- Making a Difference –
Scientific Capacity Building & Enhancement for Sustainable Development in Developing Countries

Integrating Indonesian Capacity for Coastal Zone Management

Final Report for APN CAPaBLE Project:

CBA2008-08NSY-Andonowati

LabMath-Indonesia
Bandung, Indonesia

Integrating Indonesian Capacity for Coastal Zone Management

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Final Report submitted to APN

www.apn-gcr.org

Overview of project work and outcomes

Non-technical summary

This Capable project identified coastal oceanography as the weak part of Indonesian scientific expertise in Coastal Zone Management in the era of Global Change, and started to make contacts between experts from various disciplines between universities and governmental institutions by personal contacts during meetings and by a virtual HUB accommodated by an extensive database that is available on internet.

Objectives

The present project aimed:

- to identify the existing capacities in areas of Integrated Coastal Zone Management (CZM),
- to identify the weakest spots in the existing capacities, and to start to improve these spot with a workshop in that area,
- to make publicly available the existing capacities in areas of Integrated Coastal Zone Management,
- to integrate the existing capacities in areas of Integrated Coastal Zone Management.

Amount received and number years supported

The Grant awarded to this project was:

- US$ 35,000 for Year1, 2008-2009

Work undertaken

- Organization of 2 preparatory meetings;
- Identification of weakest spots in CZM;
- Organization of a 2-day International Workshop Coastal Oceanography and a 3-day Symposium on Coastal Zone Management;
- Collection of human capacity data by personal interviews and by web-contacts;
    - Design a database for Indonesian capacity in CZM;
    - Fill the data base with collected information, and put it online;
    - Measures are taken for sustainability and maintenance of the integrated capacity;

Results

- Data about human capacity have been collected;
- A data base has been designed and stored with the data; it is now publicly available through internet: www.IndonesianCoastalHUB.org;
- The two preparatory meetings and the Workshop & Symposium have been organized as planned which led to direct contacts between various scientists and policy makers;
- Identification of ‘coastal oceanography’ as the weakest spot in Coastal Zone Management
- A workshop has been organized that addressed the weakest topic ‘coastal oceanography’ and showed how improvements can be made;
- The symposium showed the larger picture and the way how the CZM scientists can collaborate better.
- LabMath-Indonesia will take the responsibility for maintenance of the website and the database;
- Participating scientists have mutually agreed to organize yearly meetings to continue and make stronger the link in coastal zone area.

Relevance to the APN CAPaBLE Programme and its Objectives

A key issue that is relevant for all countries in the region is the observation that Global Change will most likely give rise to major climate and weather changes. Stronger winds, that are expected, will lead to more extreme wave conditions: higher waves and possibly more hurricanes in countries surrounding – but affecting- Indonesia.

The higher waves will affect the coastal zones in various ways. Directly on the coastline, we can expect morphological changes and more dangerous situations because of high waves. Harbours and off-shore structures will experience sea and ocean conditions for which they are originally not designed. Ship transportation, of major importance for Indonesia, will have to face the more dangerous sea and oceans.

Any activity, including the executed project, that can help to mitigate these effects is very helpful. Coastal Zone Management have to prepare to be able to take these expected extreme situations into account. The project developed an Integrated Capacity Inventory as a necessary step in this direction.
In enhancing the Integrated Capacity, interactions between Indonesian scientists, scientists from the Asian-Pacific region and foreign experts will be very beneficial for all groups.

On the other hand, collaboration between university scientists and policy- and decision makers at governmental institutions (BMG and LIPI) will make it easier to translate the scientific findings and warnings to the policy makers who have the responsibility for the coastal zones, as well as for creating a healthy scientific basis for their decisions.

Self evaluation

- The project has been executed along the lines of the approved application.
- The final result is satisfying.
- The major aim was to investigate the capacity, and that has been achieved with as major outcomes:
  - It was observed that in various areas of CZM, Indonesia has a very good level; especially the activities of some major universities concerning practical support for social-economic development of coastal communities, and knowledge about bio- and ecological aspects.
  - Just as important was the (not unexpected) finding that work on the water-side of the coastal zone is very scattered over various universities, governmental agencies /institutes and even many ministries. Except from the work of small groups and some incidental scientists, the infrastructure does not yet reach the highest possible (and needed) scientific level.

As a contribution for future further improvements, the project led to a professional website, with guaranteed maintenance and the potential to really make it possible to link the scientists from many different disciplines, with involvement of policy makers, and to work on improvements needed for expected effects of Climate Change.

Potential for further work

As a result of the project we concluded that knowledge, but even more so a healthy infrastructure for coastal zone aspects ‘viewed from the sea’ (coastal oceanography,) can and have to be improved. In the project we started with a short workshop in that direction, but still much more has to be done.

The research institute LabMath-Indonesia, as part of a non-profit Foundation Yayasan AB, not having the daily university burden of teaching but having good

links to various players in this area, wants to seek possibilities to play a role in the further development:

- Help to organize yearly meetings of the Indonesian Coastal Community – as part of the execution of the IndonesianCoastalHUB-website as a virtual knowledge park,
- Help to link the Indonesian activities to international coastal zone research and coastal zone advisory agencies,
- Look for funding to organize (research) workshops for various groups in coastal zone management, for upgrading and to attract more interest from young students for this direction,
- Execute relevant research, in collaboration with Indonesian and international scientists, and disseminate the results.

Publications

No formal publications were published, or are pending to be published from this Capable project.

A website has been designed and created: www.IndonesianCoastalHUB.org

Ppt's of all presentations during the Workshop and Symposium held in May 2009 are available on internet: see www.labmath-indonesia.org/lectures

Acknowledgments
The project coordinator and the participating scientists are grateful to APN for the opportunity to execute the activities in this project.

Technical Report

Preface

Limit to 100 words

In May 2007 waves of 5 to 7 meter high invaded the shoreline at the south-coast of Jawa, causing casualties and coastal settlements ruined. This exceptional event illustrated the impact on the coastal areas of bad weather conditions that are likely to become custom as an effect of Global Change. The project aimed to contribute to a better Management of Coastal Zones. To that end, activities were executed to start to integrate scientists and policy makers that work isolated at Indonesian institutions. The project has identified the weakest topics and subjects and has taken measures for future linkages. Scientists from various Indonesian institutions and from The Netherlands have collaborated.

Table of Contents

1. Introduction

In this section we describe the background information, the scientific significance, the objectives, and provide some other relevant information leading to the development and justification of the current project.

1.1 Background information

Global Change affects many aspects of our environment, not at least it will have considerable impact on coastal zones. Coastal zones are important: they are from old times the places where people started to build settlements form which economic activities resulted. Fishery activities gave direct high quality food, and a source for trading the fish to places land-inward. Ships as means of transportation made it possible to become in contact, and extend trading, to other islands or other countries. Besides that, even in very mountainous countries, where building may be difficult, the coastal area is often much flatter over a large adjacent area.

All these factors make that the majority of the people of this earth live along the coast, and that much economical activity takes place there. Besides that, the coastal zones are usually areas with a large bio-diversity, in the water and near the shore line.

However, the past decades it has become clear that the coastal area is in severe threat. Overpopulation, overfishing and pollution from industrial activities and from pollution in the inner-land carried by the rivers to the coastal zone, create severe ecological problems.

Effects of Global Change make this picture even worse.

- Increase of temperature has various effects.
  Changes in the sea-temperature can change the biological situation, so that fish population may diminish or change, and coral reefs may degrade.
- Sea-level rise directly endangers the coastline; without protection such as dikes, in shallow coastal areas large parts of the land will disappear, and inhabitants of these areas have to find other places.
- Another expected effect of GC is heavier rainfall.
  Heavier rainfall will lead to more and faster overland run-off, and therefore larger discharge through rivers. In the inner-land this may lead to flooding, but also at the coast where the river reaches the sea/ocean, flooding will occur. Sedimentation carried by the rivers will increase as well, giving an additional contribution to morphological changes of the coast.
- Stronger winds, and increase of the number of hurricanes, are another expected effect of GC.
  All waves at the oceans and seas, except tidal waves and incidental tsunamis, are generated by the wind. The physical generation process makes that waves will become higher with increasing wind (provided the fetch is long enough). Hence, higher waves will endanger the coastline, man-made structures (harbours, off-shore structures) and ship transportation.

All these effects of GC on the coastal areas can be expected, and more and more evidence shows that indeed negative effects on the coastal zone take place to an increasing amount at a fast pace. All these considerations motivated the formulation and execution of the project.

1.2 Scientific significance

This Capability project was aimed to support the execution of research in an indirect way. The main aim of the project is to prepare the Indonesian infrastructure to become more and better prepared for the effects of Climate Change.

Observation of the possible changes, trying to minimize the possible effects and to mitigate the actual effects, all these activities need scientific work of an unprecedented extent. Collaboration between scientists from many countries, and collaboration between various disciplines, is needed, if only because the effects are not restricted to a single country or has consequences for a single discipline.

But starting point should be the awareness of the need for scientific investigations, and the quality of the network to execute such research. Only with sufficient internal support, and with a sufficiently level of organization and knowledge, a country can join the international community in GC research.

With this as starting point, the project started with an investigation into the existing Indonesian infrastructure in coastal zone management. It was expected, and in broad lines confirmed by the results of the execution, that the scientific capacity is rather scattered over many universities, governmental agencies, ministries and local governments. It became even apparent that, although concern about GC is widespread, effects on the wet-side of the coastal zone are not yet generally and clearly recognised.

1.3 Objectives

The description above was the motivation to formulate the main objectives of the project. These were formulated in the original application as follows:

The main objective is to structure and integrate the existing isolated capacities in the areas of CZSimulation, CZManagement, and GC. Currently, the capacities of human resources, existing knowledge, and infrastructures are scattered over several institutions. The integrated capacity is needed for future collaboration to withstand the effects of GC by improved CZM. These effects are likely to be more extreme weather conditions, leading to larger waves affecting the coastal area.

This shows a constructive approach, to start to create an improved infrastructure with respect to CZM research organization, and to relate it to knowledge about GC. The activities were therefore proposed and executed along this constructive line.

2. Methodology

In this section we explain how the project was carried out to achieve the aims.

We describe the meetings, which were partly meant to start the linking between different groups working in Coastal Zone. The first two meetings were essential to get suggestions (for changes) of the design and content of the database. For these two meetings experts in CZ and in CC were invited. As public meetings, one workshop and one symposium were organized, with expected participation of 30 and 50 participants respectively.

Consistent with the aims of the project, to try to link better the scattered capacities in coastal zone management, meetings were organized.

- Two meetings took place with scientists and policy makers from various institutions. The idea and aims of the project were discussed in broad lines. Besides that, practical and technical aspects were discussed, among which the contents, design and utility of the data base under (successive stages of) construction.

During these meetings the weaknesses of the CZM was identified to be on the 'wet side' of the coast.

- As a consequence it was decided to organize a 2-day workshop on Coastal Oceanography.

This workshop would immediately be followed by a 3-day Symposium.

- In the Symposium 'Effects of Climate Chance for Coastal Zone Management' the many different aspects of CZM would get a broader attention, and the interrelation between the present problems, and problems to be expected from Climate Change, would be emphasized.
- During the Symposium the formal launching of the website with the data base took place.

The actual design of the contents of the data base also reflects the intention to try to give a means to connect people working in different institutions and in different disciplines.

We will describe the various activities in more detail below.

2.1 First meeting 24-25 October 2008

The Initial meeting took place at 24-25 October 2008, according to the project description, attended by 10 participants, scientists and policy makers. In this meeting, it was suggested that the first list of the people to be included in the expert data base and interviewed are restricted to the best or most influential scientists, practitioners, and policy makers related to coasted zone management.

The input of the first meeting was useful, leading to various changes in the prepared questionnaire and suggestions for scientists/ policy makers to be included.

Discussion and Suggestions:

- Several institutions in Indonesia, such as MGI (Marine Geology Indonesia) and Fisheries and Marine have made a database containing of list of people who worked related to coastal zone. But it's just a database, without sustainability and already more than 10 years old. Nowadays, these databases are not updated. Hopefully, the new created database could be more updated and valuable so that all the scientists, policy makers, and also the stakeholders could be more integrated and the database can be exploited beneficially.

- In Gajah Mada University, the Engineering Research Study had organized database training in Integrated Coastal Zone Management, collaborated with Public Works Affair (Coastal Swamp Irrigation).
- It is necessary to emphasize the objective of this project, not only obtain a database, but also results a in a useful web database, that people who will be included can list their project activities and build opportunities to collaborate among them. Each person in the database will have their own username and password, so it would be enable them to update their own personal information.
- Good qualification is needed to obtain a useful database. We have to make sure that each person in the database is relevant enough to be included in the database. Several criteria or requisites for one to be included in database are discipline background (from well known universities), publication records, and work experiences. This will be the guarantee for this database to be prestigious.
- Maybe we can start from the capacities with well known institutions, or offshore company like CALTEX/Chevron also proper enough to be included, because they must have good data also expert in coastal area. It is easier maybe for us to find people with hard skill, but people with soft skill are quite difficult to be found. It is necessary to consider the Non Government Organization that has a soft skill expertise (i.e. economics aspect, environmental aspects). It is also necessary to consider the local government and offshore consultancy company because generally they have their own data.
- Information which will be shown in the database is taken from the ticked/selected information in expert questionnaire.
- It is better if the questionnaire is in Indonesian version also, because it would be easier for the Indonesian scientist and policy makers to fill out the questionnaire.

All these suggestion were take into account in the further design of the database, except the suggestion about the language: the website should (certainly on longer term) also – or especially- be useful for people of other countries, the countries in the Asian Pacific Region in the first place, since problems are similar in various countries and expertise could be shared if information would be better and easier available.

2.2 Second meeting 20-21 March 2009

The workshop meeting was opened by a presentation from Prof. Safwan Hadi with topic “Policy in Integrated Coastal Management”.

It was continued with a presentation of Dr.Andonowati on “Opportunity for Research Park Establishment in Indonesia and Coastal Hub Concept”.

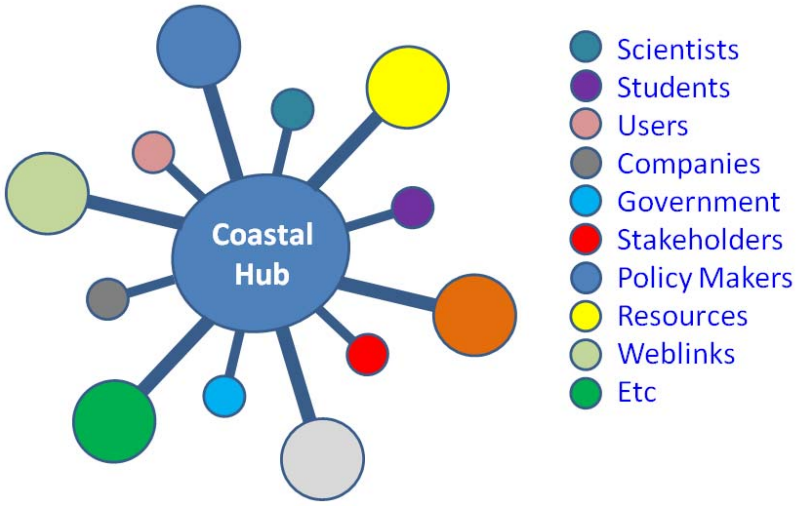
After lunch break, a short demonstration of what the coastal hub website would look like in the future was shown. Discussion among the experts took place afterwards.

Basically, the idea of the creation of the so called Indonesian Coastal Community Hub is that the hub will serve as a complete / representative / integrated hub that gives the facility to community members to identify themselves, to find and to be found by other community

members. Therefore, the hub will become more beneficial than an ordinary portal or website since the community members will be responsible for his/her own page in the hub, just like the social networking site.

Most of the responses were positive, but several suggestions came up in technical aspects of the coastal hub, such as

- The data security of the expertise
- The spatial distribution of the expertise and their published/not-published research showed by Indonesian Map
- Several add-ons tools in profile/home page to help user in updating their profile or inviting their colleagues
- Maintenance and administration of future Indonesian coastal hub hosting will be the responsibility of LabMath-Indonesia



Furthermore, in relation to the coastal hub, there will be created a mailing list which contains names of the participants to this workshop meeting for disseminating the information and progress regarding the coastal hub from now until the launching day in May 2009.

There was also assembled a list of persons in charge in several institutions where the participant came from such as education institution (IPB, UGM, ITB), and governmental institution (LIPI, BPPT, DKP, Bakosurtanal, ISOI).

2.3 Workshop 16-17 May 2009

The topic of the workshop was decided during the second meeting based on the opinions of the participants of that meeting and the outcomes of the data-base investigation till that time. The workshop addressed a weak spot in the Indonesian Coastal Zone management, in particular the coastal oceanography is part of that weak spot.

The workshop addressed various topics in an instructional way, without losing the perspective of the total environmental aspects.

In the Appendix the schedule and the abstracts of the lectures are given; at www.labmath-indonesia.org/lectures all ppt's of the lectures can be downloaded.

Here we give a short characterization of the contents of the lectures.

Hamzah Latief,

Tsunami Modelling and their Mitigation

General and more technical aspects of tsunami simulations, with

emphasis on effects on the coast, were discussed. Calculation of coastal risk, and description of protective measures, including alternatives for the international Tsunami early warning systems.

Andi Jamaluddin and Samudro,

Impacts of environmental loads on safe sea transportation

This lecture directly discussed the expected effects of Climate Change on the safety of ship transportation. Higher wave are to be expected, and the (already many) ship accidents caused by bad weather may be expected to increase; proposal for further investigations.

Indra Jaya,

Coastal Current: Generation, Measurement and Its Effect on Coastline and Coastal Fisheries

The importance of currents was discussed: currents in the direction along the shoreline give rise to sedimentation transport and shoreline changes, and currents caused by wind from or to the land give up- or down-welling, affecting fisheries. Effects of CC were discussed.

Poerbandono,

Spatial approach in watershed and coastal studies

The lecture addressed the usefulness of a spatial approach towards problems at the coastal zone, and gave also example for problems with rivers (STREAM-software).

Safwan Hadi,

Simulation of Impact of Storm Surges Vulnerable Area along Southern Coast Of Java Caused by Cyclones Jacob and George in March 2007

The cyclones mentioned in the title occurred in the north-western part of Australia, but the winds very strongly affected the Indonesian Jawa coast; such cyclones are expected to become more frequent as an effect of CC.

Simulation tools were discussed that are capable to predict the waves affecting the coasts form the given meteorological data (wind speeds); this opens the opportunity to wave predictions/warnings from weather predictions.

Gerbrant van Vledder,

Spectral wave modelling in coastal waters

This lecture addressed the methods that are nowadays used in modern software (WaveWatch and SWAN) to calculate the generation of waves by wind. Although the details are rather complicated, the overview and the differences between deep and shallow waters were explained clearly.

Brenny van Groesen,

Deterministic wave modelling and simulation

The actual evolution of waves in a dynamic way – different from spectral properties in the preceding lecture- requires different, equally complicated software if sufficient accuracy is desired; the example of waves in a harbour illustrated the complicated effect of resonance.

From this description it is clear that the lecturers treated important aspects of coastal oceanography. Young students who participated had shown their interest on these very relevant areas. Since, unfortunately at the current state, these subjects do not attract enough students in Indonesia, the

lectures had made them aware how important to perform the present and foreseeable future scientific tasks.

2.4 Symposium 18-20 May 2009

The 3-day symposium, different than the workshop, addressed many different aspects of Effects of Climate Change on Coastal Zone Management, which is shown from the titles of the various lectures:

Luky Adrianto,
The social-ecological system approach in the context of integrated coastal management and governance

Jamaluddin Jompa,
Climate Change, Potential Impacts on Coral Reefs, and Management Challenges

Hamzah Latief,
Coastal Zone Research

Dietriech G. Bengen,
Climate change and global warming: implication to coastal zone and small islands, and strategic perspective of adaptation

John I. Pariwono,
Ramification of sea level rise on sea-border between neighbouring countries

M.M. Julian, Poerbandono and P.J. Ward,
The role of precipitation, temperature, and land cover in controlling run-off of the northwest of Java coastal zones: a climate change perspective

T. Ferijal and Patricia K. Smith,
Freshwater inflows modeling using SWAT

Gerbrant van Vledder,
Wave modelling in a tidal inlet system

YAB Labmath,
Indonesian Water Balance and Waterfootprint

Kadarsah,
District Level Prediction for Assessment of the Impact of Climate Change on Coastal Management

Budianto Ontowirjo,
Hydrodynamics and sediment transport modelling for softshore protection in ICZM

W.Windupranata and I.Hayatiningsih,
Past-decadal simulations on ocean waves, tides, currents and sea surface temperatures on the northern coast of West Java

Dewayany Sutrisno,
Spatial assessment modeling for the impact of climate change on coastal management

Agus Salim,

The study of ecological risk assessment of oil spill in Jakarta bay water

Y.R.A. Lumingkewas, R. Poerbandono and K. Prijatna,
Recent adaptation measures and the progressing regional environmental settings in Seribu Islands, Java sea, Indonesia

Brenny van Groesen and Didit Adytia,
Variational Boussinesq Simulations of harbour waves

Edvin Aldrian,
Carbon nutrient coastal fluxes over Java and the possible impacts to global climatic changes

Jonson Lumban Gaol,
Impact of climate change on phytoplankton chlorophyll in Indonesian waters

Ricky Rositasari, Suyarso, Afdal, Suratno and Bayu Prayuda,
The impact of climate change to several aspects of coastal system

During the symposium, also the website with database www.IndonesianCoastalHUB.org was officially launched by Dr. Andonowati, the project leader, together with an explanation of the contents. The discussion addressed especially safety and maintenance aspects as critical points to make the database trustworthy and sustainable for the future.

2.5 Data collection

The design of the expert data base, and the collection of data, started in September 2008 and continued all during the project period. Actually, even after finishing the project, adaptations in lay-out will be made when practical use will suggest possible changes, and will be maintained to include new members, reactions to the website (questions etc), and to include more and more data.

A questionnaire to solicit the information of potential members was designed and made online available. Besides that, various scientists and institutions have been visited for oral interview. In total, extensive data of some 80 members have been assembled and are online now.

The database and website www.IndonesianCoastalHUB.org will still evolve in the coming time, depending on reactions of the members and visitors.

2.5.1 Design questionnaire

A questionnaire was designed to collect data of the experts to be inserted into the data base. The questionnaire was designed to be filled out by the expert self, or to be used for interview.
Suggestions during the first and second meeting improved the initial lay-out.

The questionnaire collected data of various types:

- bibliographical data, and information about present workplace and history,
- specific information was requested about capacity (key-words to be selected),
- type of expertise (research, applied execution, policy making or

preparation),
- information about projects executed,
- information about GIS-data that could be made available for others.

Part of the information about the experts is publicly available for all visitors to the site; the more specific information is only available for members; see the policy description below.

2.5.2 Interviews and internet-data collection of members

The information of potential members was assembled in many cases by a visit to the expert for oral interview. Although this was not anticipated before the start of the project, this turned out to be necessary because the initial response to the request to fill out the form was rather low.

This can be attributed to the common heavy workload of the potential members, but also because of a certain skeptical attitude towards 'another' database of which the usefulness was not clear in the first instance. Indeed, there exist old databases which were designed sometimes more than 10 years ago, but which are not maintained or updated.

However, after having described in more detail the aim and future contents of the new database, the experts were helpful and became interested and were willing to contribute. In total, data of more than 100 people have been assembled, of which some 80 could be used for the database

2.6 Design of database

2.6.1 Contents and policy

The database is designed and has specific features for members and general visitors. Members have more facilities and can use the database also for internal communication and exchange of data etc. (between members).

Members

The Qualification Criteria for Members are derived from the aim to have an expert database on Coastal Zone Management. Therefore, the members should be experts in one of the areas of the coastal zone. This can be on physical, biological or environmental aspects, but just as well on social and economic aspects.

Although being an 'expert' cannot be defined in a simple uniform way, a university PhD degree with some years of additional experience, will be used as a default qualification; university qualifications can be substituted by practical experience that can be evaluated from documented or published achievements.

New members can be proposed by other members, through the webmaster. After collecting information from the candidate-member, all other members will be consulted to verify that the candidate satisfies the criteria. Provided this is sufficiently supported, the candidate member will become member with his information added to the database.

Visitors have the following possibilities:

- View announcements about upcoming events

- View short descriptions of all members of the database. This information is sufficient to see the expertise of the members, and with the given contact they can approach the member by email.
- Write a specific public question. After screening by the webmaster, sensible questions will be put on the (public) Q&A tab. There will also be given the answer to the question.

Members have the same possibilities as visitors, and in addition (after log-in):

- They can see the full profile of all members;
- They can contact all members together by email, or ask questions (through the webmaster).
- They can see and download all 'files' (including data) that have been made available by other members.
- Members can provide their data to become available for other members.

2.6.2 Technical requirements

From the start on, the following requirements were formulated:

- The database should be available every day for 24 hours;
- There should be special features for members, such as log-in and editing facilities for members to change their profile;
- The database should be safe for intrusion from outside.

The actual design took these requirements into account. As safety measure, to protect spam etc to be delivered to members of the website, all communication is directed to a webmaster, who can investigate the contents of emails etc and decide about the removal or processing of the email contents.

2.6.3. Practical execution

The final result of the database and website is visible through www.IndonesianCoastalHUB.org.

Changes are still being made. The Hub will be hosted as an independent website. Maintenance and administration of the Hub will be taken care of by LabMath-Indonesia.

3. Results & Discussion

Explain your actual findings, including figures, illustrations and tables. Make comments on the results as they are presented, but save broader generalizations and conclusions for later. Discuss the importance of your findings, in light of the overall study aims. Synthesize what has (and has not) been learned about the problem and identify existing gaps. Recommend areas for further work.

3.1 Indonesian Coastal HUB

In many research areas in Indonesia, when discussing about who are doing what and where, we often have difficult to see even a global picture. What are past and current projects, where are their locations, which agencies are responsible, who are involved in the executions, where the funding comes from. A Map of researches and projects can answer those questions and thus can give direction for the future planning. In this project, we focus on the special topic that is Coastal Zone Management. Direction of a future plan & development in the Indonesian Coastal Zone is crucial particularly because of the impacts of the global climate change.

Preceded by several in-depth studies that included visits, observations and intensive dialogues with research groups in several Indonesian research institutions, it is clear that there are several research groups with very promising research capacities as well as excellent innovative ideas. Yet, many of those researchers are not connected to each other and often have no collaborations. Some time even same projects are redundantly executed by different groups.

Thus, the first step toward having a research map in Coastal Zone Management was to create a structured and standardized expert inventory in the area. This idea was the basic of this APN-Capable project. The design of the expert data base, and the collection of data, started in September 2008. A questionnaire was designed and made online available on the APN-project website www.labmath-indonesia.or.id/apn

During the course of the project, however, the idea of creating this inventory had been developed. The main concern was how the data base can grow, dynamically updated, and become a point of interest to the participants. For this, we had been trying to study some scientific communities and how the members of these communities interact. We concluded that we wanted to make a virtual meeting point called Indonesian Coastal HUB. The Hub in-fact can also become a nucleus for a Virtual (Thematic) Research Park.

We brought up the idea and showed the model of an Indonesian Coastal Indonesian Hub in the second APN meeting held on 20-21 March 2009 attended by 20 senior researchers from Universities such as Institut Teknologi Bandung, Institut Pertanian Bogor, Universitas Gajah Mada as well as Government Agencies such as Indonesian Institute of Sciences, Agency for Assessment and Applications of Technology as well as senior representatives from the ministries. It was opened with a presentation of Prof. Syafwan Hadi entitled “Policies on Indonesian Coastal Management” followed with a presentation on the model of Indonesian Coastal Hub.

All participants were very positive with the idea of Indonesian Coastal HUB. The following suggestions were made regarding the Hub & expertise.

- The data security of the expertise needs to be addressed
- Expertise and projects can be shown and accessed on the Indonesian Coastal Map
- Additional tools to help the user in updating their profile or inviting

their colleagues

- The Hub will be hosted as an independent website.
- Maintenance and administration of the Hub are the responsibility of LabMath Indonesia.
- Meeting of the core experts will be conducted yearly at different institutes/agencies/ministries.

After considering the suggestions, the model of the hub was revised accordingly. Although, some features are still under being revised, the Hub can be observed from samples of snapshots in Figure 1 – 3. From the main page (Home) of the Hub shown in Figure1, recent information that is entered by members and collected can be accessed through buttons related to Files, Events, Links and Questions. Members can also upload their simulation tools, research papers, teaching material, and their networks in the area of Coastal Zone Management.

The Hub accommodates the core expertise as its members. These members then are listed alphabetically and can be sorted as well as searched by names, institutions, keyword (associated with his/her research areas) as shown in Figure2. New members can be added based on the invitations of the current members. Application form for the new member is shown in Figure 3. Here, a login name and password will be requested and later when the membership is approved it can be used to login to the web. The core members will have access of information from the main page.

Besides this, the Hub also accommodates memberships from larger coastal management Community such as consulting companies, policy makers, etc.

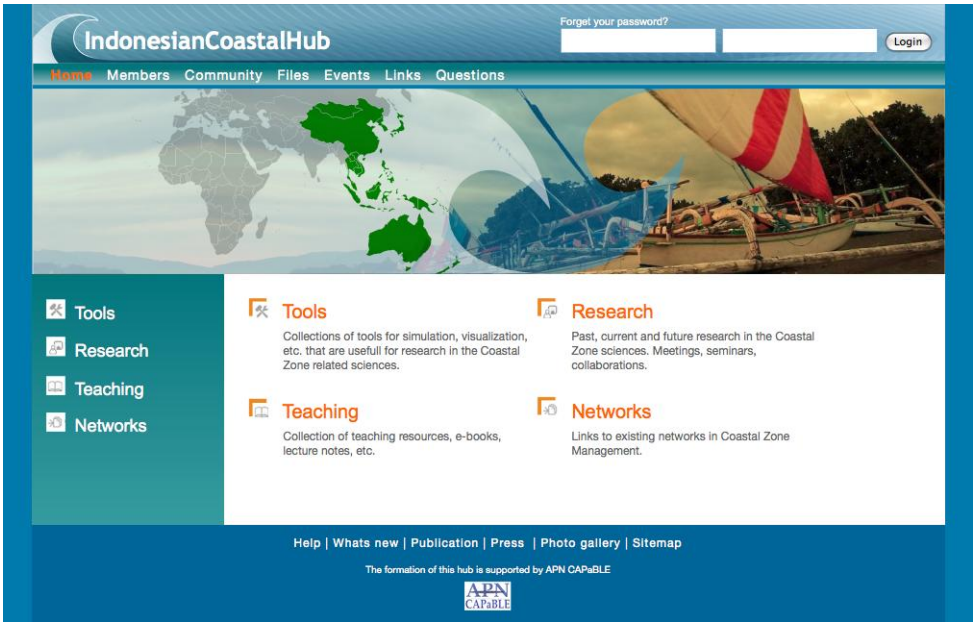


Figure 1. A snapshot of the main page (home) of the Indonesian Coastal Hub

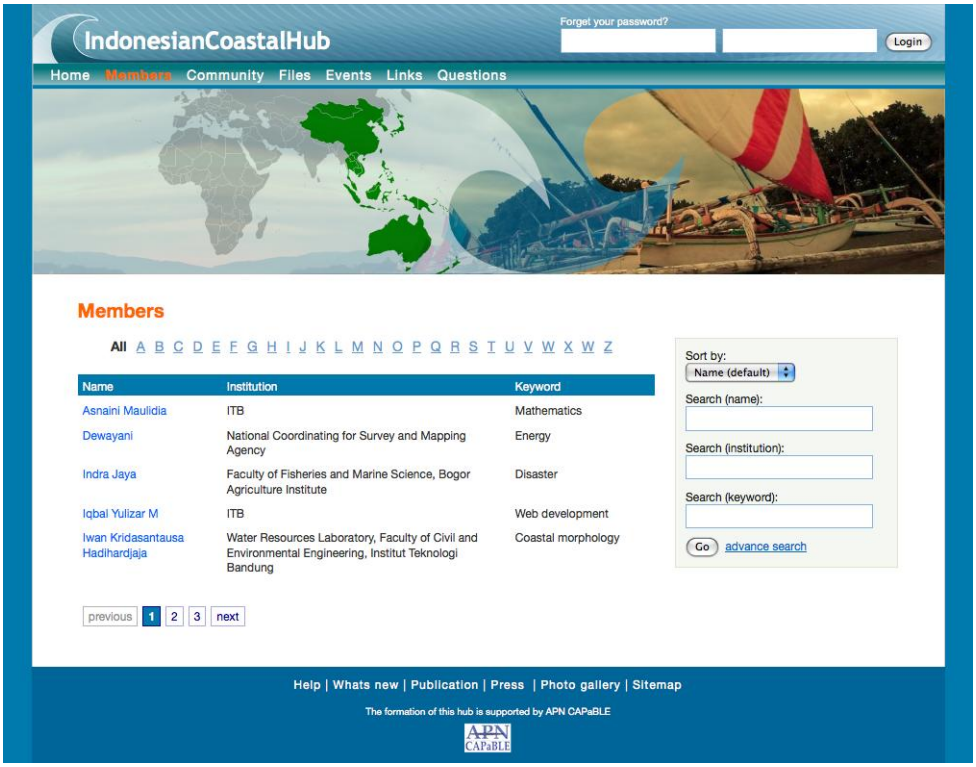


Figure 2. A snapshot of the HUB members listed alphabetically with an added search engine from the Indonesian Coastal Hub.

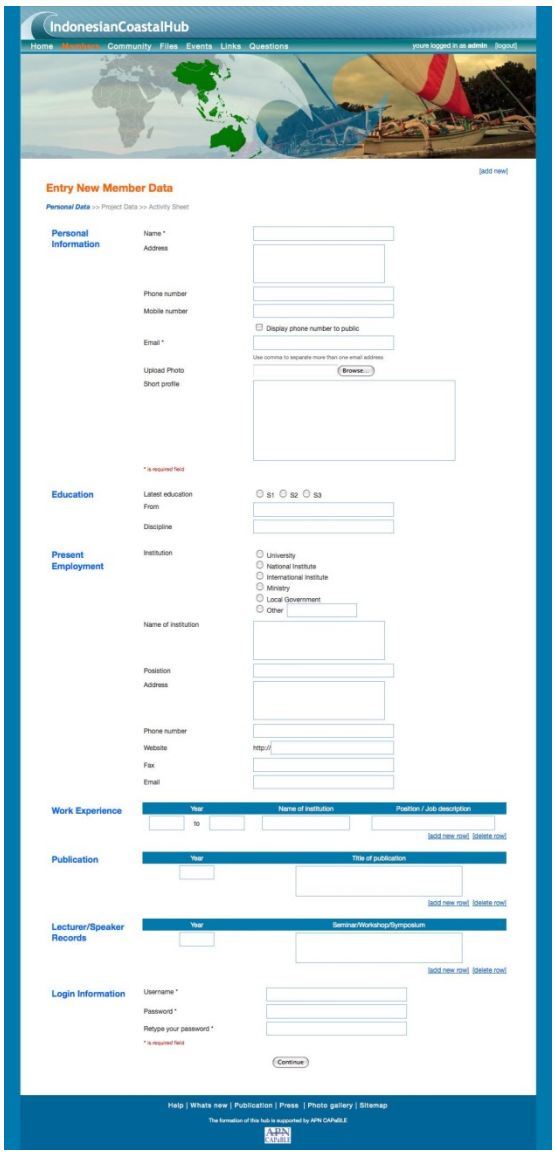


Figure 3. A snapshot of application form for a new member based on the invitation of the current members

Finally the Hub was launched during an International Workshop and Symposium 16-20 May 2009 in Bandung under an independent site www.IndonesianCoastalHUB.org as one of the results of this project.

Picture 4. The participants of the WorkShop, 20-21 March 2009

3.2. Indonesian Capacity

One of the aims of the project was to investigate the weakest areas in the Indonesian Capacity, i.e. the area in which coastal zone management has to be improved in order to be able to cope with expected changes from Global Change.

From the discussions during the meetings, and form the results of the questionnaires, it became evident that when it concerns the social aspects of the development of the coastal community, expertise is well available and that there is much interest and activities.

Universities like Institut Pertanian Bogor (IPB, Bogor Agricultural University) and Universitas Gaja Madah in Yogyakarta, and the governmental research institute LIPI pay much attention and have many projects in these areas. Local communities around the coast are investigated in a supportive way. Fishery activities along the coast are well investigated and support for fishermen is given.

It is to be expected that if problems due to Global Change become more pronounced, which is to be expected, the scientific infrastructure is there to try to cope with these problems just as well as that will be the case in other countries. This does not mean that such problems can be overcome easily, but that in these areas no severe discrepancies in knowledge or experience exist with other countries when compared to international standards.

A somewhat different conclusion was drawn when it concerns the aspects of the coastal zone at the 'wet side', i.e. when concerning the ocean and sea waters interacting with the coast or with ships and off-shore structures. To describe the present situation it is important first to recognize the possible effects of GC.

Meetings (WorkShops & Symposium) held during the project execution concluded that GC will lead to various changes that directly affect the coastal zone:

- Sea level rise. Clearly this will affect the coastline, and in shallow coastal areas can lead to loss of much land area, forcing the people to move to other areas. At this moment there are not yet hard evidence that this sea level rise place an important role, since it interferes with other aspects also.
- Changing of global current. This refers to a very global effect that is not well understood at this moment. It is unclear if it may actually happen, but changes in global warming and global sea (surface) temperature may induce an unbalance in the sensitive differences that now exists between different oceans and seas and which determine the direction and strength of the exchange by currents of water. The Indonesian Through flow, which accounts for exchange between the Pacific ocean and the Atlantic ocean through flow from the Chinese sea to the Indian ocean, could theoretically (?) change direction. This would lead to a huge disturbance of biological and ecological situation, especially for a country like Indonesia with its large bio-diversity. But it will also give rise to large changes in the interplay between currents and wind waves, and may endanger the direct safety of the coastline.
- Even without changes in global currents, wind waves can be expected to become higher because of stronger winds as an expected result of GC. Higher waves seem to become more common already, in view of increasing number of unofficial reports of high waves that affect the coast.
- Stronger winds, combined with global warming may also increase the number of cyclones in the neighbouring countries of Indonesia (like Australia), but with effects of much higher waves at Indoensian coast. (See as example the contribution in the workshop "Simulation of Impact of Storm Surges Vulnerable Area along Southern Coast Of Java Caused by Cyclones Jacob and George in March 2007".)
- Changes in water waves, will also lead to morphological changes, by changing patterns of sedimentation. Erosion of beaches, and sand depositions along large coastal infrastructures like harbours, may give large changes and problems.
- In the Indonesian archipelago, ship transportation between the many islands plays an important role. For various reasons this transportation is not very safe, mainly because of using ships with characteristics that do not well match the prevailing waves very well. Increased wave heights may make this problem more severe, ship transportation even more dangerous.

However, discussions during those meetings also recognized that the above descriptions are rather qualitative, and should be supported with much more research. Participants of the meeting realized that this type of research is hampered for a number of reasons.

- Wave Data. One of the problems is that there does not exist a reliable data set about the Indonesian wave characteristics. While it is common in most western countries to have measurements of waves for long periods of time, often over a period of tens of years, in Indonesia such measurements do not exist. Occasionally, for

specific purposes, measurements are performed for specific reasons, such as design of off-structures, or harbours. Then measurements of waves during some periods in one year are used to obtain (rather unreliably with the limited data set) information about extreme weather situations and estimates of maximal possible waveheights (1 in 100 year waves).

Not knowing accurately the wave characteristics for extreme situations hampers the design tasks mentioned above, but also makes impacts of GC more difficult to observe or anticipate.

Not knowing accurately the wave climate (the average wave situation) hampers simulations of erosion and morphological changes, at present and possible impacts of GC.

- Internationally there is much attention for coastal oceanography, and (sometimes free) software is available for increasingly accurate numerical simulations of the interplay between waves, currents, and tides. In Indonesia the groups that have shown to be able to perform such research are very limited. Except from some individual scientists scattered over universities, governmental research institutes and ministries, the largest and best qualified group with a substantial amount of researchers is a group at ITB (Institut Technology Bandung). Because of their expertise, they are involved in many specific projects for which their support is requested. This is very important, but also has as effect that the building of a large institutional infrastructure is hampered somewhat.
- Although some knowledge and infrastructures are present, it should explicitly be observed that (larger) commercial advisory companies are almost absent in Indonesia. Such companies are quite common in western countries; they usually have good connections with universities where the knowledge is generated and transferred, and safeguard the scientists form daily routines to deal with specific actual problems, while shortcomings of the theory/software in these practical cases can easily be transferred back by these companies to the scientists.

The meetings further concluded that future direction is needed where independent institutions and possibly advisory groups or companies can play a role in filling the current gap where university scientists are replacing the absent of these consulting companies.

4. Conclusions

Restate the study aims or key questions and summarize your findings

The aim to start to connect the Indonesian Capacity in the area of Coastal Zone Management has been achieved in two ways.

- Various opportunities have been created and used to directly connect major players in this area by personal contacts.
    - In the two preparation meetings they gave valuable information to identify the weakest areas in CZ research and capacity, and reacted to preliminary versions of the database under development. Personal contacts were laid and enforced during informal parts of the meetings.
    - In the workshop and the symposium more formal exchange of knowledge was efficiently communicated. In the workshop, for a group of interested, predominantly young, people, details of many modeling and software tools were explained and illustrated. The lectures of the symposium gave a broad overview of many aspects of Coastal Zone Management.
- The successful design and launching of the database with expertise of some 80 scientists is a second way to connect to the Indonesian capacity. On the one hand, experts now have an easy way to connect and exchange info about projects and data. On the other hand, the website gives opportunities for others to see the experts in various areas of CZM. The future use will make clear how successful this will be, but the maintenance of the website and continuous update of the website is guaranteed by LabMath-Indonesia.

The project has also successfully identified the weakest spot of the CZM expertise, and recognized that modeling and simulation of the ocean and sea waters can still be improved compared to international standards, especially with respect to institutional activities, despite good quality of some individual activities on incidental cases.

5. Future Directions

In line with the work of this project, the maintenance of the website and continuous update of the website will be taken care of by LabMath-Indonesia.

In the meetings organized in this project, the wish was expressed several times to have yearly meetings. To make this practically possible, without structural funding, it was suggested to let such meetings take place at various locations, possibly as part of other meetings that are organized. LabMath-Indonesia feels the responsibility to investigate the possibilities and to announce such meetings through the website.

Concerning improvement and extension of the Indonesian capacity in the area of coastal oceanography, the APN-workshop gave a glimpse of the opportunities that can be explored to bring international and Indonesian expertise to a wider group of (young) people. More attention to this group is needed to stimulate work in this scientifically interesting and very relevant area.

International experts, including the experts who contributed to this project, have indicated to be willing to remain involved and to contribute.

Although universities play a major role in the educational aspects, independent institutions and possibly advisory groups or companies could play a role in the faster development. It remains to be seen how this will develop in the future. LabMath-Indonesia will try to contribute to this development.

6. References

Follow a standard format when citing your references

Hamzah Latief, *Tsunami Modelling and their Mitigation*, International Workshop Coastal Oceanography: waves, currents, tides & tsunami, 16-17 May, Bandung Indonesia

Andi Jamaluddin and Samudro, *Impacts of environmental loads on safe sea transportation*, International Workshop Coastal Oceanography: waves, currents, tides & tsunami, 16-17 May, Bandung Indonesia

Indra Jaya, *Coastal Current: Generation, Measurement and Its Effect on Coastline and Coastal Fisheries*, International Workshop Coastal Oceanography: waves, currents, tides & tsunami, 16-17 May, Bandung Indonesia

Poerbandono, *Spatial approach in watershed and coastal studies, International Workshop Coastal Oceanography: waves, currents, tides & tsunami*, 16-17 May, Bandung Indonesia

Safwan Hadi, *Simulation of Impact of Storm Surges Vulnerable Area along Southern Coast Of Java Caused by Cyclones Jacob and George in March 2007*, International Workshop Coastal Oceanography: waves, currents, tides & tsunami, 16-17 May, Bandung Indonesia

Gerbrant van Vledder, *Spectral wave modelling in coastal waters*, International Workshop Coastal Oceanography: waves, currents, tides & tsunami, 16-17 May, Bandung Indonesia

Brenny van Groesen, *Deterministic wave modelling and simulation*, (17-05-2009) International Workshop Coastal Oceanography: waves, currents, tides & tsunami, 16-17 May, Bandung Indonesia

Luky Adrianto, *The social-ecological system approach in the context of integrated coastal management and governance*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Jamaluddin Jompa, *Climate Change, Potential Impacts on Coral Reefs, and Management Challenges*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Hamzah Latief, *Coastal Zone Research*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Dietriech G. Bengen, *Climate change and global warming: implication to coastal zone and small islands, and strategic perspective of adaptation,* International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

John I. Pariwono, *Ramification of sea level rise on sea-border between neighbouring countries*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

M.M. Julian, Poerbandono and P.J. Ward, *The role of precipitation, temperature, and land cover in controlling run-off of the northwest of Java coastal zones: a climate change perspective*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

T. Ferijal and Patricia K. Smith, *Freshwater inflows modeling using SWAT*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Gerbrant van Vledder, *Wave modelling in a tidal inlet system*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

YAB Labmath, *Indonesian Water Balance and Waterfootprint*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Kadarsah, *District Level Prediction for Assessment of the Impact of Climate Change on Coastal Management*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Budianto Ontowirjo, *Hydrodynamics and sediment transport modelling for softshore protection in ICZM*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

W.Windupranata and I.Hayatiningsih, *Past-decadal simulations on ocean waves, tides, currents and sea surface temperatures on the northern coast of West Java*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Dewayany Sutrisno, *Spatial assessment modeling for the impact of climate change on coastal management*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Agus Salim, *The study of ecological risk assessment of oil spill in Jakarta bay water*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Y.R.A. Lumingkewas, R. Poerbandono and K. Prijatna, *Recent adaptation measures and the progressing regional environmental settings in Seribu Islands, Java sea*, Indonesia, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Brenny van Groesen and Didit Adytia, *Variational Boussinesq Simulations of harbour waves*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Edvin Aldrian, *Carbon nutrient coastal fluxes over Java and the possible impacts to global climatic changes*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Jonson Lumban Gaol, *Impact of climate change on phytoplankton chlorophyll in Indonesian waters*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

Ricky Rositasari, Suyarso, Afdal, Suratno and Bayu Prayuda, *The impact of climate change to several aspects of coastal system*, International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May, Bandung Indonesia

E. van Groesen & Andonowati, *Modelling in the Natural Sciences*, (06-05-2009) key-note lecture ICONES 2009 (International Conference on Natural and Environmental Sciences) Banda Aceh 6-8 May 2009

D. Adytia, W. Kristina and E. van Groesen, Poster, *Tsunami Waveguiding Simulation Above Synthetic and Realistic Bathymetries,* European Geosciences Union General Assembly 2009 Vienna, Austria, 19 – 24 April 2009

E. van Groesen, *Indonesian environmental and coastal water, climate change related challenges*, (20-11-2008) First Bi-regional Science & Technology Policy Dialogue SEA-EU-Net, 19-20 November Paris

E. van Groesen, A. Sopaheluwakan, Andonowati, D. Adytia, *Modelling and Simulation in the Coastal Zone area* (17-12-2008) Third AIWEST-DR 2008, TDM-RC Banda Aceh, 17-19 December, Indonesia

7. Appendices

7.1 Annex-file: Conferences / Symposia / Workshops

- Interim Report (including report first meeting)
- Report second workshop meeting
- Report International Workshop and Symposium and Launching Expert DataBase IndonesianCoastalHUB, 16-20 May 2009
- Schedule and abstracts International Workshop Coastal Oceanography, 16-17 May 2009
- Schedule and abstracts International Symposium Effects of Climate Change on Coastal Zone Management, 18-20 May 2009

7.2 Funding sources outside the APN funding

Indicated in the financial report are other sources of funding:

- Contributions of organizing institute LabMath-Indonesia, and
- Contributions of Universities of foreign experts, University of Delft and University of Twente.

7.3 Pdf prints of Power Point Slides

used during the May symposium & workshop can be found at:
www.labmath-indonesia.org/lectures.

Interim Report for CAPaBLE Project
CBA2008-08NSY-Andonowati

Part One (350 words)

1. Project Title : Integrating Indonesian Capacity for Coastal Zone Management

2. Project Leader Details:
   Name: Andonowati
   Institution: LabMath-Indonesia
   Email Address: aantrav@attglobal.net
   Website labmath-indonesia.or.id (/apn)
3. Collaborating Countries: Indonesia, Japan, Netherlands
4. Non-technical summary:

   In May 2007 waves of 5 to 7 meter high invaded the shoreline at the south-coast of Jawa, causing casualties and coastal settlements ruined. This exceptional event illustrates the impact on the coastal areas of bad weather conditions that are likely to become custom as an effect of GC. This project will contribute to a better Management of Coastal Zones by building an Integrated Capacity from elements that are now isolated at Indonesian institutions. The project will identify and improve the weakest subjects and maintain the integrated capacity.

Part Two

5. Project Objectives

   The main objective is to structure and integrate the existing isolated capacities in the areas of CZS, CZM, and GC. Currently, the capacities of human resources, existing knowledge, and infrastructures are scattered over several institutions. The integrated capacity is needed for future collaboration to withstand the effects of GC by improved CZM. These effects are likely to be more extreme weather conditions, leading to larger waves affecting the coastal area.
6. Amount of Funding Received for 2008/2009

   35.000 USD (approved); 28.000 USD received.
7. Relevance to the APN's Science and Policy Agendas

   The integration of technical/engineering and management aspects of CZM into a truly Integrated approach will have direct relevance for the policy makers from the local to the national level. Especially at this time that local authorities and policy makers in Indonesia get more autonomy, and thereby responsibility, for the development of water resources, an improved organization and quality of the Integrated CZM will have a large impact on the policy process.

   The link to Policy Processes is supported by a component of the proposed team members that involves a representative from decision makers' agency and from activities above. In each workshop, invitations will be made to policy makers. Further, Activity#4 is dedicated to ensure the sustainability of the proposed approach.

8. Work undertaken and results to date (please comment on progress against your project timeline as well as any problems you have encountered)
   - Because of some delay in the start of the project caused by miscommunication between the applicants and APN-office, the project execution started 2 months later. We will try to catch up with the delay, and aim to finish the project as planned in July 2009.
   - The Initial meeting took place at 24-25 October 2008, according to the project description, attended by 10 participants, scientists and policy makers. A report of the meeting is available on-line. In this meeting, it was suggested that the first list of the people to be included in the expert data base and interviewed are restricted to the best or most influential scientists, practitioners, and policy makers related to coasted zone management.

- The design of the expert data base, and the collection of data, started in September 2008. A questionnaire was designed and made online available on the apn-project website www.labmath-indonesia.or.id/apn. Besides that, various scientists and institutions have been visited for oral interview. In total, extensive data of some 50 people have been assembled now; incomplete data of more people will be completed further. Some of those 50 people were recommended by the participants attended the first meeting.
- The analysis of the data will take place during February and March 2009, and the second 2-day workshop meeting is now being prepared for March/April 2009.
- The 5-day workshop with Final Meeting is being designed to take place in May 2009 after the World Conference on Oceans.

9. Self evaluation against project objectives
   - The input of the first meeting was useful, leading to various changes in the prepared questionnaire and suggestions for scientists/ policy makers to be included.
   - It turns out to be rather difficult to get response on the request to fill out the project questionnaire. Yet, information from internet and/or Curricula Vitae makes it possible to achieve the aim of the project. It is expected that the database will be a useful substitute for a (ten year) old list of names that are assembled in an ICZM directory from IPB.
   - The 5-day workshop with Final Meeting is scheduled to take place just after the WOC, with the hope that this will make it easier to attract interested scientists from abroad. At the moment it is discussed if it is possible to organize this meeting together with IPB (the Agricultural University at Bogor), since they cover a large part of ICZM activities, including information to local communities, fisheries etc. For that reason it seems that the course (that should address in particular the weaker points) can be restricted to more physical-oceanographic topics, such as effects of Climate Change on wave climate, storm surge, and even maybe cyclones. The analysis of the data base in the coming months will make these matters more precise.
10. Publications (to date and/or pending)
    No publications; oral presentations:
    - E. van Groesen, *Indonesian environmental and coastal water, climate change related challenges*, (20-11-2008) First Bi-regional Science & Technology Policy Dialogue SEA-EU-Net, 19-20 November Paris
    - E. van Groesen, A. Sopaheluwakan, Andonowati, D. Adytia, *Modelling and Simulation in the Coastal Zone area* (17-12-2008) Third AIWEST-DR 2008, TDM-RC Banda Aceh, 17-19 December, Indonesia

11. Acknowledgments
12. Appendix: Photographs, Diagrams, Graphs for APN (website) dissemination

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The interim report is to be used in a special APN publication and as such should be written in the form provided above in **Calibri Normal Font Size 10.5** and should not exceed **2 pages** in length. The deadline for submission of this interim report is **Monday 19th January, 2009**. The report should be submitted electronically as a **WORD DOCUMENT** to Linda A. Stevenson lstevenson@apn-gcr.org, Scientific Officer and Kristine Garcia kgarcia@apn-gcr.org, Programme Fellow for Scientific Affairs of the APN Secretariat.

Report of Workshop Meeting
APN CAPaBLE Project

Integrating Indonesian Capacity for Coastal Zone Management
CBA2008-08NSY-Andonowati

THE MAIN OBJECTIVE of this project is to identify and to integrate, the existing capacities in areas of Integrated Coastal Zone Management (CZM), in order to become better able to cope with the effects of Global Change (GC). The effects of GC with more extreme weather situations will have serious consequences for the coastal area; a more integrated capacity can be better equipped to cope with the foreseeable problems. An inventory of specific capacities in various areas of CZM will become available through an open database website. Hopefully, this database can be used as a tool for each person in the database to public their activities, furthermore the users may have opportunity to build collaboration among them, for instance to exchange data personally.

Agenda

- To evaluate the progress of the database construction
- To discuss the idea and content of coastal hub
- Preparation for the final meeting, workshop and symposium

Time and Venue

The two day Workshop Meeting was held in: 20th of March, 2009, at Prima Taste Restaurant, Jl. Ir. H. Djuanda no 145 Bandung, and 21st of March, 2009, at Puri Bima Room, The Jayakarta Hotel, Ir. H. Djuanda no 381A Bandung.

Meeting Participants

This meeting was attended by 18 participants. Details of the participants are listed in the table below.

No	Name	Institution	Email
1	Dr. Andonowati	Project Leader, LabMath Indonesia	aantrav@aatglobal.net
2	Dr. Ardhasena Sopaheluwakan	General Project Manager, LabMath Indonesia	ardhasena@labmath-indonesia.or.id
3	Dr. Sugiarta Wirasantosa	Ministry of Marine Affairs and Fisheries	swirasantosa@yahoo.com
4	Dr. Augy Syahailatua	Research Centre for Oceanography-Indonesian Institute of Sciences	augy001@lipi.go.id
5	Dr. Poerbandono	Faculty of Earth Science and Technology, Bandung Institute of Technology	poerbandono@gd.itb.ac.id
6	Dr. Agus Setiawan	Agency for Assessment and Application of Technology (BPPT)	setiawan.agus@gmail.com
7	Dr. Agus Supangat	Ministry of Marine Affairs and Fisheries (BRKP)	supbrkp@yahoo.com
8	Dr. Budianto Ontowirjo	Agency for Assessment and Application of Technology (BPPT)	ontowirjo@gmail.com
9	Dr. Dewayani	National Coordinating for Survey and Mapping Agency (Bakosurtanal)	dewayani@bakosurtanal.go.id
10	Dr. Indra Jaya	Dean of Faculty of Fisheries and Marine Science, Bogor Agricultural University	indrajaya@ipb.ac.id
11	Prof. Jacub Rais	Director of Postgraduate Program of the National Institute of Technology at Malang	jrais@indo.net.id
12	Dr. Jonson Lumban Gaol	Faculty of Fisheries and Marine Science, Bogor Agricultural University	jonsonrt@yahoo.com
13	Dr. M. Djuwansyah	Research Center for Geotechnology, Indonesian Institute of Science	djuwansah@geotek.lipi.go.id
14	Dr. Parluhutan Manurung	National Coordinating for Survey and Mapping Agency (Bakosurtanal)	parlman@cbn.net.id
15	Prof. Safwan Hadi	Faculty of Earth Science and Technology, Bandung Institute of Technology	safwan@ppk.itb.ac.id
16	Dr. Zainal Arifin	Research Centre for Oceanography Indonesian Science of Institute	zarifin@dnet.net.id
17	Chairul Paotonan, MT	Lecturer in Civil Engineering, Hasanuddin University, Makassar	paotonan_ch@yahoo.com
18	Oki Setyandito, MT	Lecturer in Civil Engineering, Mataram University, Nusa Tenggara	okisetyandito@yahoo.com

Discussion and Suggestions:

The workshop meeting was opened by presentation from Prof. Safwan Hadi with topic "Policy in Integrated Coastal Management", continued with Dr.Andonowati presentation in "Opportunity for Research Park Establishment in Indonesia and Coastal Hub Concept"

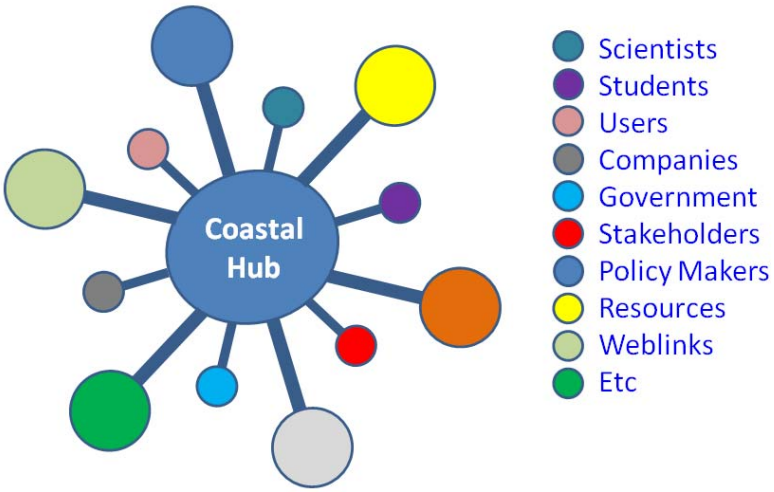
After lunch break, a short demonstration of what the coastal hub look like in the future was shown. Discussion among the experts took place afterwards.

Basically, the idea of the creation of the so called Indonesian Coastal Community Hub is the hub will serve as a complete / representative / integrated hub that gives the facility to community members to identify themselves, to found and to be found by other community members.

Therefore, the hub will become more beneficial that the ordinary portal or website since the community members will be responsible to his/her own page in the hub, just like the social networking site.

Most of the responses were positive, but several suggestions came up in technical aspects of the coastal hub, such as

- The data security of the expertise
- The spatial distribution of the expertise and their published/not-published research showed by Indonesian Map
- Several add-ons tools in profile/home page to help user in updating their profile or inviting their colleagues
- Maintenance and administration of future Indonesian coastal hub hosting will be the responsibility of LabMath-Indonesia



Furthermore, in relation to the coastal hub, will be create a mailing list (mailist) which contains names of the participants in workshop meeting for disseminating information and progress regarding the coastal hub from now until the launching day in May 2009.

There was also a creation contact person list or person in charge in several institutions where the participant came from such as education institution (IPB, UGM, ITB), and governmental institution (LIPI, BPPT, DKP, Bakosurtanal, ISOI).

Report for CAPaBLE Project CBA2008-08NSY-Andonowati
International Workshop and Symposium
and Launching Expert Data Base IndonesianCoastalHUB
16-20 May 2009

Workshop, Symposium and launching of the Data Base as part of the APN-Capable project

In the approved project description this is the fourth activity.

Design and Announcement

A 5-day workshop with Final Meeting was scheduled to take place just after the WOC.
To be able to present a more global view on the many aspects, it was decided to split the meeting in a 2-day workshop and a 3 day symposium.
The previous activities of this project have shown that the specific weaknesses in the Indonesian Capacity in Coastal Zone Management lie in particular on the ocean side and on the immediate land-ocean interaction. Knowledge about management of the land-part of the Coastal Zone is well covered by the many activities (teaching, advice, local community interaction) by the Indonesian Agricultural University IPB (Institut Pertanian Bogor), and has much attention also at universities in Yogyakarta (Universitas Gadjah Mada) and Makassar (Universitas Hassanuddin).
Therefore it was decided to take the 'water-land' topics, physical-oceanographic topics, such as effects of Climate Change on wave climate, storm surge, and even cyclones, as main focus for the 2-day workshop and the 3-day symposium:

International Workshop Coastal Oceanography: waves, currents, tides and tsunami;
International Symposium: Effects of Climate Change on Coastal Zone Management.

The activities were announced well in advance, by website, email and posters, to reach many universities and institutions in Indonesia; members of the capacity data base also helped to spread the announcement.

Execution

Good lecturers were invited and responded positively.
For the workshop 8 lecturers were approached; because of time-limitations, it was decided in good agreement that the contribution of Prof. Takao Yamashinta was cancelled, but follow-up arrangements were agreed to organize a workshop with him as main contributor, at a tie more suitable for him. Two of the seven lecturers came from The Netherlands.
For the Symposium 3 Workshop lecturers and an additional 8 lecturers gave 11 invited lectures; 6 contributed papers were presented.
The launching of the website www.IndonesianCoastalHUB.org took place with an explanation, demonstration and discussion.
In the Annex the schedule of the 5 days and abstracts of the lectures are given. The presentations of all lectures are available online and can be downloaded from the above site.
A selection of photographs of the meeting is found below.

Participation

For the Workshop 28 participants were accepted who also formed the core of the participants of the successive Symposium. In total 47 people participated in the Workshop and Symposium.

Conclusion

The interest for these activities was larger than could be accommodated within the constraints given by the budget. Positive reactions from applicants, participants and lecturers indicate that the need for such meetings is very large. Together with the high quality of the lectures it is much desirable to have succession of this type of meeting to further develop capacity in this area.

PARTICIPANTS List

No	Name	Institution
1	Agus Setiawan	Agency for Assessment and Application of Technology
2	Annisa	Bandung Institute of Technology
3	Ardi Irawan Putra	Bandung Institute of Technology
4	Arief Rullyanto	Bandung Institute of Technology
5	Aries Dwi Siswanto	Sepuluh Nopember Institute of Technology
6	Bagus Dwi Nurindro	Diponegoro University
7	Edi Kurniawan	Diponegoro University
8	Erik Ensing	University of Twente
9	Fajri Dwihastasi Justitianto	Bandung Institute of Technology
10	Ferdinand van den Brink	University of Twente
11	Huda Bachtiar	Bandung Institute of Technology
12	Izzatul Ummah	LabMath-Indonesia
13	Indra B.P.	Bandung Institute of Technology
14	Johan Risandi	Research Institute for Mariculture – the Agency for Marine and Fisheries Research
15	Mashuri	Bandung Institute of Technology
16	M. Maskur Tamanyira	Diponegoro University
17	Mujahid Sukarno	Diponegoro University
18	Rahmi Dina	Bogor Agricultural University
19	Ranggi Fajar Muharram	Diponegoro University
20	Retno Anggraeni	Bogor Agricultural University
21	Salman Fariz	Diponegoro University
22	Yoke Hany Restiangsih	Diponegoro University
23	Yuliana Fitri Syamsuni	Bogor Agricultural University
24	Anindya Matuari D.	LabMath-Indonesia
25	Winkausyar	LabMath-Indonesia
26	Samudro	Indonesian Hydrodynamic Laboratory
27	Iqbal Yulizar M.	LabMath-Indonesia
28	I.Hayatiningsih	Bandung Institute of Technology

APN-Capable project

Project Reference: CBA2008-08NSY-Andonowati
Project Title: **Integrating Indonesian Capacity for Coastal Zone Management**

LECTURERS List

No	Name	Institution
1	Andonowati	LabMath-Indonesia
2	Brenny van Groesen	LabMath-Indonesia
3	Dewayany Sutrisno	National Coordinating for Survey and Mapping Agency
4	Dietriech G. Bengen	Bogor Agricultural University
5	Edvin Aldrian	Meteorological, Climatological and Geophysical Agency
6	Gerbrant van Vledder	Alkyon & TU Delft
7	Hamzah Latief	Bandung Institute of Technology
8	Jamaluddin Jompa	Hasanuddin University
9	John I. Pariwono	Bogor Agricultural University
10	Jonson Lumban Gaol	Bogor Agricultural University
11	Kadarsah	Meteorological, Climatological and Geophysical Agency
12	Luky Adrianto	Bogor Agricultural University
13	Safwan Hadi	Bandung Institute of Technology
14	Miga M. Julian	Bandung Institute of Technology
15	Ricky Rositasari	Research Center of Oceanography, Indonesian Science Institute
16	W. Windupranata	Bandung Institute of Technology
17	Yellen R.A. Lumingkewas	Bandung Institute of Technology
18	Andi Jamaluddin	Indonesian Hydrodynamic Laboratory
19	Poerbandono	Bandung Institute of Technology

APN-Capable project

Project Reference: CBA2008-08NSY-Andonowati
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APN-Capable project

Project Reference: CBA2008-08NSY-Andonowati
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SCHEDULE AND ABSTRACTS

International WORKSHOP

16 -17 May 2009

Coastal oceanography:
waves, currents, tides & tsunami

Saturday 16 May 2009

8:30-9:00	registration
9:00-9.30	opening, introduction participants/lecturers
9:30-10:30	**Hamzah Latief**
	Tsunami Modelling and their Mitigation
10:30-11:00	coffee
11:00-12:00	**Andi Jamaluddin and Samudro**
	Impacts of environmental loads on safe sea transportation
12:00-13:30	Lunch
13:30-14:30	**Indra Jaya**
	Coastal Current: Generation, Measurement and
	Its Effect on Coastline and Coastal Fisheries
14:30-15:00	coffee
15:00-16:00	**Poerbandono**
	Spatial approach in watershed and coastal studies
16:00- --	Discussion

Sunday 17 May 2009

9:30-10:30	**Safwan Hadi**
	Simulation of Impact of Storm Surges Vulnerable Area along
	Southern Coast
	Of Java Caused by Cyclones Jacob and George in March 2007
10:30-11:00	coffee
11:00-12:00	**Gerbrant van Vledder**
	Spectral wave modelling in coastal waters
12:00-13:30	lunch
13:30-14:30	**Brenny van Groesen**
	Deterministic wave modelling and simulation
14:30-15:00	coffee
15:00-16:00	Demonstrations
16:00- --	Discussion

TSUNAMI MODELLING AND THEIR MITIGATION

Hamzah Latief[1,2)] hamzah@ppk.itb.ac.id

and Haris Sunendar[2)] haris@ppk.itb.ac.id

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The catastrophic tsunami of December 26, 2004 caused nearly 283,000 deaths and more than one million people were left homeless in 13 Asian and African countries surrounding the Indian Ocean. Buildings and Infrastructures damage, economic and ecology loss were extremely high. Aceh Province in Indonesia suffered the most. One and half year after that i.e. July 17, 2006, the moderate tsunami occurred in West Java and killed more than 600 people. A large or moderate tsunami will occur somewhere in Indonesia sooner or later. These events triggered a number of initiatives to mitigate tsunami-related events. One of them is developing mathematical model for tsunami mitigation. In Tsunami Research Group, Institute of Technology Bandung (TRG-ITB), Indonesia, we are developing models for tsunami mitigation such as: precalculated tsunami modeling database for TEWS, source, propagation and inundation tsunami modeling and then modeling of the effectiveness of forests to reduce tsunami heights.

Keywords: *Tsunami, Precalculated tsunami database, Coastal forest, numerical model*

IMPACTS OF ENVIRONMENTAL LOADS ON SAFE SEA TRANSPORTATION

Andi Jamaluddin and Samudro

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Jl. Hidrodinamika, Kompl. ITS, Sukolilo- Surabaya

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Indonesian is one of the largest archipelago countries in the world in which two thirds of its territories consist of sea areas with nearly 18,000 islands and with a coastal line of 81,000 km, where two hundred million people are living. Consequently sea transportation plays very important roles in this nation's development in addition to the land modes transportation and the air modes transportation. Many types of sea transportation are operating in Indonesian waters for mobility of people and cargo and for means of connecting among islands.

However many ship accidents have unfortunately happened in Indonesian domestic seas in the past. Regarding this issue, ship safety is an important one. Many aspects have to be considered in respect to ship safety such as transfer, intact and damage stability, load lines and maneuvering qualities.

Ship performance in waves can be predicted through two kind of theoretical studies. First theory is the strip theory and the second one is simulation of ship motion in the wave basin. Strip theory is the most robust and accurate method to estimate the motion (sea keeping) qualities of ship in waves. Thereby it has been widely used for ship designs as well as ship operations from the view point of not only safety but also economy cost of ship operations. While the second approach is ship simulation in wave basin. When a ship traveling in following seas, of which length equals to the order of ship length, the encounter frequency of ship to the wave is very low in comparison with that in heading seas. In this situation, the roll motion occurs at approximately the natural roll period caused by the periodic change in static righting arm during the repeated passage of a wave crest followed by through. The maximum roll angles to port and starboard occur when a crest passes the midship section. In such circumstance, parametric rolling also referred to as the parametric resonance can result in capsizing.

In spite of wave heading, wave height also give large contribution to the ship roll motions or ship stability. The larger wave height the larger ship motion occurred. This statement is related to the recent issue "climate change". Climate change maybe the most significant issue facing

transportation today. Scientific consensus on climate change has grown rapidly in recent years to make progress towards the ultimate objective of studying the impact of climate change on sea transportation. This needs to predict the probability of extreme values of sea level, wave height, wind speed and their likely variation with changing climate. It is evidence that the impact of climate change gives a strongly influence on safe sea transportation.

COASTAL CURRENT: GENERATION, MEASUREMENT AND ITS EFFECT ON COASTLINE AND COASTAL FISHERIES

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The challenge of managing the length of Indonesian coastline, which is approximately 81.000 km or twice the circumference of the earth, is indeed huge for the present and future Indonesian coastal oceanographers. In this lecture, we will attempt to raise and to motive a young Indonesian coastal oceanographer to dwell into one of the important aspects of coastal oceanography that is coastal current or the movement of water at the coastal area. It is well known that the direction and strength of this water movement is highly depending on land formation at the coastal area and on the winds that blow along the shoreline. When the current run parallel to the shoreline (longshore current), which is often carried in it particulates or suspended sediment from one location to another along the shoreline on the horizontal direction, it may changes the shape of the coastline. In other case, when the wind blows across the sea surface and push water away from the coastal area and then to replace this water, the water from the bottom will rise up (upwelling). This subsurface or bottom water usually colder, contained rich in nutrient, hence biologically more productive. Upwelling process is very important for coastal fisheries since it enhance the productivity of the coastal water and makes the coastal area a better fishing ground. The lecture outline is as follows. First, the formation or generation mechanism of coastal current will be described. There are several types of current maybe found at the coastal area, but we will limit our discussion on the longshore current/drift and the upwelling or its reverse process, down-welling. Next, the method of how to measure this coastal current will be presented and discussed. In particular, we will emphasize on the current measurement using Acoustic Doppler Current Profiler (ADCP) instrument, which is now widely used. Example of the current measurement results will be provided. Finally, we will present several examples of the effect of coastal current on the Indonesian coastline and coastal fisheries. **Keywords:** *coastal current, coastline, fisheries*

SPATIAL APPROACH IN WATERSHED AND COASTAL STUDIES

Application of 'run-off calculator' in climate change perspective

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Spatial parameters define geometric relation between objects. They are commonly represented by (horizontal or vertical) distance and angle or direction, in the case that the reference angle is pre-defined. In this course, the use of spatial approach to imitate physical watershed processes is depicted, with simulation of run-off being the primary concern. Spatial approach uses spatial parameters to operate physical interaction between environmental elements. In this particular case, empirical formulae that relate environmental elements should be made available. The role of spatial data (i.e. maps) is prominent. When simulation over a period is to be made, the spatial data should also contain information that changes in time.

The use of existing tool and available empirical approach in calculating run-off across watershed is displayed in this course. The tool used here is Spatial Tools for River Basins and Environment and Analysis of Management Options (STREAM) [1]. STREAM applies Thornthwaite-Mather water balance calculation [2]. STREAM is raster-based Geographic Information System (GIS) and compatible to file format provided by IDRISI^{TM} GIS software. The primary inputs of this spatial tool are maps of topography, climate (i.e. air temperature and precipitation) and land use. The quality of the calculated run-off requires calibration and validation. Sufficient direct observation data should exist.

A study case from the northwest of Java coastal zone will be discussed. Run-off is presented as discharges of major watersheds contributing to the Jakarta bay. Prior to the application of such a spatial tool, several inputs are prepared. These include mainly flow direction map, spatio-temporal climate maps and water holding capacity (WHC) map. Flow direction map is derived from digital elevation model (DEM). Spatio-temporal climate maps are obtained from existing global dataset. WHC map is converted from land use data according to a look-up table. Model of drainage network derived from flow direction map can be verified with existing river network map. Record of air temperature and precipitation is used to verify the climate dataset.

Set up and calibration of the spatial tool [3] will be discussed. Reconstruction of discharges during the 20th century will be shown [4]. Ranges of application such a spatial approach will also be presented. These consist of the investigation of temporal discharge evolution, the role of climate and land use to discharge [5,6] and the estimation of watershed response to the prevailing rainfall climate [7]. Course participants are expected to obtain awareness to the requirement and working sequence prior to the use of spatial tool for simulating watershed processes. Course participants are also expected to obtain insight of advantages and limitations of using of such tool for wider spectrum of application.

References

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MAPPING OF STORM SURGE VULNERABLE AREA ALONG THE SOUTHERN COAST OF JAVA GENERATED BY CYCLONES JACOB AND GEORGE IN MARCH 2007

[a]Nining Sari Ningsih, [b]Marthina Dian Utami, and [a]Safwan Hadi

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Storm surges generated by tropical cyclone have often caused severe damage in the southern coast of Java. For example, storm surges of about 2 – 6 m attacked western coast of Sumatera and southern coast of Java – Bali on 16 – 19 May 2007, which were caused by huge strom with wind speed more than 126 km/hr (35 m/s) at the Cape of Hope (South Africa) on 9 May 2007 (Kompas, 19 Mei 2007). The storm surges led to serious disasters, such as: houses and infrastructures around the coastal areas are totally flooded, hundreds of families are displaced, tourism activities were unavailable, and fisherman ships are damaged. Therefore, accurate estimates of maximum storm surge (MSS) and inundation areas caused by storms are important.

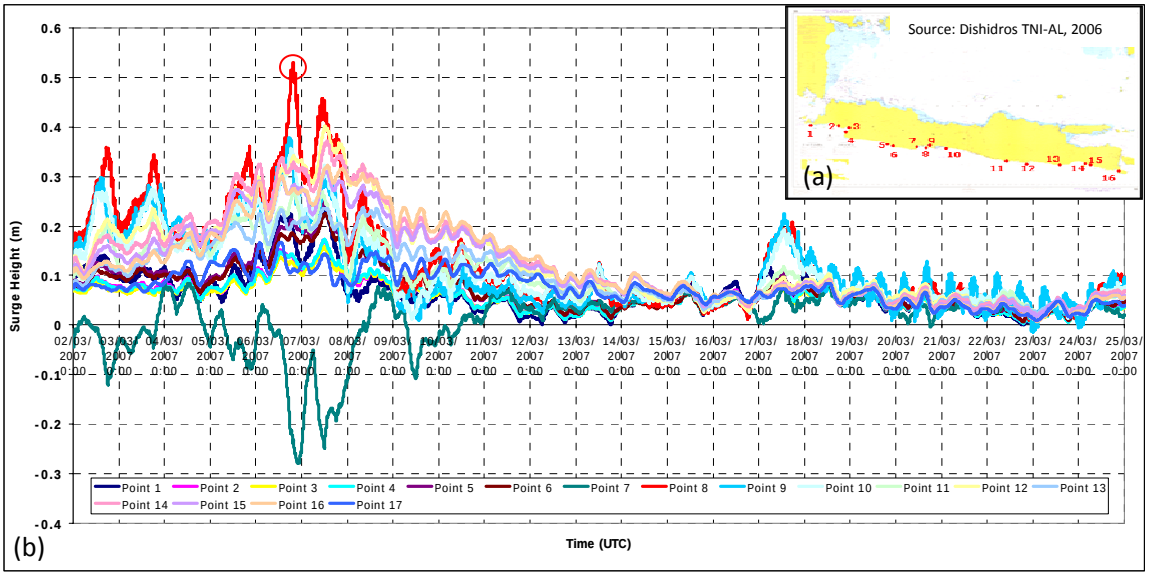

Figure 1. (a). Areas are mostly affected by the storm surge generated by the Cyclones Jacob and George; (b). Storm surge heights at those areas (Figure 1a); the red circle is the highest surge, occurred at Pananjung Bay (marked 8 in Figure 1a).

The subject of the present study is estimation of surge heights, water run-up, and inundation processes generated by the Cyclone Jacob on 2 – 12 March 2007 and by the Cyclone George on 3 – 9 Maret 2007 in northwestern part of Australian coastal waters, mainly based on a numerical model, namely by using a 2D hydrodynamic model of Mike 21 software (DHI Water & Environment, 2005). The model based on unstructured grid approach employing finite elements to solve the governing equations. The applied model allows for a very flexible discretization of the model domain. This is demonstrated by grid sizes, which vary from ~ 50 km in the deep ocean but a considerably higher resolution of about 150 m in the coastal area. To simulate water run-up and inundation processes, a wetting and drying (WAD) capabilities of the model was enabled.

The model domain covers coastal areas of southern part of Java and Indian Ocean. The storm surges event was simulated by imposing tidal elevations at the open boundaries, winds, and air pressure. Tidal elevation data derived from the tide model driver (TMD) of Padman and Erofeeva (2005), while wind and air pressure data were obtained from NCEP (National Centers for Environmental Prediction).

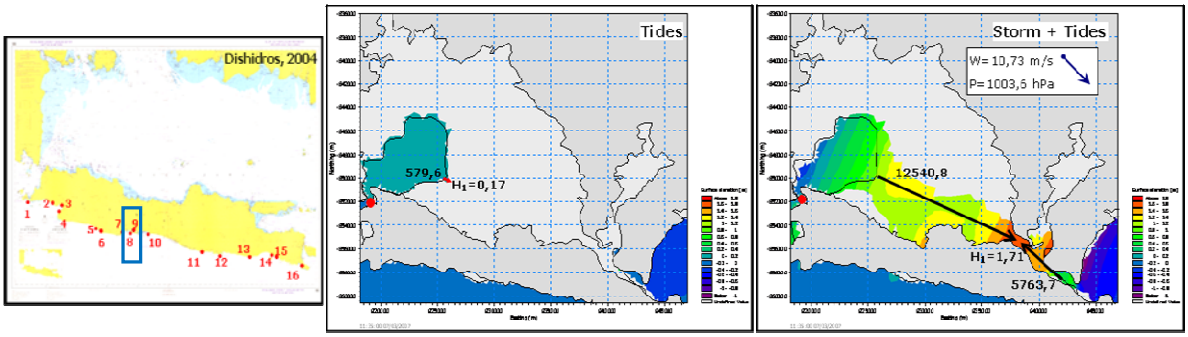

Figure 2. The simulated inundation area at Nusakambangan

Figure 1a shows areas mostly affected by the storm surge generated by the Cyclones Jacob and George, namely: Telereng Cape, Karang Taraje Cape, Pelabuhan Ratu, Ciletuh Bay, Pameungpeuk, Gedeh Cape, Parigi, Pananjung Bay (a part of Cilacap Regency), Nusa Kambangan (a part of Cilacap Regency), Karang Batu Cape (close to Kebumen Regency), Pacitan, Munjungan, Tapen Bay, Pelindu Cape, Pisang Bay, and Purwa Cape (marked 1 – 16 in Figure 1a). Meanwhile, storm surge heights at those stations can be seen in Figure 1b. It can be seen from the figure that the Pananjung Bay (marked 8 in Figure 1a, a part of Cilacap Regency) experienced the highest surge among the others stations, namely about 0.53 m, at 19:35 UTC on

6 March 2007. The waves generated by the tides and cyclones had attacked and inundated coastal areas of southern part of Java. Maximum distance of inundation and highest water run-up exist at the Nusa Kambangan a part of Cilacap Regency), namely about 12540.8 m and 1.71 m, respectively (as shown in Figure 2). In the figure, the boundary of the simulated inundation area after the event is shown as well.

Keywords: *storm surges, inundation, run-up, hydrodynamic model, wetting and drying capabilities*

SPECTRAL WAVE MODELLING IN COASTAL WATERS

Gerbrant van Vledder

Alkyon Hydraulic Consultancy & Research

And Delft University of Technology

This lecture gives an overview of the theory and computational methods to predict wind-generated storm waves in coastal waters. This is supplemented with an overview of various applications for wave forecasting and hindcasting, offshore engineering, coastal engineering, ship routing and wave climate studies.

Although the sea surface has a chaotic character, it can conveniently be described by the wave spectrum indicating how wave energy is distributed over directions and periods. Next, the energy balance equation is introduced describing the evolution of the wave spectrum in time and space. The main physical processes affecting the waves are discussed, such as the generation of wave energy by wind and dissipation by wave breaking, and the processes when the waves enter the shallow coastal zone and penetrate into harbours.

The energy balance equation forms the basis of numerical models to predict the generation, propagation and evolution of wind waves from oceanic scales to coastal scales. Examples will be given of various state-of-the-art models and modelling systems in use, such as the WAVEWATCH and SWAN model. Reference will be made to other types of wave models, e.g. those used to compute tsunami's.

A crucial element in the development of any numerical model is its validation. Since each numerical model is based on certain assumptions in setting-up the model, the range of applicability of each model must be assessed. Wave measurements play a crucial role in this validation. These measurements can be obtained from satellites or from wave buoys, and integrated in model applications.

Wave models are routinely used to predict worldwide wave conditions (forecast mode), such as done by the WAVEWATCH model. This information is used for ship routing, offshore operations and harbour entrance management. A recent application of such models is the prediction of freak waves. The models can also be used in hindcast mode to reconstruct wave conditions that have occurred at the time of, e.g., a ship accident. Another application of such models is to determine the normal and extreme wave climate at a certain location. Such climatic information

can be used for the design of coastal structures, the determination of the downtime of a harbour, long-term coastal morphology and coastal zone management. The latter application is becoming more and more important in view of climate change and sea level rise.

Finally, the prospect of setting up a wave forecasting system for the Indonesian coastal waters is discussed.

DETERMINISTIC WAVE MODELLING AND SIMULATION

E. (Brenny) van Groesen

University of Twente, Netherlands

& LabMath-Indonesia, Bandung

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This lecture gives an overview of the theory and computational methods for deterministic waves.

Applications include simulations of tsunamis - direct and inverse-, and simulations for coastal zone management, such as harbour waves.

The wave model developed at LabMath-Indonesia in collaboration with University of Twente is the so-called Variational Boussinesq Model (VBM). The basis of this model is the special property that water waves (when friction forces are neglected) can be described as a dynamical system as in Classical Mechanics. This implies that by using as variables the surface elevation and the potential at the surface, all interior fluid motions are incorporated (in an approximate way) from dynamic equations completely determined by the energy (or an approximation).

The simplest approximation of the wave energy leads to the shallow water equations. A more refined approximation includes dispersive effects. This is possible in such a way that at most second order spatial derivatives appear in the equations, which makes it possible to design relatively simple numerical implementations, such as with Finite Elements.

The code can deal with steep bottom variations, and transparent boundary conditions have been implemented; at the moment no run-up modelling is supported.

The version for the SWE is freely available, with documentation, although still in a premature stage for which the use of matlab is required; a more professional version is planned to be available before the end of the year.

International WORKSHOP

16 -17 May 2009

Coastal oceanography: waves, currents, tides & tsunami

International SYMPOSIUM

18 - 20 May 2009

Effects of Climate Change On Coastal Zone Management

Launching of **Expert Capacity Data Base**

IndonesianCoastalHUB

Bandung , Indonesia
Hotel Jayakarta

CBA2008-08NSY-Andonowati
Integrating Indonesian Capacity for Coastal Zone Management

Organized by

SCHEDULE AND ABSTRACTS

International Symposium

18 - 20 May 2009

Effects of Climate Change On Coastal Zone Management

Monday 18 May 2009

8:30-9:00	registration
9:00-9.30	Opening **Andonowati**
9:30-10:15	**Luky Adrianto** *The social-ecological system approach in the context of integrated coastal management and governance*
10:15-10:45	**Jamaluddin Jompa** *Climate Change, Potential Impacts on Coral Reefs, and Management Challenges*
10:45-11:30	coffee
11:30-12:15	**Hamzah Latief** *Tsunami Modelling and their Mitigation*
12:15-13:30	Lunch
13:30-14:15	**Dietriech G. Bengen** *Climate change and global warming: implication to coastal zone and small islands, and strategic perspective of adaptation*
14:15-15:00	**John I. Pariwono** *Ramification of sea level rise on sea-border between neighbouring countries*
15:00-15:30	coffee
15:30-15:45	**M.M. Julian, Poerbandono and P.J. Ward** *The role of precipitation, temperature, and land cover in controlling run-off of the northwest of Java coastal zones: a climate change perspective*
15:45 - --	Discussion
18:30 - --	**Symposium Dinner** at restaurant “Prima Taste”, Jl. Ir. Juanda 145, (Dago Street) Bandung

SCHEDULE

International Symposium

18 - 20 May 2009

Effects of Climate Change On Coastal Zone Management

Tuesday 19 May 2009

8:30-9:00	registration
9:00-9.45	**Gerbrant van Vledder** *Wave modelling in a tidal inlet system*
9:45-10:30	**YAB Labmath** *Indonesian Water Balance and Waterfootprint*
10:30-11:00	Coffee
11:00-12:30	**LAUNCHING WEBSITE INDONESIAN COASTALHUB** Presentation: **Andonowati** Demonstration: **Iqbal Yulizar M** Discussion www.IndonesianCoastalHUB.org
12:30-13:30	Lunch
13:30-14:15	**Kadarsah** *District Level Prediction for Assessment of the Impact of Climate Change on Coastal Management*
14:15-14:35	**W.Windupranata and I.Hayatiningsih** *Past-decadal simulations on ocean waves, tides, currents and sea surface temperatures on the northern coast of West Java*
14:35-14:55	**Dewayany Sutrisno** *Spatial assessment modeling for the impact of climate change on coastal management*
14:55-15:30	Coffee
15:30-15:55	**Jonson Lumban Gaol** *Impact of climate change on phytoplankton chlorophyll in Indonesian waters*
15:55- --	Discussion

SCHEDULE

International Symposium

18 - 20 May 2009

Effects of Climate Change On Coastal Zone Management

Wednesday 20 May 2009

8:30-9:00	registration
9:00-9.45	**Brenny van Groesen and Didit Adytia** *Variational Boussinesq Simulations of harbour waves*
9:45-10:30	**Edvin Aldrian** *Carbon nutrient coastal fluxes over Java and the possible impacts to global climatic changes*
10:30-11:00	coffee
11:00-11:20	**Y.R.A. Lumingkewas, R. Poerbandono and K. Prijatna** *Recent adaptation measures and the progressing regional environmental settings in Seribu Islands, Java sea, Indonesia*
11:20-11:40	**Ricky Rositasari, Suyarso, Afdal, Suratno and Bayu Prayuda** *The impact of climate change to several aspects of coastal system*
11:40-12:00	**Closing**
12:00-13:30	Lunch
13:30-15:00	Excursion to new Office **Lawangwangi** of LabMath-Indonesia

ABSTRACTS

INVITED LECTURES

THE SOCIAL-ECOLOGICAL SYSTEM APPROACH IN THE CONTEXT OF INTEGRATED COASTAL MANAGEMENT AND GOVERNANCE

Luky Adrianto

Center for Coastal and Marine Resources Studies

Bogor Agricultural University, Indonesia

Coastal zone is widely known as the most complex systems, both in terms of ecosystem and human system so that the need of integrated approach is considerably very important for enhancing efforts to achieve sustainable development objectives of such ecosystems. One of important approach in governing the coastal complex system is social-ecological system approach (SES approach). Anderies, et.al (2004) define social-ecological system as an ecosystem/biological unit intricately linked with and affected by one or more social systems. In this regards, Daly's full and empty world theory would be relevant to identify the relations among social actors in the complex ecosystems or between social actors and complex ecosystem. In this lecture, principle of SES management and governance would be emphasized with some relevant case studies.

CLIMATE CHANGE, POTENTIAL IMPACTS ON CORAL REEFS, AND MANAGEMENT CHALLENGES

Jamaluddin Jompa

Director of Center for Coral Reef Research, Hasanuddin University, Makassar

Executive Secretary of COREMAP II, Ministry of Marine Affairs and Fisheries

Climate change is not a mere prediction anymore, it has happened, and it will continue in the future. The warming sea surface temperature has caused a serious coral bleaching since 1998 and it seemed to be worsening in the following years. Coral bleaching involves the rejection of microalgal symbiotic zooxanthellae from the coral tissues, in response to stress, such as from an extreme seawater temperature (~2 ^{0}C warmer than average temperature). In the absence of these symbiotic microalgae, the reef builder Scleractinian corals may not be existent and dominate the reef any longer. The increasing CO_2 emission in fact not only trigger global warming and cause the reef to die from bleaching, but also affect ocean acidification that eventually make coral to grow slower. Furthermore, due to the global growing economy and development in the past century, coastal communities have put even bigger pressures to the coral reef ecosystem through destructive fishing, coral mining, sedimentation, and pollution. Then, are we going to lose our valuable coral reefs? Indonesia as the center of the Coral Triangle, of course rely so much on these resource, so we need to find the best solution urgently. The fate of our coral reefs seem to be gloomy, they face multi stressors, these indeed huge management challenges if we are going to save our coral reefs for future generation.

CLIMATE CHANGE AND GLOBAL WARMING: IMPLICATION TO COASTAL ZONE AND SMALL ISLANDS, AND STRATEGIC PERSPECTIVE OF ADAPTATION

Dietriech G. Bengen

Faculty of Fishery and Marine Science,

Bogor Agriculture Institute (IPB)

Indonesia that consists of more than 17.000 islands and 95.181 km of coastlines, makes it the biggest archipelagic state in the world and a host to rich and essential coastal and marine goods and services to society. Some 60% of the total Indonesia's population live on the coastal and small islands areas, and these areas become more crowded every year.

Coastal and marine environment are strongly linked to climate in many ways. The potential consequences of climate change are not yet being considered in Indonesia's coastal and small islands management. It is urgent to begin adaptation now with regard to development of coastal and small islands uses.

In coastal and small islands areas where beaches or wetlands must migrate inland to survive, implementing protection or retreat strategies for coastal and small islands developments can reduce the economic impacts of inundation and shoreline movement.

Key words: *coastal zone, small islands, climate change, global warming, adaptation*

RAMIFICATION OF SEA LEVEL RISE ON SEA-BORDER BETWEEN NEIGHBOURING COUNTRIES

John I. Pariwono

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The direct effect of climate change is the increase of surface air temperature causing warming of the Artic and Antartic regions, melting glacier ice, and in turn raising the global sea level. This eustatic change in sea level will conspicuously reduce the land areas of all coastal states of the world.

Furthermore, the global sea level rise is bound to have considerable legal ramifications on sea-borders between neighbouring states. Whether the existing sea-boundary requires adjustment or not depends on a number of factors, such as the bathymetric condition between the respective countries. When such adjustments took place the prevailing geopolitical condition need to be reshaped, and this could provoke political tensions, economical disputes, and conflicts between the relevant states.

The effect of sea level rise on Indonesian sea-border is discussed in this paper, since Indonesia has sea-borders with ten (10) neighbouring countries, and some of them need to be ratified.

WAVE MODELLING IN A TIDAL INLET SYSTEM

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The Netherlands is a low-lying country protected by an elaborate system of dikes. Without these dikes about 40% of the Netherlands would be flooded. The safety of these dikes is a major concern for the coastal authorities. By law, these dikes must be monitored every five years (2001, 2006, 2011, etc.) to assess the required level of protection. This check is based on Hydraulic Boundary Conditions (HBC) that are derived every five years. In this way, the latest developments in statistical analysis, climate change, modelling techniques and strength of coastal structures can be accounted for. The HBC consist of near-shore water levels and wave conditions.

Presently, a long-term investigation is taking place in the Netherlands to determine these HBC for the Wadden Sea. This is a shallow sea situated in the north of the Netherlands and partly sheltered from the North Sea by a number of barrier islands. The Wadden Sea is connected to the North Sea via a number of tidal inlets. The water depth in the Wadden Sea varies from about 25 m in the tidal channels up to +1 m above mean sea level on the tidal flats. In addition, a set of 10 wave buoys is deployed to measure the wave conditions in the tidal inlets and interior of the Wadden Sea.

The wave conditions in the Wadden Sea are determined by transforming North Sea wave conditions into the Wadden Sea using the spectral wind wave model SWAN. This model is driven by storm winds. Wave boundary conditions are obtained from wave buoys located in the North Sea. Water level and current fields are provided by numerical flow models. The wave buoys are used to assess the reliability of the wave model in storm conditions.

The wave model computations show that the tidal inlets act as an effective filter for the North Sea waves, such that the wave conditions are mainly locally determined. Since the Wadden Sea is rather shallow, the wave height becomes depth-limited. The role of the various physical processes acting on the waves will be illustrated. This includes the role of the processes of generation and dissipation of the waves, as well as the role of propagation effects. A weak point in the present modelling is the penetration of low-frequency wind waves (waves with periods larger than 10 s) through a complicated bathymetry.

Sensitivity analyses were performed to assess the effect of climate change on the wave conditions in the interior of the Wadden Sea and along the dikes of the Netherlands. These changes include a sea level rise and increased storm conditions on the North Sea. The results of studies were used identify weak points in the coastal protection and in the modelling of wind waves under extreme conditions.

Indonesian Water Balance and Footprint

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In this lecture we motivate the use of modelling and simulation tools to study the effect of Climate Change on environmental water, i.e. rainwater. With as extreme example the important current problems of peatlands, it is argued that also more generally knowledge about the groundwater level is of much urgent interest, in view of increasing scarcity of water for human consumption and agricultural use. The main effects of CC for groundwater are the increase of wind speed and higher temperature, both resulting in higher evapotranspiration. Together with the fact that more intensified rain (at constant total rain) will lead to more run-off, the groundwater storage can be expected to decrease from simple balance law arguments.

Local variations may increase or reduce these effects; these variations can result from human interactions, such as changing land use (changing crop cultivation), urbanization, etc.

One measure to calculate the amount of water that is actually already 'virtually' assumed by the inhabitants is to use the concept of virtual water: the water needed to produce (grow) a specific crop, given the climatological circumstances and the way of producing (lan use and yield). We report about research performed at LabMath-Indonesia by Rik Bulsink and Meese Beeker from Utwente Netherlands in 2008, who estimated the total waterfootprint to be 1092 m^3/cap/year on average for Indonesia, with large differences between the main islands.

INDONESIAN COASTAL HUB www.IndonesianCoastalHUB.org

Andonowati

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In many research areas in Indonesia, when discussing about who are doing what and where, we often have difficult to see even a global picture. What are past and current projects, where are their locations, which agencies are responsible, who are involved in the executions, where the funding comes from. A Map of researches and projects can answer those questions and thus can give direction for the future planning. In this article, we focus on the special topic that is Coastal Zone Management. Direction of a future plan & development in the Indonesian Coastal Zone is crucial particularly because of the impacts of the global climate change.

Preceded by several in-depth studies that included visits, observations and intensive dialogues with research groups in several Indonesian research institutions, it is clear that there are several research groups with very promising research capacities as well as excellent innovative ideas. Yet, many of those researchers are not connected to each other and often have no collaborations. Some time even same projects are redundantly executed by different groups. Thus, the first step toward having a research map in Coastal Zone Management is to create a structured and standardized expert inventory in the area. This idea was the basic of our application to APN-Capable project. The proposal entitled *Integrating Indonesian Capacity for Coastal Zone Management* was granted last year (2008) under Project Reference CBA2008-08NSY-Andonowati.

The design of the expert data base, and the collection of data, started in September 2008. A questionnaire was designed and made online available on the APN-project website www.labmath-indonesia.or.id/apn. During the course of the project, however, the idea of creating this inventory has been developed. The main concern is how the data base can grow, dynamically updated, and become a point of interest to the participants. For this, we have been trying to study some scientific communities and how the members of these communities interact. We conclude that we want to make a virtual meeting point that is called Indonesian Coastal HUB. The Hub in-fact also become a nucleus for a Virtual (Thematic) Research Park.

From the main page (Home) of the Hub, recent information that is entered by members and collected can be accessed through buttons related to Files, Events, Links and Questions.

Members can also upload their simulation tools, research papers, teaching material, and their networks in the area of Coastal Zone Management.

The Hub will accommodate the core expertise as its members. These members then are listed alphabetically and can be shorted as well as searched by names, institutions, keyword (associated with his/her research areas). New members can be added based on the invitations of the current members. In the application form for the new member, a login name and password will be requested which, when the membership is approved, can be used to login to the web. The core members will have access to information from the main page.

The Hub will also accommodate memberships from larger coastal management Community such as consulting companies, policy makers, etc.

We brought up the idea and showed the model of an Indonesian Coastal Indonesian Hub in the second APN meeting held on 20-21 March 2009. This second meeting was attended by 20 senior researchers from Universities such as Institut Teknologi Bandung, Institut Pertanian Bogor, Universitas Gajah Mada as well as Government Agencies such as Indonesian Institute of Sciences, Agency for Assessment and Applications of Technology as well as senior representatives from the ministries. It was opened with a presentation of Prof. Syafwan Hadi entitled “Policies on Indonesian Coastal Management” followed with a presentation on the model of Indonesian Coastal Hub. All participants were very positive with the idea of Indonesian Coastal HUB. The following suggestions were made regarding the Hub & expertise.

- The data security of the expertise needs to be addressed
- Expertise and projects can be shown and accessed on the Indonesian Coastal Map
- Additional tools to help the user in updating their profile or inviting their colleagues
- The Hub will be hosted as an independent website.
- Maintenance and administration of the Hub are the responsibility of LabMath Indonesia.
- Meeting of the core experts will be conducted yearly at different institutes/agencies/ministries.

During this presentation the official launching of the website will take place.

DISTRICT LEVEL PREDICTION FOR ASSESSMENT OF THE IMPACT OF CLIMATE CHANGE ON COASTAL MANAGEMENT

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Climate change, as implication of global warming, which caused by increasing of green house gasses, has consequence on two main case at boundary layer, that is fluctuation of rainfall and temperature. This implication happens to several district region on Indonesia Island.

In this study, it is performed a prediction of distric's rainfall . HyBMG model can be used to build this prediction on spatial map. The result is focused to Malang area regarding to the research area to provide climate information which it appropriates with the farmer and policy maker needs. Malang is a unique district which locates in East Java, has a mountainous area and some part of Malang is urban area. Furthermore, this is a national program was initiated to develop a climate information system which is intended largely to provide high resolution climate information to support climate-related decision making processes at regency/district scales. The result of climate information in the newly implemented system in Indonesia is basically a high resolution climate forecasting based on dynamical and statistical downscaling in combination with some 'classical' and advanced statistical techniques.

The applications of the district level prediction has been usefull to support many activities of climate change particularly on coastal and agricultural management.

Keyword: *climate change, coastal management, district level prediction*

VARIATIONAL BOUSSINESQ SIMULATIONS OF HARBOUR WAVES

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Essential principles of fluid dynamics for surface water waves are the basis of the Variational Boussinesq Model (VBM) that is in development in collaboration between LabMath-Indonesia and the University of Twente. This model has exact energy conservation, incorporates approximate dispersion properties and can deal with steep bottom variations, with calculations that can be restricted to the horizontal directions only.

In this lecture we present some results of simulations performed with a numerical Finite Element implementation on an unstructured grid of the VBM. Geo-physical problems are characterized by the presence of length and time scales that can be orders of magnitude different, which creates specific need for attention for reliable simulations.

We present results for coastal waves, in particular waves entering the harbour of Cilacap on the coast of South Jawa. The very detailed wave interactions that are seen in the simulations can lead to numerically observable resonance phenomena in the relatively small inner harbour, for a specific value of the period of the waves entering the harbour from the ocean.

Comparison of the dispersive simulations with non-dispersive simulations (the shallow water limit) show good agreement for the waves outside the harbour, but at the same time essential differences inside the harbour.

Remarkably, although incoming waves have periods of the order of 10 seconds, the total numerical ‘loading time’ for the (initially still water) harbour is much longer, of the order of one thousand periods; for reliable simulations one has to accept this additional computer time since in most cases no suitable initial wave field will be available.

CARBON NUTRIENT COASTAL FLUXES OVER JAVA AND THE POSSIBLE IMPACTS TO GLOBAL CLIMATIC CHANGES

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ABSTRACTS

CONTRIBUTED PAPERS

THE ROLE OF PRECIPITATION, TEMPERATURE, AND LAND COVER IN CONTROLLING RUN-OFF OF THE NORTHWEST OF JAVA COASTAL ZONES: A CLIMATE CHANGE PERSPECTIVE

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This paper discusses the role of land cover and climate represented by precipitation and temperature in controlling run-off of the northwest of Java coastal zones focusing in Ciujung, Cisadane, Ciliwung, Citarum, and Cimanuk watersheds. Changes of land cover in terms of conversion of forest into agricultural and residential areas, as well as increasing of temperature are known. It is the intention of this study to investigate how both parameters control run-off.

Run-off is simulated using Spatial Tools for River Basins and Environment and Analysis of Management Options (STREAM) [1]. STREAM has already been calibrated [2]. Climate represented by 10'×10' spatio-temporal maps of precipitation and temperature are of among the inputs of this spatial tool [3]. In this simulation, temporal land cover data are generated from available historical maps and forest cover. Land cover is converted to water holding capacity (WHC) [4]. WHC is used to estimate amount of infiltration. Model of drainage network is derived from Shuttle RADAR Topographic Mission and presented as 1km×1km resolution digital elevation model [2].

Figure 1 shows the simulation result in decadal average of discharges. Citarum and Cimanuk are the most contributor of freshwater to Java Sea. It can be seen that there has been increasing discharge during the last decade in all catchments. Total annual discharge is shown in Figure 2. Increasing trend of discharges is shown clearly in the latest 20-year. In order to examine the effect of climate and land cover changes to the computed discharge, separate simulations are carried out. Increasing of discharge correlate well with decreasing of WHC. Changes of land cover are thought to contribute to decreasing of water resident time in the watersheds studied here.

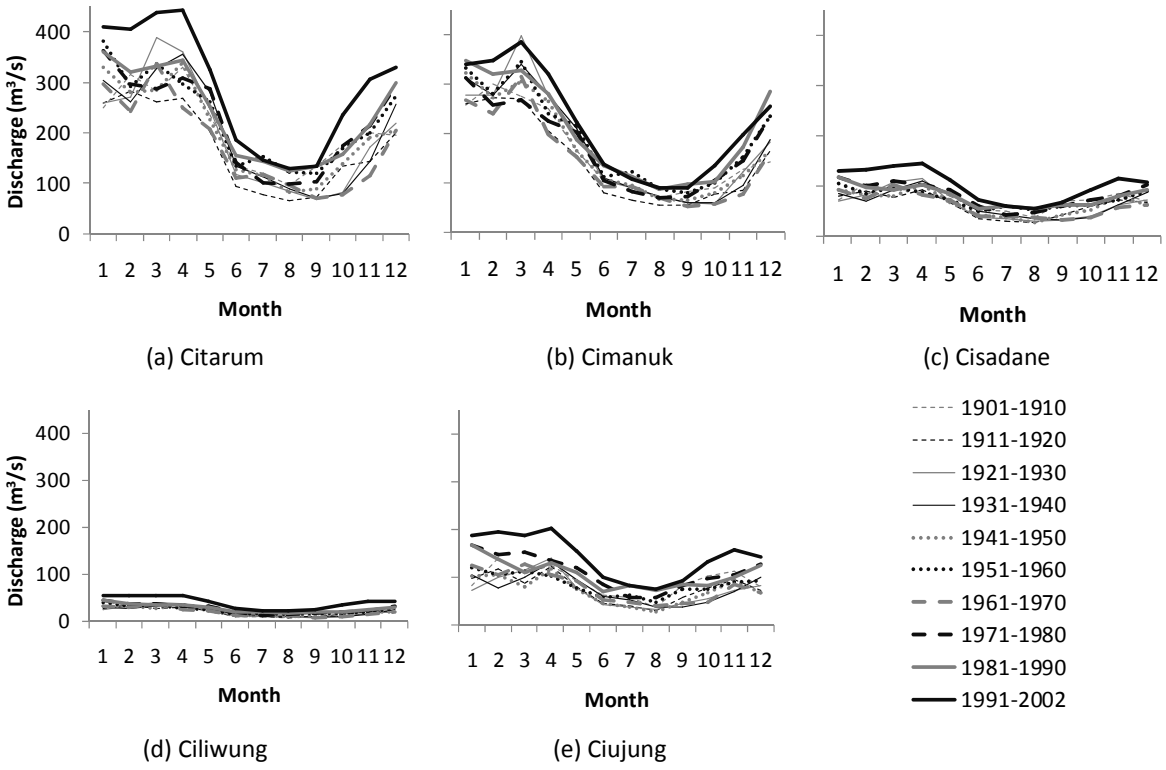

Figure 1. Decadal average discharge

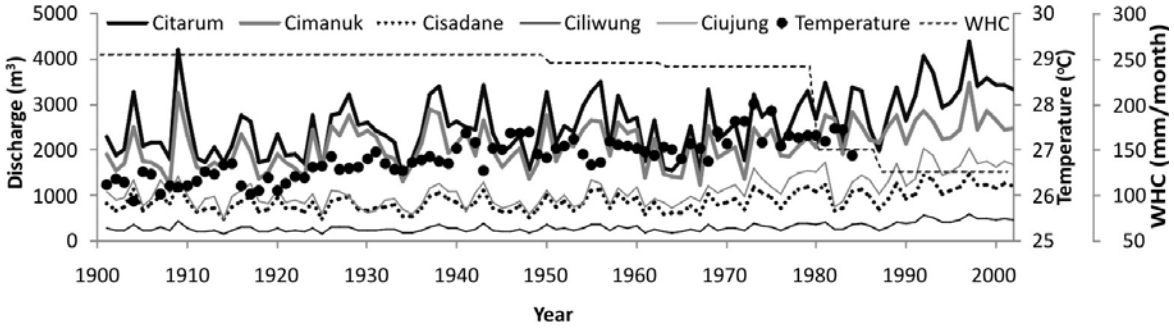

Figure 2. Total annual discharge, annual average temperature, and water holding capacity (WHC)

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PAST-DECADAL SIMULATIONS ON OCEAN WAVES, TIDES, CURRENTS AND SEA SURFACE TEMPERATURES ON THE NORTHERN COAST OF WEST JAVA

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West Java is an important province in Indonesia since it close to the capital city of Jakarta and plays an important role in the economical activities in the country. The province has two seas, the Java Sea on the northern part and the Indian Ocean on the southern part. Unlike the southern coast, the northern coast of West Java is characterized by the presence of broad deltaic plains built out into the relatively low-wave energy micro-tidal environment of the Java Sea by silt-laden rivers. These deltas are formed by mud, sand and other sediments resulting from siltation in the mouth of the rivers. The length of coastline on the northern coast is about 365 km and highly dynamic due to erosion process. It is important to study ocean and coastal characteristics to support our knowledge in the dynamic of coastal area, especially if it is referred to the climate changes. The characteristics can be analyzed through comprehensive studies covering measurements and numerical simulations of oceanographic parameters. Simulation on the oceanographic parameters (e.g. tides, currents, sea surface temperatures and waves) during the period of 1998 – 2008 on the Northern Coast of West Java Province, Indonesia was investigated in this paper. Simulation of flow was driven by the global tide model derived from sea level data observed by TOPEX-POSEIDON/JASON Satellite. Actual observed meteorological conditions (wind, temperature and rainfall) and river discharges were also imposed to the simulation. Any climate change represented by the meteorological conditions during the simulation period will be taken into account. The simulation was verified, calibrated and validated by some measurements data from any sources during the simulation period. Based on the verification and validation, the model presents a satisfy result and can simulate the past-decadal variations of tides, currents, waves and sea surface temperatures properly. The sea level and sea surface temperature rise within 10-years period of simulation are captured. Currents and waves were simulated and can be further analysed to calculate the erosion process.

SPATIAL ASSESSMENT MODELING FOR THE IMPACT OF CLIMATE CHANGE ON COASTAL MANAGEMENT

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The phenomenon of climate change has numerous effects on coastal and marine environment. The earth's oceans will expand, sea level will be rose, coral reefs bleaching, algae bloom, lost of certain marine species, shoreline retreat etc. All of these factors will affect the human social economic activity and their welfare. Dealing with the coastal management, this study will indicate the impact of climate change on its. Sea level rise is one of the case that will study furtherly. *International Geographical Union's Commission On The Coastal Environment* reported that coastal recession has been occur in more than 70 % of the world coastal area. Sea level rise is believed to be the major issues that cause these problems. On the other hand, the pressure of economic need, supporting by the world demand in fisheries sectors, have given way to the exploitation of the coastal ecosystem. Both aspects can affect the sustainability of coastal ecosystem and the availability of social economic services. Dealing with this condition, a study to see the impact of sea level rise and social economic' use of coastal ecosystem was employed. A shoreline retreat model based on Geographical Information System (GIS) was developed to predict the future impact of sea level rise on coastal environment and its existincg land use management. Two small islands, one that has been degraded by human activities and another island that almost nature have been selected as the study area. The comparison of the impact of sea level rise cause by climate change indicated that the coastal ecocystem may give protection to the shoreline. Therefore, the coastal management have to consider the role of coastal ecosystem in its policy scenario in order to mitigate the impact of sea level rise.

IMPACT OF CLIMATE CHANGE ON PHYTOPLANKTON CHLOROPHYLL IN INDONESIAN WATERS

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More than ten years of global ocean color satellite data with records of chlorophyll-phytoplankton changing in Indonesian waters. Generally in Indonesian waters, the chlorophyll-phytoplankton declined in 10 years. Global warming caused the ocean temperatures warmed or nutrient depletion in ocean, so that any kinds of species of phytoplankton die. The decline in phytoplankton-chlorophyll has a direct effect on the world's carbon cycle and will reduce the food available to fish and other organisms, including marine birds and mammals. Therefore we need the grand scenario of the impact of global warming to anticipate the impact of global warming on marine living resources.

Key words: *phytoplankton, sensor, climate*

RECENT ADAPTATION MEASURES AND THE PROGRESSING REGIONAL ENVIRONMENTAL SETTINGS IN SERIBU ISLANDS, JAVA SEA, INDONESIA

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This paper presents documentation of recent regional environmental settings and discussion of current measures of local adaptation practices in Seribu islands, southwest of Java sea, Indonesia, focusing on Pramuka, Panggang, Karya and Semak Daun cays. Socio-economic profile of the studied site in terms of demography and Gross Domestic Product, as well as land use practices are also considered. The discussion is related to increasing risks of erosion and inundation. Recent regional environmental settings are represented by the prevailing regional wave climate and sea level according to available scientific reports. Changes of recent regional sea level are specifically obtained from Topex/Poseidon and Jason-1 data. Changes of land use are detected according to manual interpretation of remote sensing imagery. This comprises of aerial photo mosaic from 2004 and IKONOS image from 2008. Evidences of erosion and inundation are identified according to direct observation from several visits. Direct observations also provide qualitative measures of local adaptation practices.

In the investigated site, rate of changes of sea level of 0.015m per year during 1992 to 2005 is found. Conversion of vegetation into residential is found to be typical and thought to lead to retardation of stabilization of coral beaches. Constructions are found to be the typical solution to overtopping of water during high spring tide and erosion due to wave attack. Local inhabitants seem to possess sufficient awareness to the currently progressing environmental changes. It seems that their role as key player of subsistence economy prevents effective application of sustainable conservation strategy.

It is confirmed that even with successful achievement of local actions, regional controls in the forms of suitable development policy and natural governing factors are still considered the most contributors to the conservation and adaptation measures in Seribu islands. Still, local anthropogenic adaptation practices lead to the demotion of local natural environmental capability to cope with risks of erosion and inundation.

THE IMPACT OF CLIMATE CHANGE TO SEVERAL ASPECTS OF COASTAL SYSTEM

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Research on climate change impact to several aspects of coastal system was conducted at the coastal of Cirebon in 2008. Primary productivity, the dissolution of CO_2 in sea water, the land used altered and the vulnerability of inundation in coastal area were measured. The result showed that the dissolution of CO_2 had negative correlation with chlorophyll a. There are trend of increased on build land and decreased of vegetative area, and based on the measurement of low elevated area along the coastal of Cirebon pointed out that there are 10200,43 hectare of various land used would counted as vulnerability area of inundation if the sea level has rose 1 meter.