



**Regional Training Course on "Tsunami wave modeling
& Multi-temporal satellite image processing and analysis of the
impact of the December 26th event"
28th March-1st April, 2005**

Objectives

Main aim of the course

To provide the participants in five days time the opportunity to acquire skills in the field of earth observation, and flood zoning of the tsunami damaged shore zones of the Indian Ocean.

Main purpose

One week workshop in cooperation with ADPC, Bangkok, on "Tsunami wave modeling & multi-temporal satellite image processing and analysis of the impact of the December 26th event", in the framework of the CASITA Phase-II project.

Target Group

Scientific staff of the Universities participating in the CASITA projects and other professionals involved in the study of the tsunami wave modeling, damage assessment and mitigation of tsunami hazards.

Course objectives

After having followed the workshop the participants should be able to:

- (1) understand the causes of a tsunami;
- (2) understand the basic principles of tsunami wave simulation modeling
- (3) process medium and high resolution satellite imagery in ERDAS Imagine software;
- (4) analyze the pre- and post tsunami satellite imagery for damage assessment of natural, infra-structural and urban elements;
- (5) integrate elevation data of the Shuttle Radar Topography Mission (SRTM);
- (6) create a flood inundation map to be used for strategic shore zone

management for reconstruction

Staff involved in the course

Teaching staff

Dr. Hamzah Latief, Tsunami Research Group, Coastal Oceanography Laboratory, Department of Geophysics and Meteorology, Institute of Technology Bandung (ITB), Bandung, Indonesia, Secretary of the Marine Research Center, ITB and Scientific Staff of Disaster Mitigation Center, ITB, Indonesia.

Drs Michiel Damen, Dept. Earth Systems Analysis, ITC, The Netherlands

Dr. Lal Samarakoon, Acting Director, G.I.S. Application Center (GAC), Asian Institute of Technology (AIT), Bangkok, Thailand

Mr. N.M.S.I. Arambepola, Director, Urban Disaster Risk Management, Asian Disaster Preparedness Center (ADPC).

Mr. Mehdiyev Magsud, Research Associate, Asian Center for Research on RS (ACRoRS), on behalf of Dr. Lal Samarkoon

Coordinating staff

Mr. Rajesh Sharma, Project Manager, Urban Disaster Mitigation Project (UDRM), ADPC

Ms. Clarence M. Carlos, Project Coordinator, UDRM, ADPC

Ms. Shalini Sharma Kanwar, CASITA Phase-2 Project Coordinator, UDRM, ADPC

Supporting staff

Mr. Kyaw Sann Oo, Project Researcher, Geoinformatics Center

Ms. Ponthip Limlahapun, Project Researcher, Geoinformatics Center

Ms. Kulapramote Prathumchai, Project Researcher, Geoinformatics Center

Overview of course activities

Introduction

The earthquake from December 26 west of Sumatra, with a magnitude of 9.0, caused a devastating tsunami resulting in many casualties all around the Indian Ocean till as far as Africa. In a wide strip along the low lying coasts most of the infrastructures and agricultural fields were destroyed. Also many elements of the natural environment, such as fringing coral reefs, and mangrove forests, were severely damaged.

Already before the end of the year 2004, a large number of high-resolution satellite images became freely available of the flooded zones, such as IKONOS and Quickbird, on which the destruction of the buildings, fishponds and roads could be seen in detail. From several areas also satellite images of the pre-tsunami situation were made available for comparison. Also tsunami wave simulations from the last tsunami were published, among others by the Institute of technology in Bandung, Indonesia, for the modeling of the run-up and run-in wave. During the one week workshop, organized by the Asian Disaster Preparedness Center(ADPC) Bangkok in collaboration with Asian Institute of Technology (AIT), Bangkok, and the Institute for Geo-information Science and Earth Observation (ITC), the Netherlands, and the Department of Geophysics &

Meteorology of the Institute of Technology (ITB), Bandung, Indonesia, the participants have been demonstrated how to process and interpret some of the available high and medium resolution satellite images of pre- and post tsunami dates. Also Shuttle Radar Topography Mission (SRTM) elevation models have been used in combination with the satellite imagery. An attempt has been made to make a tsunami flood-zoning map to be used for strategic shore zone management for reconstruction.

The course was run in the facilities of the Geoinformatics Center of the AIT Campus, Bangkok, from Monday 28 March until Friday 01 April 2005. In total 13 scientific staff of various Universities and Institutions from the Indian Ocean region followed the course (see for names and addresses the Appendix). Fortunately all the registered participants showed up.

Some selected materials related to the course, such as satellite imagery and all power point presentations (pdf format) was given to the participants at the end of the course on CDrom. ADPC provided also a folder to each participants to collect handed-out paper materials, such as the program, printed power points, background reading materials, computer instructions, etc.

Daily overview of course activities

Monday 28 March

- 09.00 hrs. Opening of the course by Mr. Earl Kessler Deputy Executive Director ADPC, Mr. N.M.S.I Arambepola, Program Manager Asian Urban Mitigation Programs and Urban Risk Programs, and myself.
- 9.30 hrs. Visit to the NOAA and MODIS satellite receiving station of the GAC Center
- 10.30 hrs. Presentation by M. Damen, ITC on the "Course structure, aims & objectives"
- 11.15 hrs. Introduction of each participant on his/her University/Institution, experience of tsunami work, experience with GIS / RS, the software used and the expectations of the course. Only a few students (for instance the participants of IIRS) used ERDAS Imagine before, some were more familiar with ER Mapper (participants from Indonesia). Several participants were working in the field of seismology / geological hazards in relation to CZM.
- 11.45 hrs. Presentation by Mr. N.M.S.I. Arambepola, ADPC on "Observations from rapid assessment carried out by ADPC and aspects to consider in recovery planning", with several interesting but shocking field photos taken in the damaged zones of Sri Lanka and Banda Aceh.
- 13.30 hrs. Presentation by M. Damen, ITC on "The use of geoinformation examples of satellite images of the tsunami effected areas", with several pre- and post Quicklook images of Banda Aceh.
- 15.30 hrs. Presentations by Dr. Hamzah Latief, ITB, Bandung, on the "Cause of the December 26th tsunami and the impact on Banda Aceh and " State of the art of the tsunami research in Indonesia". Dr Latief explained that the Tsunami Research Group of the Coastal Oceanography Lab of ITB is the only one doing research in that field in Indonesia. Dr Latief showed various examples of tsunami

modeling of historic events (for instance the earthquake generated tsunami in front of the coast of Sumatra in 1833; he explained also that based on historic records one can say that approx. every 200 years a tsunami occurred in the region). Based in this information his research group made also a tsunami hazard map of the West coast of Sumatra.

Tuesday 29 March

- *09.00 hrs.* Discussion on the earthquake and small (30 cm high) tsunami of 27 March 11.10, near Nias Island, in front of the West coast of Aceh, having caused over 300 casualties. Coasts of Thailand also evacuated; later in the morning another earthquake in West Aceh reported.
- *09.45 hrs.* Lecture by M. Damen, ITC on the "Concepts of Hazard, vulnerability and risk with examples of the GIS work on cyclone hazard in Bangladesh (Banskhali). Discussion afterwards on the vulnerability and elements at risk mapping of the damaged zones. The conclusion was, that a detailed mapping will not be easy to do.
- *11.00 hrs.* Continuation of the lectures by Dr. Hamzah Latief on tsunami modeling; also on the run-in aspect. Very interesting and also promising for future mitigation measures were the modeled contribution of vegetation (volume and height) on the decrease of the tsunami wave as roughness coefficient. Discussion on the need to come up with some listing of coastal vegetation structure types, which should be mapped from images.
- *13.30 hrs.* Introductory lecture by M. Damen, ITC on the basics of the ERDAS Imagine software.
- *14.45 hrs.* Guided hands-on practicals with ERDAS, using images (ETM and Quickbird) and rectified Topomaps of Banda Aceh. The use of image processing and ERDAS was new for all participants. There was also lack of knowledge on aspects of the land cover and terrain as seen on the images. But there was great interest, in particular the swipe and fade options in the Viewer using pre and post Quickbird imagery.

Wednesday 30 March

- *08.45 hrs.* Continuation of ERDAS Imagine exercise "on-screen" digitizing of the pre tsunami coastline, as visible on the Quickbird image, draped over the post tsunami image (also Quickbird)
- *10.30 hrs.* Handing in data CD-rom with courses materials (power points, images, tsunami bookmarks, demos, fly-overs, etc.
- *12.30 hrs.* Drive to GISTDA Ground Receiving Station
- *14.00 hrs.* Welcome at GISTDA and introduction by Dr. Thongchai Charrupat, Deputy Director GISTDA. He is also ITC alumni Forestry Dept. (for 20 yrs.) Presentation by Ms. Supapis Plongam, Head Geo-informatics Appl. Group on the use of IKONOS & Quickbird for tsunami disaster studies.
- *15.00 hrs.* Guided tour by Ms. Varaiporn Sintop (IIRS alumni) to IKONOS receiving station.

Thursday 31 March

- *08.45 hrs.* Presentation by Dr. Lal Samarakoon (presented by Mehdiyev Magsud)- AIT - Coastal Damage assessment carried out in Sri Lanka

- 10.00 hrs. Continuation of ERDAS Imagine exercise "on-screen" digitizing. Polygons of elements at risk using Quickbird images.
- 11.00 hrs. Demonstration with ERDAS Imagine of the giving of coordinates to a scanned topographical map (example Banda Aceh 1:50.000) and after this image to topomap rectification of a Quickbird satellite image. Due to the limited quality and accuracy of the topographical map this was not too successful.
- 13.30 hrs. Demonstrations on the download, import and processing of SRTM and Landsat ETM images from the GLCF website; also demo on image browse of Landsat and ASTER. Import of SRTM Hgt data not successful due to the fact that the ENVIR program could not find the software key.
- 15.30 hrs. Demo of hyperlinks on tsunami images, databases, atlases, etc.
- 16.15 hrs. Individual work by students (downloading of data, browsing tsunami websites)

Friday 01 April

- 08.45 hrs. For some selected participants demonstration of image-to-image rectification with ERDAS Imagine of the pre- and post tsunami Quickbird images. Other participants worked meanwhile on other image processing subjects (using the instructions which were provided the day before)
- 10.30 hrs. Discussion on recommendations for future tsunami studies and courses (see the appendix).
- 11.30 hrs. Presentations by the participants;
 - Mitra, IIRS: Introduction IIRS and Milit-temporal satellite analysis
 - Abdul Ghani Care-GIS: Bangladesh: examples of the use of GIS for poverty alleviation
 - Ms. Yudhicara: Examples from tsunami studies & mitigation works, carried out in Japan
 - Djati Mardiatno, Fac. Geografi, UGM: Examples of tsunami studies by UGM
 - Barandi Sapta Widartono, Fac. Geografi, UGM: Examples of the use of a small format camera for tsunami hazard studies in Aceh
- 14.30 hrs. Closing Ceremony and Handing out of Certificates by Dr. Suvit Yodmani, Executive Director ADPC.

Recommendations

The recommendations of the discussion between participants and staff, which took place on Friday 1st April, are listed below.

1. CASITA to take initiatives to help the partners in obtaining low-cost or free softwares; and also data to achieve goals of the project. ADPC to write to ESRI and ERDAS to take action on this.
2. More such (refresher) courses to be organized regularly for the universities to help them learn latest knowledge and skills and use them in their teaching and research activities.
3. Mechanisms for obtaining high-resolution temporal data (such as quickbird, IKONOS) for a specific area to help monitor and analyse the disasters. CASITA project can provide help.
4. Seminars/ workshops for decision makers in the countries to emphasize the importance of RS/GIS tools in disaster risk management to get full support from

policy and decision makers

5. Longer course duration with inclusion of field visit to the disaster affected areas
6. More such courses to be organized in each of the tsunami affected countries
7. Research in the institutions to focus on tsunami modeling. Generic model to be developed at global level, which can be used by any country
8. Requirements (data quality, mathematical mapping) for tsunami modeling to be made available
9. A discussion list of the participants to be set up to allow sharing of data and experiences
10. Mapping of vegetation along the coast for tsunami modeling needed
11. Modeling to be used as a tool for generating scenarios and quantifying losses to propose actions to save lives and property.
12. Fellowships to be made available for students to undertake research on these topics

Data provided to the participants

1. Image data

Digital Quickbird satellite data of BandaAceh (ERDAS Img format), georeferenced by using the topographical map 1:50.000. Dates of acquisition: 23 June 2004 and 28 December 2004

Landsat ETM data of 15 August 2001 and 29 December 2004

Printed maps scale 1:12.500 of the Quickbird images of Banda Aceh in natural colours.

2. Course data

All presented power point presentations in PDF

Bookmarks of interesting Internet sites related to tsunami studies

Course evaluation

A course evaluation form was handed out to the participants present on Friday 1st April. The form was filled anonymously by 13 participants. The scores on a four-point scale are given in the Appendix, with at the end remarks from the participants. The course content, presentations and practical exercises were well received, although some participants found that more time would have been needed and more work on the vegetation aspects. Also the need for a field visit to the disaster area was mentioned. Some participants wished to have the ERDAS Imagine and ArcGIS 9 software to continue the exercises.

Encl: Appendix

- 1. Course Description**
- 2. Time Schedule**
- 3. List of Participants**
- 4. Course Evaluation**