JCOMM/CHy COASTAL INUNDATION FORECASTING DEMONSTRATION PROJECT (CIFDP)
FIRST MEETING

Geneva, Switzerland, 29 June - 1 July 2009

FINAL REPORT

JCOMM Meeting Report No. 69

WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

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NOTES

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C O N T E N T S

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING OF THE SESSION

1.1 Opening

1.1.1 The first meeting for the development of the Coastal Inundation Forecasting Demonstration Project (CIFDP) concept and implementation plan was opened by the co-president of JCOMM, Dr Peter Dexter, at 0900 hrs on Monday, 29 June 2009, in the WMO Headquarters, in Geneva, Switzerland. Dr Dexter welcomed participants to the session, and introduced Dr Geoffrey Love, the Director of the Weather and Disaster Risk Reduction Services Department, to address the session.

1.1.2 On behalf of the Secretary-General of the WMO, Dr Geoffrey Love welcomed participants to the session, to Geneva in general and to the WMO in particular. Dr Love recalled that oceanic combined with hydrological phenomena have major impacts on the marine coastal environment and socio-economic activities in coastal regions, where a large percentage of population inhabits and often depends on coastal resources and the marine environment for their livelihood, which is especially vulnerable to extreme events on coastal areas.

1.1.3 Dr Geoffrey Love also recalled the environmental emergency that has inflicted damage to homes, livelihoods and infrastructure in many parts of the Papua New Guinea as a result of large wind-induced waves (swell), which caused widespread flooding in the exposed islands in December 2008; and the tropical cyclone Nargis that caused such devastation and loss of lives in the most populous and low-lying areas of Myanmar in May 2008. Dr Love noted that there were more challenges in the improvement of forecasting and warning systems that allow dedicated disaster prevention agencies to safeguard lives and mitigate damages on infrastructure in coastal areas. In this context, Dr Love informed the meeting that the WMO Executive Council, at its 60th session (June 2008), identified two high priority areas, namely:

(a) The need for the provision of storm surge guidance information to Members exposed to these risks as a matter of priority, and therefore agreed that storm surge watch schemes attached to the tropical cyclone advisory arrangements would help to increase advisory lead-time and thus contribute to saving lives and properties;

(b) The implementation of the recommendations from the First JCOMM Scientific and Technical Symposium on Storm Surges (Seoul, Republic of Korea, October 2007), including coastal inundation and linkages to storm surge forecast and warning operations in all relevant regions.

1.1.4 Dr Geoffrey Love pointed out that coastal inundation forecasting and warning systems depend on the crosscutting cooperation of different scientific disciplines and user communities. An integrated approach to storm surge, wave and flood forecasting would be the strategy for building improved operational forecasts and warnings capability for coastal inundation. A Coastal Inundation Forecasting Demonstration Project (CIFDP) would show how coastal inundation forecasting products can be improved and effectively coordinated with warning services provided by the National Meteorological and Hydrological Services (NMHSs), therefore contributing to the implementation of the storm surge watch schemes. Dr Love was pleased to note that this meeting was likely to transform the WMO Executive Council decisions into concrete activities under the framework of a Coastal Inundation Forecasting Demonstration Project (CIFDP).

1.1.5 Dr Love concluded by expressing his sincere appreciation to the meeting for assisting WMO and the UNESCO/IOC to provide coordinated guidance to their Members/Member States in order to face the challenges of improving weather forecasting, adaptation to climate change, disaster risk reduction, and the many weather and many “societal benefit areas”. Lastly, Dr Love

assured participants of the full support of his staff and concluded by wishing everyone a successful meeting and an enjoyable stay in Geneva.

1.1.6 The list of participants in the session is provided in Annex I to this report.

1.2 Adoption of the agenda

1.2.1 The meeting adopted its agenda for the session based on the provisional agenda that had been prepared by the Secretariat. This agenda is provided in Annex II to this report.

1.3 Working arrangements

1.3.1 The meeting agreed its hours of work and other practical arrangements for the session. Participants briefly introduced themselves, to facilitate future interactions. The meeting was informed that it would be co-chaired by the co-president of the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), Dr Peter Dexter, and by the representative of the president of the Commission for Hydrology (CHy), Dr Abu Saleh Khan.

2. ORGANIZATIONAL AND ADMINISTRATIVE ASPECTS OF THE CIFDP

2.1 The meeting noted that one of the main drivers for the WMO national and regional DRR project planning was the outcome of the detailed fact-finding survey conducted by the DRR Programme in 2006 in cooperation with other technical programmes and the Development and Regional Activities Department. The meeting noted the results of the WMO Country-level DRR survey (http://www.wmo.int/pages/prog/drr/natRegCap_en.html), which shows that storm surge is included in the top ten hazards of concern for WMO Members. In the same context, the meeting recalled that, at its sixtieth session (Geneva, Switzerland, June 2008), the WMO Executive Council requested JCOMM, CAS and CHy, in close cooperation with other relevant UNESCO/IOC subsidiary bodies, to implement the scientific/technical recommendations from the *First JCOMM Scientific and Technical Symposium on Storm Surges* (Seoul, Republic of Korea, October 2007), including coastal inundation and linkages to storm surge forecast and warning operations in all relevant regions. It agreed that coastal inundation forecasting and warning systems depend on the cross-cutting cooperation of different scientific disciplines and user communities, and that an integrated approach would be the strategy for building improved operational forecast and warning capabilities for coastal inundation. The meeting therefore welcomed the Secretariat proposal to develop and implement a Coastal Inundation Forecasting Demonstration Project (CIFDP) and its draft outline as presented in Annex III to this report.

2.2 The meeting reviewed the emergency and disaster management requirements and agreed that the CIFDP should facilitate the development of efficient and informed warning systems for coastal inundation. It further indicated that the CIFDP should:

(1) Support informing decision-making, including land-use planning

(2) Transfer and translate science and technology to communities

(3) Facilitate the development and implementation of warning services

(4) Provide improved science to forecasters

(5) Support risk assessment and mapping

and a variety of other issues, always towards supporting end-user needs. In this context, the meeting stressed on the need to clearly define and understand the end user needs, and therefore agreed that the full engagement of stakeholders and partners in the CIFDP from early stages is critical for the successful development and implementation of the project.

2.3 The meeting agreed on the major goals and expected outcomes of the CIFDP as follows:

(a) Technology development and transfer, including training, which would enhance the capabilities of NMHSs to produce and provide coastal inundation forecasting and warning services, through the provision of tools for coastal inundation forecasting and warning services, and risk assessment;

(b) Communication platform and training, which would improve interactions of NMHSs with stakeholders and partners (Government, Disaster Management and Civil Protection Agencies, media, etc) for better understanding of user requirements, effective communication of the message, and user feedback.

2.4 The meeting discussed the project framework and other organizational matters. However, it agreed that these depend on the technical and regional aspects, which were considered under agenda item 3. The meeting therefore decided to address these issues again under the following agenda items.

3. TECHNICAL ASPECTS OF THE CIFDP

3.1 Existing models (or in development)

3.1.1 The meeting was presented with the existing storm surge, wave and hydrological models (or in development) and integrated systems for coastal inundation, including those implemented in Australia, Bangladesh, India, Netherlands, Germany, UK and USA. All presentations in PDF format are available at the JCOMM website (see http://www.jcomm.info/CIFDP).

3.1.2 The meeting noted that the draft project outline focused on the development and plan for the implementation of an end-to-end coastal inundation forecasting system. However, noting with appreciation that there were a considerable number of storm surge, wave and hydrological models running for different locations around the world, the meeting agreed that the project should also include a model output inter-comparison for the selected locations (see agenda item 3.2) and use the results to improve the end-to-end system.

3.1.3 In this context, the meeting outlined the framework of the project in two different modules, including their activities, as follows:

Module I: End-to-End System

(a) Development of an integrated atmosphere-ocean and hydrological forecasting software package for coastal inundation:

- Package based on existing open sources;
- Front-end and back-end integrated software to be developed;

(b) Implementation, calibration and validation of the software package (fine-tune);

(c) Training forecasters before the operational experiment;

(d) Building communication platforms;

(e) Evaluation (identification of gaps and potential areas for improvement).

Module II: Technology Development and Transfer

(a) Collecting data (database) for the selected countries;

(b) Model output inter-comparison for the selected countries;

(c) Documenting best practices (existing capabilities);

(d) Using Module II results to improve Module I.

3.1.4 The meeting noted with concern the usual difficulties in getting access to bathymetric data, which is critical for storm surge forecasting, and sea level data for evaluation and calibration of the models. It requested the Secretariat to establish agreements with the selected countries (see agenda item 3.2) and with the International Hydrographic Organization (IHO) in order to facilitate the access to these required data. The meeting recognized the valuable contribution of the data available through the UNOSAT in identifying past events and in providing the associated data required for evaluation and calibration of models.

3.1.5 The meeting stressed on the need the CIFDP would require a Project Steering Group (PSG), which should cover the appropriate expertise required for the development and implementation of the project. It agreed that the PSG should comprise met-ocean, hydrological and social experts, and that a consultant was required for the development of the software package as described in paragraph 3.1.3 (Module I, item (a)).

3.2 Regional aspects

3.2.1 The meeting was presented with the regional assessments/requirements for coastal inundation prone-areas in the different Regional Associations, in particular it considered the regional aspects in West Africa (RA I); South China Sea with focus on Shanghai area (RA II); Bay of Bengal (RA II); Caribbean (RA III/IV); Indonesia (RA V), and South Pacific Ocean and Storm Surge Watch Scheme (RA V). All presentations in PDF format are available at the JCOMM website (see http://www.jcomm.info/CIFDP).

3.2.2 On the bases of the assessments/requirements and the existing capabilities, the meeting agreed that there were six potential regions, with identified countries, where the CIFDP should be implemented as a demonstration. The meeting noted that there were other initiatives in place where the CIFDP could be seen as a component. These include the Shanghai Multi-hazard Early Warning System (MHEWS) project and the Severe Weather Forecasting Demonstration Project (SWFDP). On the other hand, the CIFDP would be based on the experience and knowledge gained from these projects. In addition to the above considerations, the meeting took into account the limited resources available and the time required for the implementation of the CIFDP, to decide on the priority regions/country for the implementation of the CIFDP. It agreed that initially the project should be implemented in:

(a) Bay of Bengal (Bangladesh);

(b) Caribbean (Dominican Republic or Cuba).

3.2.3 While deciding to initiate the implementation of the project in selected countries for demonstrating the system, the meeting indicated that the overall project concept should have a regional approach.

3.2.4 At the same time, the meeting agreed that the PSG should develop modalities for interactions with and input from associated projects, particularly for the following regions/countries - project:

(a) Shanghai, China (RA II) – Multi-hazard Early Warning System (MHEWS) project;

(b) Indonesia (RA V) – proposed project by *Deltares*;

(c) RA I and RA V – Severe Weather Forecasting Demonstration Project (SWFDP) and the Storm Surge Watch Scheme (SSWS);

(d) West Africa – SWFDP and other initiatives in the region.

4. FULL PROJECT PROPOSAL

4.1 The meeting recalled that it had agreed under agenda item 3.1 (see paragraph 3.1.4) to establish a Project Steering Group (PSG). Based on information and extensive discussions under the preceding agenda items, the meeting defined on the Terms of Reference and membership of the PSG. It therefore agreed that the PSG should:

(a) Prepare the overall project implementation plan, and define a set of criteria to be fulfilled by the candidate centres operating the storm surge, wave and hydrological models for setting up the software package;

(b) Work with the consultant to define the functionalities of the software package and maintain oversight on its development;

(c) Select the storm surge, wave and hydrological models for the development of the software package;

(d) Develop and implement a plan for stakeholder interactions and consultations;

(e) Follow up the progress of the project and sub-project(s), and coordinate stakeholders input;

(f) Develop modalities for interactions with and input from associated projects;

(g) Prepare regular progress/activity reports describing the different phases of the project;
(h) Issue the final report on the CIFDP and prepare recommendations to be transmitted to the relevant bodies.

4.2 The meeting nominated Mr Val Swail and Dr Donald Resio as co-chairpersons of the PSG, and agreed on its membership as follows:

- Bay of Bengal expert (Dr Abu Saleh Khan);
- Caribbean expert (TBD);
- Shanghai, China expert (Dr Li Yongping);
- Social scientist (Dr Linda Anderson-Berry);
- Two met-ocean modelling/forecasting experts (Dr Will Shaffer and Professor Shishir Dube) – at least one from the identified regions;
- Two hydrological modelling/forecasting experts (TBD) – at least one from the identified regions;
- Consultant or a representative (Mr Deepak Vatvani);
- Representative of the SWFDP/SSWS (Dr Jens Kruger).

4.3 Some effort was devoted to defining the timelines and the overall activities/actions for the implementation of the CIFDP in the two identified regions/countries, as follows:

4.3.1 Module I:

Bangladesh

- Establish the PSG (July 2009);

- Formal arrangements (WMO Secretariat; July-Sept 2009) and commitment by stakeholders, including a workshop (Nov 2009);

- Development of the software package (consultant; 8 months starting in September 2009);

- Implementation of the software package and training on its use (coastal inundation forecast, PWS and DRR programmes) (April 2010);

- Incorporation of stakeholders input into process for better communication of the message, etc; coincident with fine-tune, sensitivity test, etc of the implemented package (Nov 2009 - April 2010).

- First progress report (May 2010);

- Demonstration phase during the Tropical Cyclone season (May-Nov 2010);

- Second progress report and evaluation of the project (Dec 2010).

Dominican Republic or Cuba

- Establish the PSG (July 2009);

- Formal arrangements (WMO Secretariat; July-Sept 2009) and commitment by stakeholders, including a workshop (Dec 2009 or Jan 2010);

- Development of the software package (consultant; 10 months starting in September 2009);

- Implementation of the software package and training on its use (coastal inundation forecast, PWS and DRR programmes) (June 2010);

- Incorporation of stakeholders input into process for better communication of the message, etc; coincident with fine-tune, sensitivity test, etc of the implemented package (Jan - June 2010).

- First progress report (June 2010);

- Demonstration phase during the Tropical Cyclone season (July-Nov 2010);

- Second progress report and evaluation of the project (Dec 2010).

4.3.2 Module II:

Bangladesh and Dominican Rep or Cuba

- Formal arrangements and commitments by the different Services (WMO Secretariat; July-Nov 2009);

- Collecting data (database) for the selected countries (Consultant and selected country, Nov 2009 *(Bangladesh)* / Jan 2010 *(Dominican Republic or Cuba)* – Dec 2010);

- Model output inter-comparison for the selected countries (Selected Service to host, May 2010 - …);

- First progress report and use the results to improve Module I (Dec 2010);

- Documenting the existing forecasting systems' capabilities (2010).

4.3.3 Finally, the meeting agreed that as far as possible the CIFDP should be integrated in existing marine multi-hazard frameworks for a comprehensive and improved coastal risk management.

5. CLOSURE OF THE SESSION

5.1 In closing the meeting, the JCOMM co-president and the representative of the CHy president expressed their appreciation to all participants for their very positive and valuable input to the discussions. Dr Dexter and Dr Saleh Khan concluded by thanking, on behalf of all participants, the Secretariat for the ongoing support.

5.2 The meeting closed at 11:35 hours on Wednesday, 1 July 2009.

Annex I

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Annex II

AGENDA

1. Opening of the Session

2. Organizational and administrative aspects of the CIFDP

- Introduction and discussion of the project concept and outline;
- Goals and Expected Outcomes of the project;
- Project Stakeholders and beneficiaries;
- Governance issues;
- Funding sources;
- Establishment of working guidelines for the planning and implementation of the CIFDP.

3. Technical aspects of the CIFDP

- Overview of existing storm surge, wave and hydrological models and forecasting systems. Prioritization of models to be included in the software package;
- Modes of integration of atmospheric-ocean and hydrological models;
- Data and information requirements for the implementation of the project;
- Minimum infrastructure and professional requirements for candidate centres operating the storm surge, wave and hydrological models in the framework of the project;
- Prioritization of regions/countries for the implementation of the project and outline of the regional/national sub-project implementation plan;
- Components of the capacity building module;
- Components of the communication platform module;
- Integration with the Storm-Surge Watch System.

4. Full project proposal

- Contents of the full project proposal;
- Outline of the Logical Framework of the project;
- Outline of the Project Implementation Plan (PIP);
- Preparation of an Action Plan;
- Establishment of the Project Steering Group.

5. Closure of the Session

Annex III

JCOMM/CHy COASTAL INUNDATION FORECASTING DEMONSTRATION PROJECT (CIFDP)

"In the 1970s, '80s, and '90s, inland flooding was responsible for more than half of the deaths associated with tropical cyclones in the United States." (Ed Rappaport, National Hurricane Center)

DRAFT PROJECT OUTLINE

1. BACKGROUND

1.1 Recognizing the extreme vulnerability of coastal areas to storm surges and coastal inundation/flooding, there is a strong need for the development and implementation of forecasting and warning systems, which allow dedicated disaster prevention agencies to safeguard lives and mitigate damages on infrastructure in coastal areas. As many sectors are involved, this requires an integrated approach that is embedded in an overall framework of coastal risk management. Key players are the National meteorological and Hydrological Services (NMHSs) of affected Members and related national and local institutions responsible for disaster prevention, international organizations with their subsidiary bodies as well as centres of excellence in research and application of storm surge and coastal inundation mapping, modelling and forecasting. At some stage awareness raising and education expertise will also be required. Some of the developments achieved to date are outlined below.

1.2 WMO Fifteenth Congress (May 2007) requested the Secretary-General to "coordinate the collection and dissemination of information on meteorological, hydrological and climate-related hazards and their impacts, when possible and available". To assist in meeting this objective there is a requirement for the development of guidelines for the maintenance of common database structures, metadata, and tools for mapping and analysis of tropical cyclones, storm surges, extreme waves and related coastal inundation.

1.3 WMO through JCOMM has initiated the development of standard methodologies and tools for hazard data monitoring, archiving (including metadata), analysis and mapping for storm surges and extreme waves. Additionally, JCOMM has engaged in the development of a database of extreme wave events, which provides a useful reference to historical background on various studies and applications, including modelling, monitoring and predicting extreme events and their impacts.

1.4 In view of the extreme vulnerability of the coastal areas to tropical cyclones, the WMO Tropical Cyclone Programme (TCP) gives great importance to coastal risk management. It initiated a TCP sub-project entitled "Combined Effects of Storm Surges and River Floods and Wind Waves in Low Lying Areas". This project aims to provide Members in low-lying areas with guidance on how to be better prepared and to prevent damage and losses from flooding, storm surges and waves associated with tropical cyclones. In response to a request of the WMO Executive Council, at its 60th session (June 2008), WMO has initiated, through the joint efforts of TCP and JCOMM, the development of Storm Surge Watch Schemes (SSWS) in regions subject to tropical cyclones. The RA I and V Tropical Cyclone Committees established the SSWS Action Teams; the ESCAP/WMO Typhoon Committee decided to develop a regional SSWS plan; the WMO/ESCAP Panel on Tropical Cyclones made the SSWS arrangements in cooperation with the RSMC-New Delhi and the India Institute of Technology; and the RA IV Hurricane Committee recognized that capacity building initiatives are required for a successful implementation of the SSWS in its region.

1.5 WMO, through its Hydrology and Water Resources (HWR) Programme, is contributing through the improvement of tools and methodologies for flood hazard and risk analysis. This effort

considers coastal inundation linked to tropical cyclones and marine-related hazards, including storm surge and extreme waves. The integration of flood forecasting and warning services (systems and models) with storm surge and tidal effects where appropriate is seen by the HWR programme as adding significant value to hazard mitigation.

1.6 Flood mapping is an activity that would form an essential element of managing flood risks. Flood maps serve as important tools to organize the information on flood risks to be used by decision makers and the public. While detailed technical methodologies in data rich situations are available in literature for calculating flood prone areas and flood risks, guidance on the overall approach to flood mapping and risk assessment are conspicuously missing. For these reasons, WMO and its partners have embarked on a project to develop Guidelines on Flood Mapping covering pluvial, fluvial and coastal flooding processes. The draft guidelines are expected to be available in autumn 2009.

2. WHY A DEMONSTRATION PROJECT ON COASTAL INUNDATION FORECASTING?

2.1 Cooperative work as a strategy for building improved operational forecasts and warnings capability for coastal inundation

2.1.1 Storm surges and wind-induced waves associated with severe cyclones, and its combined effect with river flooding, leading to coastal inundation, stand out as natural hazard with extreme damaging potential including loss of lives and livelihoods.

2.1.2 Coastal inundation forecasting and warning systems depend on the crosscutting cooperation of different scientific disciplines and user communities. An integrated approach to storm surge, wave and flood forecasting will be the strategy for building improved operational forecasts and warnings capability for coastal inundation. The goal of the Coastal Inundation Forecasting Demonstration Project (CIFDP) is to show how coastal inundation forecasting products can be improved and effectively coordinated with warning services provided by the NMHSs. This process will be facilitated primarily by technical commissions, in particular JCOMM and CHy, in cooperation with a consortium of experts and related institutions of excellence in the field of storm surge, wave and coastal flooding.

2.1.3 A second, but closely related goal of CIFDP is to contribute to the improvement of interaction of NMHSs with Disaster Management and Civil Protection Agencies, through the development of preparedness, response and management strategies of storm surges and waves associated with coastal inundation. These strategies will be built on the basis of hazard and vulnerability maps and related information for the use of Disaster Management and Civil Protection Agencies.

2.2 Introducing new products and training

2.2.1 Despite the increasing number of NMHSs that run storm surge, wave and hydrological models, coupled coastal forecasting systems are still limited. With CIFDP, NMHSs will benefit from utilizing such forecast products operationally and linking them to coastal flood management programmes and related activities. This requires substantive training in the use of these products, under different hydrometeorological and risk situations.

3. EXPECTED OUTCOMES OF CIFDP AND HOW IT CONTRIBUTES TO THE STORM SURGE WATCH SCHEME (SSWS)

3.1 In line with recommendations from the First JCOMM Scientific and Technical Symposium on Storm Surges (Seoul, Republic of Korea, October 2007), including coastal inundation and linkages to storm surge forecast and warning operations the expected outcomes of the CIFDP can be formulated as listed below. The WMO Executive Council had agreed on the need to incorporate a SSWS in the tropical cyclone advisory arrangements, which would be the first step

towards a comprehensive and integrated marine multi-hazard forecasting and warning system for improved coastal risk management.

3.2 The WMO Executive Council, in its sixtieth session (June 2008) requested JCOMM and CHy, in close cooperation with other relevant UNESCO/IOC subsidiary bodies, to implement the recommendations from the above-mentioned Symposium, including coastal inundation and linkages to storm surge forecast and warning operations in all relevant regions through the participating NMHSs as primary target organizations and executing partners of the project.

3.3 Formulation of Expected Outcomes of CIFDP:

1. To enable NMHSs to provide credible forecasting of coastal inundation events with adequate lead time for warnings;
2. To improve the skill of forecasting and warning products through feedback from NMHSs and user communities;
3. To improve interaction of NMHSs with Disaster Management and Civil Protection Agencies before and during events;
4. To provide tools for undertaking risk assessments for coastal inundation associated with extreme events such as tropical cyclones;
5. To share best practices on coastal inundation forecasting among NMHSs and users of such information;
6. Facilitate preparatory steps for the development of a comprehensive SSWS.

3.4 Some Regional Specialized Meteorological Centres (RSMCs) with activity specialization in Tropical Cyclones do not have the capacity to function as storm surge forecast producing centres. The CIFDP will contribute to the implementation of the SSWS, by facilitating the use of an integrated atmospheric-ocean and hydrological forecasting software package for coastal inundation, therefore contributing to building the required capacity of selected RSMCs.

4. THE FRAMEWORK FOR REALIZING BENEFITS OF THE CIFDP

4.1 On the basis of the expected results of CIFDP, the main work packages and project activities will focus on:

a) Establishment, calibration and test-operation of an integrated forecasting module;
b) Capacity building through the training of technical personnel;
c) Building communication platforms that allow interaction with relevant organizations and institutions on national, regional and global levels;
d) Facilitation of the development of a comprehensive SSWS.

4.2 Development of an integrated atmosphere-ocean and hydrological forecasting software package for coastal inundation

4.2.1 The CIFDP will assemble an integrated atmosphere-ocean and hydrological forecasting software package for coastal inundation, including visualization tools, and the use of selected storm surge, wave and hydrological models (effectively comprising a coupled coastal forecasting system). This software will be built on available and tested components rather than the development of an entirely new software package.

4.3 Implementation, calibration and validation of the software package, including sensitivity tests and development of coastal inundation scenarios and mapping

4.3.1 The CIFDP will implement the above-mentioned software package in selected NMHSs of coastal inundation-prone countries, including the RSMCs with activity specialization in tropical cyclones.

4.3.2 Sensitivity tests will be conducted taking into account boundary conditions, including bathymetry and topography, and input data available in each region/country to fine-tune the process and products. Near real-time verification and evaluation will be conducted, based on observations as well as on information gathered on the impacts of the coastal inundation, such as those reported by local Disaster Management and Civil Protection Agencies (DMCPA). Guidelines for coastal inundation scenarios and mapping will be developed. This will be the basis for the development of coastal risk management strategies. It is recognized that data availability will be a key limiting factor and must be considered carefully in the design of appropriate tools.

4.4 Training the forecasters before the operational experiment

4.4.1 Some initial training has to be undertaken prior to the testing phase of the CIFDP. The forecasters of the NMHSs assigned to the CIFDP need to know how to optimally operate and utilize the software package products. The presentation of case studies will be indispensable. The training provided will focus on the adaptation and use of the software package, analysis of forecast results and the generation of forecasting products and warning bulletins.

4.5 Building communication platforms

4.5.1 As an important component of institutional strengthening and in view to ensure the effectiveness of the CIFDP, formalized communication platforms will be established, linking relevant institutions responsible for forecasting and warning as well as disaster prevention through a dedicated information generation, reporting and response system of communication. This requires an assessment of the existing communication streams, gaps and shortfalls and subsequently the establishment of communication platforms in a fully participatory manner with relevant shareholders.

4.6 Towards a comprehensive Storm Surge Watch System (SSWS)

4.6.1 In cooperation with partners and in particular JCOMM and TCP, the components of CIFDP will be evaluated for a suitable packaging in view of a comprehensive SSWS. A critical pre-requisite of this activity is the regionally different state of development of the SSWS components. It is however envisaged to test-run a demonstration version of a CIFDP/SSWS system to gain experience in the day-to-day operation of such a complex integrated system.

4.7 Evaluation and conclusion at the end of the project

4.7.1 At the end of the testing period, a complete evaluation of the project has to be undertaken. The main part of this evaluation consists of a complete assessment concerning the skill of the forecasts and especially on the ability of the NMHS to fulfil the requirements expressed by the responsible civil protection authority. The evaluation must assess how the enhanced coastal inundation forecasting process of the CIFDP has improved. It would be highly beneficial that the NMHS and the responsible civil protection authority be involved in the evaluation.

4.7.2 The evaluation should also include an assessment on the relevance of the products. Finally, the evaluation of the CIFDP should identify the shortcomings, and propose improvements in order to ensure the sustainability of the coastal inundation forecasting system as well as to facilitate an extension of the system to other NMHSs of the same geographical region, in the context of the SSWS. It will be essential to identify the cost of improvements and the benefits that would flow from their implementation, so that value judgements can be made before progressing any further.

5. THE THREE PHASES OF THE CIFDP

5.1 It is proposed to plan and implement the project in three phases.

5.2 Phase I

5.2.1 This phase comprises of all administrative and organizational steps required for the planning and implementation of the project, including agreements with all partner organizations and securing of the funding base. Technical preparations include the selection of model components, and securing critical data and information sources for the implementation of the forecasting module. Critical milestone will be the availability of a full project proposal, project implementation plan and robust agreements with project partners.

5.3 Phase II

5.3.1 This phase consists primarily of a full-scale implementation of the project with the milestone of demonstration versions of the forecasting module at regional and national levels (sub-projects), establishment of the communication platforms and ongoing capacity building, including technical training.

5.4 Phase III

5.4.1 This phase is characterized as the project finalization and transfer phase to defined partners on national and regional levels. It also contains all activities that are essential for the project exit strategy and will include the final evaluation of the project.

5.4.2 A Monitoring and Evaluation (M & E) Plan is an integral part of the entire project and its phases that allows fine-tuning of project components and improvement of project implementation processes.

5.5 Phases II and III are specific to each regional/national sub-projects and will be repeated in each sub-project. From the point of view of the project management, it is clear that the overall CIFDP begins with the first step of Phase I and ends after completion of Phase III of the selected regional/national sub-projects. Each selected regional/national sub-project will have its own commencement and completion dates.

6. THE DEMONSTRATION PROJECT STEERING GROUP (PSG)

6.1 Establishment of a Project Steering Group

6.1.1 The PSG will comprise of experts from the marine meteorology/oceanography and hydrological communities on storm surge, wave and hydrological modelling and forecasting. For the implementation of the regional/national sub-projects, participants from the region/country as well as experts of selected institutions of excellence will be invited to be part of the PSG. The initial tasks of the PSG will primarily comprise of the activities outlined below.

6.2 Tasks of the PSG

6.2.1 The PSG prepares the overall project implementation plan, and defines a set of criteria to be fulfilled by the candidate centres operating the storm surge, wave and hydrological models for setting up the software package and its regional/national application (sub-projects).

6.2.2 The PSG selects the storm surge, wave and hydrological models for the development of the software package, and the region/country for the implementation of the regional/national sub-projects.

6.2.3 The PSG follows up the progress of the project and sub-project(s). Regular reports are expected for the different phases, at a minimum of once every 4 months.

6.2.4 The PSG is responsible for issuing the final report on the CIFDP and preparing recommendations to be transmitted to the relevant WMO and UNESCO/IOC bodies.

6.2.5 The terms of reference of this PSG will be reviewed and adapted at its first meeting in Geneva, scheduled from 29 June to 1 July 2009.

7. FUNDING SOURCE(S)

7.1 WMO funding is available for phase I (2009-2010) and partly phase II (2010-2011). The project will be submitted to the EU 7th Framework Programme for funding. It will also be submitted to partner organizations/donors (such as World Bank, etc.) for funding of the regional/national sub-projects.

Annex IV

ACRONYMS AND OTHER ABBREVIATIONS

CAS	Commission for Atmospheric Sciences (WMO)
Cg	Congress (WMO)
CHy	Commission for Hydrology (WMO)
CIFDP	Coastal Inundation Forecasting Demonstration Project (JCOMM, CHy)
DMCPA	Disaster Management and Civil Protection Agencies
DRR	Disaster Risk Reduction (WMO)
EC	Executive Council
ESCAP	Economic and Social Commission for Asia and the Pacific
EWS	Early Warning System
GDPFS	CBS Global Data Processing and Forecasting System (WMO)
HWR	Hydrology and Water Resources (WMO)
IHO	International Hydrographic Organization
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
M&E	Monitoring and Evaluation
MHEWS	Shanghai Multi-hazard Early Warning System Project
NMHS	National Meteorological (and Hydrological) Service
PIP	Project Implementation Plan (CIFDP)
PSG	Project Steering Group (CIFDP)
PWS	Public Weather Services (WMO)
RA	Regional Association (WMO)
RSMC	Regional Specialized Meteorological Centre (WMO)
SSWS	Storm Surge Watch Scheme (WMO)
SWFDDP	Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project
SWFDP	Severe Weather Forecasting Demonstration Project
TBD	To Be Decided
TCP	Tropical Cyclone Programme (WMO)
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNITAR	UN Institute for Training and Research
UNOSAT	UNITAR Operational Satellite Applications Programme
WMO	World Meteorological Organization (UN)