be considered for the second phase of the project. These include: expansion of main domain to include Andaman Sea, Sulu Sea, Indonesian Seas etc; development of higher-resolution models for sub-domains, including Gulf of Thailand (GoT) & Peninsular Malaysia's eastern shelf, and the South of Java Island and/or west of Sumatra which will be operational by the end of second phase and integrated into the OFDS Web Portal; more cruises / data collection for model validation; technical hands-on modeling workshop, scientific workshops; availability of archived OFDS forecasting data, boundary conditions and surface forcings in the OFS Web Portal; and outreach activities.

## **3. TECHNICAL PRESENTATION OF OFS: PROGRESS BY EXISTING AND NEW MEMBERS**

9. Dr Mohd Fadzil bin Mohd Akhir from Universiti Malaysia Trengganu reported on several joint cruises that involved Universiti Kebangsaan Malaysia, Universiti Malaysia Terengganu and the First Institute of Oceanography, SOA, China. These cruises mainly covered the upper portion of the Peninsular Malaysia's eastern shelf. Dr Fadzil further provided some preliminary analysis result of the collected data and these would be important for understanding key processes in the region as well as model validation. He informed the meeting of his plan for the next cruise to mainly cover the southern part of the Peninsular Malaysia's eastern shelf, and a plan for long term deployment of an AWAC in a location in the southern part of the Peninsular Malaysia's eastern shelf.
10. Prof Fredolin Tangang presented an overview of modeling activities as part of the development of Malaysia component of OFS system. These activities include the application of the MASNUM wave-tide-circulation coupled model to simulate seasonal circulation in the southern region of the South China Sea. Prof Fredolin also highlighted other modeling work, including forecasting ocean response to the typhoon Vamei using POM in both rectilinear and curvilinear grid systems with wind forcing from interpolating NCEP and those downscaled using WRF; seasonal circulation using ROMS; wave climate modeling work for the southern region of the South China Sea using WaveWatch III. He stressed that all these

modeling activities are part and parcel of the Malaysian's team effort in developing high-resolution OFS for the Peninsular Malaysia's eastern shelf in the OFS second phase. Prof Fredolin also underscored the need for Malaysia to form a national committee that comprises various agencies, including Malaysian Meteorological Department, to facilitate OFS implementation at the national level. To this end, he finally reiterated his willingness to convene a meeting of his university (Universiti Kebangsaan Malaysia) and Universiti Malaysia Terengganu, discussing about the establishment of the Committee.

11. Dr Anukul Buranapratheprat, from Burapha University, Thailand gave an overview of the variability of circulations and oceanographic conditions in the Gulf of Thailand. He stressed that GoT circulations were mainly influence by seasonal winds. Due to data limitation, he tried to validate the results of the numerical simulation with some prominent phenomena including sediment transport along the gulf coastline and the distributions of sediment characteristics, such as total organic content. Satellite images and POM results revealed that flows and transport along the western coastline directed northward from Thai-Malay border into GoT. He also pointed out the possibility of upwelling along the western and the eastern GoT during the southwest and the northeast monsoon, respectively. The influence of river discharges (Chaopraya, Maeklong, Bangpakong and Thachin) during the flood year of 2011 on circulation patterns in the upper GoT was also addressed. He introduced the important of missing freshwater in the central GoT as a diluter making GoT salinity to be 1 psu lower than in the South China Sea (SCS). Finally the interaction between GoT and SCS water was also discussed.
12. Dr Somkiat Khokiattiwong, from the Phuket Marine Biological Center of Thailand, introduced the workplan of Thailand for the year 2013-2014 in the development of SEAGOOS Ocean Forecasting System. He stressed the importance of an Ocean Forecasting System for the Gulf of Thailand & Andaman Sea in view of ocean forecasting system providing essential information and knowledge to understand ocean processes, like coastal erosion, sea level rise, water circulation to serve the needs of a variety of human activities in these regions, such as fisheries, oil and gas exploitation, pollution and disaster risk reduction. He briefed on one interdisciplinary project on the development of hypoxia, plankton bloom warning system in the upper Gulf of Thailand, in which, among others, Ocean Forecasting System will serve as one of key components to generate forecasting information on ocean circulation, water quality etc. To this end, he proposed to develop the capacity of Thai scientists for operating MASNUM model with higher resolution, gather necessary data and information to validate the model, operate MASNUM-based ocean forecasting system in GISTDA, and keep collecting data to improve the system in the second phase.
13. Dr Tukul Rameyo Adi, from Research and Development Center for Marine and Coastal Resources (RDCMCR), Indonesia, introduced the development plan of Indonesian Ocean Forecasting System (IOFS), which was designed with emphasis to address various scientific and societal needs. He underscored the need for SEAGOOS Ocean Forecasting System to generate products for developing country –specific research and application programs, particularly its national Ocean-Climate Information& Prediction Services (CLIPS). He finally informed the meeting that Indonesia has been attaching great importance to this development, and thus established five national working groups respectively on: observation, modeling, information products, dissemination and capacity building with Indonesia Agency for Meteorology (BMKG) taking a lead as national coordinator.
14. Dr Rita Tisiana Dwi Kuswardani (Anna) from RDCMCR, Indonesia reported progress on Ocean Forecasting System activities in Indonesia. Several numerical models have been used to develop forecasting system (COHERENS, MIKE21, WAVEWATCH-III). BMKG using WAVEWINDS-05 to provide Wave Prediction for operational forecasting system with 0.5

degree horizontal resolution. In terms of the national task force on Indonesia Ocean Climate Information System, the modeling working group will focus on developing wave modeling.

15. Prof Fangli Qiao from the First Institute of Oceanography (FIO), China highlighted considerable progress made in the development of SEAGOOS OFS over the first phase (June 2010 to May 2012), with focus on capacity building, the operation of the SEAGOOS Ocean Forecasting Demonstration System ([http://221.0.186.5/IOC-WESTPAC\\_OFDS/results.jsp](http://221.0.186.5/IOC-WESTPAC_OFDS/results.jsp)), and joint cruises conducted for the improvement of scientific understanding and model validation. After Reviewing the major outcomes of the third workshop (WESTPAC/SEAGOOS-OFS-III, 23 July 2012), he reported on the progress made ever since, particularly on data collection, numerical models development, research on the path of diluted water in the upper Gulf of Thailand, participation of new member into this project, organization of IOC Training on Ocean Models scheduled for August 2013, establishment of operational OFS system in Malaysia in Nov 2012, preparations of outreach materials. In terms of financial constraints, he further suggested the possibility of exploring funding from China-ASEAN framework in support of the development of SEAGOOS OFS in its second phase, even beyond.
16. Dr Changshui Xia from FIO, China reported on the establishment of the wave-circulation coupled model for the Southeast Asia region by introducing MASNUM wave-circulation couple model whose circulation part is based on POM and wave part is MASNUM model with the wave-induced mixing coefficient  $B_v$  added to the vertical mixing coefficients from the M-Y scheme in POM. After presenting model outputs and validation, he concluded that the simulated temperature and circulation patterns agree well with the observations. The model can provide open boundary conditions for higher resolution sub-models (with horizontal resolutions of 2-4 km), and be shared among OFS members. He also provided preliminary results on water exchange between the Gulf of Thailand (GOT) and the South China Sea, and the path of the diluted water from the inner GOT.
17. Dr Guansuo Wang from FIO, China briefed the meeting on the establishment and verification of wave model for the second phase of OFS. He presented the verification results compared with the Wave Observation Radar (WOR) fixed on the oil platform PY30-1 (114.941E, 20.245N) and Jason-1 altimeter satellite data. He further expressed his willingness to provide operational supports at the second phase on model boundary conditions for higher-resolution sub-domain wave models, including the Gulf of Thailand, Eastern Peninsular Malaysia and the South of Java Island and/or west of Sumatra, coupled with circulation model. Those higher-resolution sub-domain wave models will be validated with the data collected from joint cruises in 2012 and 2013, 13 HF radar stations along the Gulf of Thailand, Argo buoys and other data sources with objectives to operate on operational basis.
18. Dr Zhou Li from FIO, China reported on the web portal development of the SEAGOOS Ocean Forecasting System ([http://221.0.186.5/IOC-WESTPAC\\_OFDS/results.jsp](http://221.0.186.5/IOC-WESTPAC_OFDS/results.jsp)). Major improvements were made on the inclusion of fundamental geographic information module, archival of products and data, cross browser compatibility, modification of storage structure and webpage outlook. He further informed the meeting of the future plan, including the display of domain and sub-domains, data sources display, and improvement of on-line generated products.

#### **4. PROJECT DOCUMENT AND ROADMAP FOR OFS OVER THE SECOND PHASE**

19. Extensive discussions were conducted to revise the Project Document for the development of SEAGOOS Ocean Forecasting System over its second phase, which would be of great help for participating members to define clear objectives, guide the planning of joint activities and the implementation of OFS in the 2nd phase.

20. Numerous suggestions were put forwarded on the project document with major substantive revisions summarized as follows:

Part I: Background:

21. To insert an invitation to those who are interested to join the project.

Part II: Motivation:

22. to be re-arranged with more descriptions on country-specific requirement, success in the first phase, importance of the geographic coverage in the second phase, difference of this OFS from others.

Part III: Geographic coverage:

23. i. need to be extended to 20°S-20°N, 80°E-150°E , to covered Indonesia seas; ii. To be divided into two levels. The first level will be the regional coverage, whereas the second level will be the sub-domain area with higher resolution.

Part IV: Scientific Focus:

24. To change the “scientific focus” into “key scientific issues” and add on the scientific issues that we identified, which should be important, visible and achievable. Indonesia, Malaysia and Thailand need to give the specific issues within each country to be addressed through this project.
25. To put scientific issues on Java Upwelling variation in Eastern Indian Ocean and BMKG’s concerns on storm surge.

Part V: Project Activities:

26. General descriptions on regional and national efforts; change the name of 6.1 to “Development of Ocean Forecasting System”, and arrange activities into two tiers, regional level and national level.
27. The meeting requested that Dr Rita Tisiana Dwi Kuswardani (Indonesia) come up with a revised layout with clear assignments (who do what), taking into account all comments received from discussion.

## **5. FUNDING**

28. Prof Fredolin introduced his previous idea of seeking possible funding from the framework of the South China Sea Workshop through the establishment of one working group on OFS under that framework. However, he informed the meeting it seems unlikely to achieve it due to the poor response from, and funding situation of SCS workshop.
29. Prof Qiao highlighted there maybe existing possibilities of seeking funding from the China-ASEAN Cooperation Fund which China pledged for collaborative activities with member states in the Southeast Asian region. He further suggested that all participating members jointly develop one project proposal for submission once needed.
30. Dr Somkiat stressed the need to seek funding form national authorities, which has been demonstrated through various WESTPAC programmes as a feasible way to sustain

SEAGOOS OFS development. Dr Tukul Rameyo Adi informed the meeting the ICCOC could also support regional projects.

31. The Meeting noted with appreciation the efforts of Prof Fredolin in seeking funding for the development of this project, and recommended all participating members to link this project to their national relevant projects, leveraging more support from their national agencies. The meeting also considered developing a joint proposal for China-ASEAN Cooperation Fund to support the future development of SEAGOOS Ocean Forecasting System, built on its current achievements and high demands of participating numbers.

## **6. STRATEGY FOR SEAGOOS OCEAN FORECASTING SYSTEM**

32. Mr Wenxi Zhu suggested it is high time to develop one long-term strategy for the SEAGOOS Ocean Forecasting System over next ten year or beyond, in consideration of past achievement and ever-increasing demands from many countries in the region. The strategy will set out a clear strategic vision, missions, goals and objectives for all participating members to move OFS forward in a long run.
33. Strong interests were prompted in terms of the long term development of OFS. Upon the request, Mr. Zhu prepared one outline of the Strategy for SEAGOOS Ocean Forecasting System titled "Ocean forecasting for a healthy, prosperous South East Asian Seas". The meeting reviewed and agreed on the outline, and decided to start the development at an appropriate time. The outline is attached to the report as Annex IV.

## **7. OTHER MATTERS**

34. Prof Fredolin Tangang suggested Indonesia nominating one expert to be member of the OFS Steering Committee which will not only lead the development, implementation of OFS at regional level, but also function as national coordinator for the implementation of OFS within their countries. Indonesia expressed its strong willingness to take part in this SEAGOOS OFS, and informed the meeting they would nominate their member for this steering committee via correspondence.
35. In view of the increasing workload incurred in the rapid development of OFS, the meeting agreed on Prof Fredolin's suggestion by acclamation to designate Prof. Fangli Qiao as Co-Project Leader. Prof Fangli Qiao accepted the assignment and assured the meeting that he will continuously do his utmost to push forward this SEAGOOS OFS development in close cooperation with all members.
36. The meeting further suggested exploring possibility of recruiting or identifying one Project Assistant capable to coordinate the implementation, provide technical assistance, and develop and/or prepare relevant meeting and project documents for the SEAGOOS OFS development on a daily basis. Prof Qiao expressed he would positively consider the possibility in close consultation with Mr Wenxi Zhu, Head of WESTPAC Office.
37. Mr Wenxi Zhu informed the meeting that the 9th WESTPAC International Scientific Symposium Vietnam 2014 will take place in Nha Trang, Vietnam, 22-25 April 2013, in which one session on ocean forecasting system could provide another opportunity for this group to meet again to review the development progress and address emerging challenges.

## **8. CLOSURE**

38. The meeting expressed great appreciation to Dr Budi, Adi, Anna and all local staffs for thoughtful arrangement made for all participants. All participants highlighted the high spirit of

cooperation reflected since the inception of this pilot project, and look forward to a great success at the second phase.

39. The 4th WESTPAC Technical Workshop on SEAGOOS Ocean Forecasting System was closed at 19:00pm, 6 March 2013.





ANNEX I

**AGENDA AND TIMETABLE**

March 5 (Day 1)

**0845-0910: Opening Ceremony**

Welcome address by Dr. Budi Sulistiyo (Local Host)

Welcome address by Dr. Somkiat (Chair of IOC/WESTPAC & SEAGOOS Coordinator)

Welcome address by Mr Wenxi Zhu (Head of IOC/WESTPAC Office, Bangkok)

**0910-0930: Achievement, Lessons learnt of OFDS in its first Phase (Prof. Fredolin Tangang)**

**0930-1200: Technical Presentation of OFS Second Phase Progress by Existing and New Members (Moderator: Prof. Fredolin Tangang)**

[Note: First Presentation: Scientific results, Second: Country detailed plans for Second Phase]

0930-1000: Cruises, Data Analysis and Plan for Future Cruises (Dr. Mohd Fadzil bin Mohd Akhir)

1000-1030: Development of Malaysian component of OFS system (Prof. Fredolin Tangang)

**1030-1045: Tea Break**

1045-1115: Influence of wind on seasonal variability of Circulation in the Gulf of Thailand investigated using POM (Dr. Anukul Buranapratheprat)

1115-1145: Need of Thailand for the Ocean Forecast System and Action Plan towards the second phase of OFS Project (Dr. Somkiat Khokiattiwong)

1145 -1215: Development Plan of Indonesian Ocean Forecasting System (Dr. Tukul Rameyo Adi)

**1215-1330: Lunch Time**

**1330-1500: Technical Presentation (Cont') & Presentation by new and existing members of their OFS plan (Moderator: Prof. Fredolin Tangang)**

1330-1400: Progress on Ocean Forecasting System activities in Indonesia ( Dr. Rita Tisiana Dwi Kuswardani)

1400-1430: Progress on the Construction of Ocean Forecasting System (Prof. Fangli Qiao)

1430-1450: Establishment of the wave-circulation coupled model for the region of (20°S-20°N, 80°E-120°E) (Dr. Changshui Xia)

1450-1510: Establishment of the wave model for the 2nd phase of OFS (Dr Guansuo Wang)

**1510-1530: Tea Break**

1530-1730: Open Discussion on Scientific Results and Overall Implementation of the OFS Second Phase (Moderator: Prof. Fangli)

[Note: Discussion should focus on the coordination of activities as part of OFS activities; This would provide inputs to Project Document and Roadmap]

**1800-2000: Dinner Time**

March 6 (Day 2)

**0900-1215: Project Document and Roadmap (Moderator: Dr. Somkiat and Mr Tukul Rameyo Adi)**

0900-0930: Project Document and Roadmap Presentation (Prof. Fredolin)

0930-1030: Open Discussion on Project Document and Roadmap

**1030-1045: Tea Break**

1045-1145: Open Discussion on Project Document and Roadmap

1145-1215: Discussion on Project Implementation

**1215-1330: Lunch time**

**1330-1700: Discussion on Possible funding opportunities (Moderator Mr. Wenxi)**

1330-1400: Possible funding opportunities

1350-1410: A Proposal of Establishment of OFS Working Group by Prof. Fredolin

1410-1500: Discussion on these funding opportunities.

**1500- 1530: Tea Break**

1530- 1700: Other matters

## ANNEX II

### CONCEPT PAPER

#### 1. Background

The SEAGOOS pilot project on Ocean Forecasting Demonstration System (OFDS), established by WESTPAC in May 2010, has achieved the objectives of its first implementation phase (June 2010 - May 2012). Main achievements could be highlighted on: i. the establishment of regional expert network on ocean numerical modeling; ii. improved regional capacity on ocean numerical modeling; iii. development of an ocean forecasting demonstration system for the Peninsular Malaysia eastern shelf and Gulf of Thailand; and iv. operation of the web-portal based 12.5km resolution WESTPAC/SEAGOOS Ocean Forecasting Demonstration System (OFDS) for Southeast Asian Seas ([http://221.0.186.5/IOC-WESTPAC\\_OFDS/index.jsp](http://221.0.186.5/IOC-WESTPAC_OFDS/index.jsp)) with 3 days forecast products and downloadable archived data provided on surface wave height (Hs), wind, current, sea temperature and salinity.

In view of the needs for such a forecast system which could generate crucial forecast information, such as ocean circulation, sea surface temperature, wave height, to serve the needs of a variety of human activities related to marine hazards mitigation, oil and gas exploration, fisheries, navigation, marine parks management and coastal recreational activities, WESTPAC decided in May 2012 to continue developing this system for another two years (Second Phase, June 2012 – May 2014).

The third WESTPAC Technical Workshop on SEAGOOS Ocean Forecasting System was organized on 23 July 2012, Qingdao with focus on various issues related to the implementation of the project at second phase. The workshop decided to develop one project document for its second phase, taking into full account the following agreements reached on:

- renaming of Ocean Forecasting Demonstration System (OFDS) as Ocean Forecasting System (OFS);
- involvement of new members into this project with confirmation received from Indonesia, and interests expressed from Cambodia and Vietnam to participate in the 2nd phase of this project;
- extension of OFS geographic coverage to cover the region of (20°S-20°N, 80°E-120°E), including the Indonesian Seas, eastern part of Malaysia, Andaman Sea, Bay of Bengal, and South China Sea, etc with horizontal resolutions no less than  $(1/6)^\circ \times (1/6)^\circ$ ;
- development of high-resolution models ( with horizontal resolutions of 2-4 km), in a couple of selected sub-domains, including the Gulf of Thailand, Eastern Peninsular Malaysia and the South of Java Island and/or west of Sumatra, subject to the request of participating countries;
- data collection for model validation from joint cruise in late 2012, 2013 and 2014, as well as 13 HF radar station along the Gulf of Thailand, Argo buoys and other sources;
- improvement of current OFDS Web Portal on accessibility and model forcing and boundary conditions downloadable, and online analysis tools;

- scientific issues to be investigated, including water exchange between the Gulf of Thailand and the South China Sea; Compensation bottom current in the Gulf of Thailand in SW monsoon; Role of diluted water from the inner Gulf of Thailand and the Mekong River; Trend of surface wave heights and its effects on coastal erosion; Water exchange through straits; Relationship between upwelling and fishery; Connection between model forecasted results and ecosystem e.g. coral reef; East Malaysia bottom water and mixing; Eddy generation and mechanism; and Particle tracking e.g. oil spill;
- Funding and capacity building with funding for cruises to be sought from respective national agencies through available bilateral and national channels, and training opportunities to be provided through the regular trainings at the UNESCO/IOC Regional Training and Research Center on Ocean Dynamics and Climate and two technical workshops to be organized by WESTPAC.

## **2. Workshop objectives**

Subsequent after the third workshop on 23 July 2012, a draft version of the revised Project Document and Roadmap was preliminarily prepared and facilitated via email exchanges. Therefore, this technical workshop was designed, providing an opportunity for Indonesia and other members to present their plans and activities for the OFS Project with a view to finalizing the project document.

Meanwhile, this technical workshop will explore funding opportunities for carrying out joint cruises, technical workshops etc. This workshop on SEAGOOS Ocean Forecasting System will be hosted by the Research & Development Center for Marine and Coastal Resources, Research and Development Agency for Marine and Fisheries, Ministry of Marine Affairs and Fisheries of Indonesia.

Detailed objectives of this workshop are to:

- review the recent progress and scientific findings of members regarding the OFS project;
- detail the action plan of each country towards the development and implementation of this OFS project for its second phase;
- revise, update and finalize the Project Document and Roadmap of OFS Project;
- explore funding opportunities for the implementation of this project.

## **3. Expected Output**

- Improved and updated Project Document
- Project Roadmap for the implementation of this OFS project at its Second Phase
- Others

## **4. Venue and Local Transportation**

The workshop will be organized in the Pulau Seribu meeting room, 1st Floor, Mercure Hotel Convention Center, Ancol - Jakarta with accommodation arranged in the Mercure Hotel.

ANNEX III

**LIST OF PARTICIPANTS**

<b>China</b>	Jakarta 14430 Indonesia
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ANNEX IV

**OUTLINE OF THE STRATEGY  
FOR SEAGOOS OCEAN FORECASTING SYSTEM (2013-2022)**



**Ocean forecasting for a healthy, prosperous South East Asian Seas**

- i. Why Ocean Forecasting
  - Definition of Ocean Forecasting
  - The need for a ocean forecasting system in the wider SEA region (Scientifically, economically and socially)
- ii. Where we are now?- SEAGOOS OFS in its first phase
  - Establishment (including those related to WESTPAC and its SEAGOOS etc)
  - Primary objectives of SEAGOOS in its first phase
  - Implementation strategy
    - *Selection of pilot areas*
    - *Model development and validation*
    - *Joint cruises*
    - *Capacity building*
  - Success and lessons learnt
  - Future Direction of SEAGOOS OFS
    - *Greater attention needs to be placed on how SEAGOOS OFS should strategically improve its product and be developed to deliver benefit to its users? This might involve a greater range of product types, higher resolution system in sub domains. For this to be possible, it will also require more involvement of operational agencies concerned.*
- iii. Strategy for the development of SEAGOOS Ocean Forecasting over next decade
  - Vision for the SEAGOOS Ocean Forecasting System
    - *Through the coordination of model development, validation and capacity development, SEAGOOS OFS shall become recognized as a key source of ocean forecast information (wave height, sea level, wind, temperature and current) to enhance understanding on key scientific processes, and support sustainable social, economic development. The system will be hosted by one regional ocean forecasting center, operational in nature, providing data, products and services on an ongoing basis, stimulating international cooperation and the building of the scientific and technical skills of personnel and the capacity of national agencies, institutes to develop and operate the system effectively.*

- Mission for the SEAGOOS Ocean Forecasting System
  - *To develop an operational ocean forecasting system for the wider Southeast Asian region and its adjacent seas, and demonstrate the value of this system through its application to scientific research and ocean management, resources exploitation, Reduction and Prevention of the impacts of natural hazards, mitigation of the impact and adaptation to climate change and variability;*
- Goals
  - *Full operation of the SEAGOOS ocean forecasting system and establishment of a regional ocean forecasting center for the wider Southeast Asian region and its adjacent seas building on the demonstration system developed in the first phase through the extension of the geographic coverage, development of higher resolution forecasting system in sub-domains, improvement of regional observation network, inclusion of additional parameters, generation of a suite of crucial forecast products with adequate model validation.*
- Objectives
  - *Establishing model for the extended geographic coverage*
  - *Developing high resolution forecasting systems for selected sub-domain, including Model validation through data collection from buoys, joint cruise and other available sources, and data assimilation*
  - *Visualizing the web portal based ocean forecasting system*
  - *Capacity building and training*
  - *outreach and promotion*
  - *Enhancing understanding and application.*
- iv. Implementation strategy
  - *Promote of transfer of technology and strengthen the exchange of expertise*
  - *Consolidate country-specific requirement (scientific issue, service) within the regional collaborative framework;*
  - *Strengthen capacity building*
  - *Pilot project with focus on application*
- financial resources
  - *National governmental agencies*
  - *International donors*
  - *Industries*
- v. Challenges in the implementation of the Strategy
  - Observation capacity
  - Scientific constraints, such as internal wave.