INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

ICG/IOTWS SECRETARIAT

INTERGOVERNMENTAL COORDINATION GROUP / INDIAN OCEAN TSUNAMI WARNING SYSTEM (ICG/IOTWS)

UNESCO-IOC INTERNATIONAL TRAINING COURSE ON TSUNAMI NUMERICAL MODELLING COURSE II: TSUNAMI INUNDATION MODELLING

Jakarta, Indonesia 25th -31st August

(R. Badal, C. Moore and U. Kanoglu)

REPORT

1. Introduction

During the second UNESCO-IOC International Training Course on Tsunami Numerical Modelling (June 2007), in Bangkok, the idea of running a third session of the training was floated around. At that time both, the budgetary issue and the timing of the course represented major constraints. However, after mutual agreement between the main stakeholders, the third run of the training has been organized in Jakarta, Indonesia. The training course was kindly hosted at the Agency for Technology and Implementation Assessment (BPPT) with the support of the US-IOTWS. Funding for the training course was provided by UNESCO-IOC under the framework of the IOC-Coast IO Map project and USAID through the US-IOTWS. In-kind support for the workshop was also provided by the BPPT in Jakarta.

2. Attendees

Back Row: Mr Hersha, Mr Sinibaldo, Mr Indra, Mr Wanchai, Mr Abdul, Mr Rezah Badal, Prof Utku Kanoglu, Mr. Chris Moore, Mr Dao My Ha, Mr Sindhu Nugroho, Mr S Mahongo

Front Row: Dr Mas Mera, Mr Chaeroni, Mr Rabefitia, Mr Rajesh G, Dr F Shaw, Ms Thin Thin, Ms Imun, Mrs Velly, Mr Sudheesh, Mr Nawa Suwedi, Mr Wahyu Pandoe

Instructors

Professor Utku Kanoglu
Middle-East Technical University, Ankara, Turkey

Mr Christopher Moore
NOAA Center for Tsunami Research, Seattle, USA

IOC Observer

Mr M. Rezah Badal
ICG/IOTWS Secretariat, Perth, Australia

Participants

The course announcement was distributed via the ICG/IOTWS Secretariat on the 12th of July 2007. The closing date for applications was 20th July 2007. In total, 30 applications were received. The participants were initially assessed by a technical selection committee consisting of Charitha Pattiaratchi, Diana Greenslade and Vasily Titov, consistent with the Melbourne and Bangkok session of the course. The final participant selection, using the technical rankings as guidance was made by representatives of the funding agencies (US-IOTWS and ICG/IOTWS Secretariat). 20 applicants were offered positions at the training course. Two participants, though having confirmed their attendance to the training, did not make it for the programme. They apparently did not get a final clearance from their respective authorities.

Coast_ IO Map member countries			
1	Rabefitia Zoaharimalala	National Institute of Meteorology	Madagascar
2	Shigalla B. Mahongo	Tanzania Fisheries Research Institute	Tanzania
3	Sinibaldo de Jesus Varela Canhanga	National Institute for Hydrography and Navigation (INAHINA)	Mozambique
4	Thin Thin Nyein	Dept of Meteorology & Hydrology	Myanmar
5	Abdul Mannan	Storm Warning Centre, Bangladesh Meteorological Dept	Bangladesh
US_IOTWS			
6	Aluthgamage hersha Rajeew Ratnasooriya	University of Moratuwa	Sri Lanka

7	RAJESH G	National Institute of Ocean Technology	India
8	K. SUDHEESH	National Institute of Oceanography	India
9	Wanchai Chanla-iad	Hydrographic Department, Royal Thai Navy	Thailand
Self-funded			
10	Dao My Ha	Tropical Marine Science Inst, National Uni of Singapore	Singapore
11	Felicia M.J. Shaw	Nanyang Technological University	Singapore
Indonesia/ US_IOTWS funded			
12	Nawa Suwedi	Agency for trhe assessment and application of Technology(BPPT)	Indonesia
13	Mas Mera	Study Centre of Disasters, Andalas Padang	Indonesia
14	Indra Gunawan	Meteorological & Geophysical Agency	Indonesia
15	Chaeroni	Coastal Dynamic Research Centre	Indonesia
16	Imun Maemunah	Centre for Volcanology and Geological Hazard Mitigation Mitigation	Indonesia
17	Sindhu Nugroho	Bureau of Meteorology & Geophysics/ Institute Technology Bandung	Indonesia
18	Velly Asvaliantina	Agency for trhe assessment and application of Technology(BPPT)	Indonesia

3. Agenda

The agenda is listed at Appendix A.

4. Participant reports

All participants gave a 10 to 15 minute oral presentation on the final day and produced a summary written document describing their case studies and results. The written reports and presentations have been compiled on a ‘class CD’. These will be made available on the IOC-UNESCO website.

5. Participant feedback

An evaluation survey on the participants' perception of the overall training was carried out on the final day. All of the responses provided by the participants were collated and are included at Appendix B. Some highlights are:

- The overall view of the course was very positive
- Above 90 % of the participants' responses showed their agreement to the general course content, benefit of the programme and on the software applications.
- On a particularly useful content of the course, the responses were rather varied, but in general the application of ComMIT was acknowledged as an efficient tool in modeling inundation.
- The course was not found to be that difficult and also to have been run in an acceptable span of time.
- Not much improvement was suggested except possibly to include a demonstration on how to convert bathymetry data brought by participants into ComMIT format for others benefit.
- All the participants agreed that they had increased their knowledge of tsunami inundation and modelling. In some cases they have been able to compare their results with different models, thus strengthening their confidence.
- Many of the participants suggested that the training course should cover more on handling bathymetry data.

6. Issues

The main difficulty that was encountered this time was in effect the ability to mobilize a sufficient group of trainers. This was partly due to the very short notice in putting up the programme and also due to an unfortunate event. One of the Instructors had to cancel his travel at the last moment because of the loss of a very close relative. Although that was an added responsibility on the two instructors that ran the course, the programme was conducted as scheduled.

On the number of participants, though we had a slightly higher number than the previous course, the training rooms was adequately large and every one was well accommodated with sufficient power supplies. From early test that was run on the existing network, it was known that the load will be too much for internet connectivity. NOAA/PMEL provided a stand alone server on which the participants had access to, through its wireless modem. Two participants did not have a laptop and they were provided both with a pc connected to the local area network. On the first day of the hands-on practical, minor issues on accessing both the local server and internet for those on the LAN were encountered. But once the different IP addresses were set, all went rather smoothly. However, some participants were experiencing a low speed in accessing the server which

was rather to do with the speed configuration of their own laptops. That was, however, resolved by downloading directly some bathymetric grid from the server itself.

On the overall the training was run very smoothly and partly associated with the build up experiences from the previous runs of the course. Though the IT facilities were not as good as in Bangkok (no ready access to broadband WIFI), the option of installing a local server in Jakarta proved to be an essential tool for accessing the pre-run seismic sources and for bathymetry gridding operations. The connection between the stand alone server and the participant's laptop required some further setting. Some time was spent on this before starting properly with the practical.

On the other hand, the recent Peru event proved to be an interesting inclusion in the training. Some time was devoted to explain how NOAA/PMEL reacted to the event and how the numerical modelling was performed on the spot to produce forecast. The novel idea of using DART data to constraint the scenarios attracted much interest and found to be quite useful in producing better forecast.

Some additional programming code was developed that converts bathymetry files from [ESRI]/ASCII to MOST format. It was also found out that some participants were intentionally applying unrealistic fault parameters (in case of distant sources) to the model. Their attentions were drawn to such spurious simulations, but the idea was ultimately to produce some inundation and thereon learn the technique to measure the flow depth.

It was also found out that some participants were intentionally applying unrealistic fault parameters to the model initial condition, including non-physical fault slip distributions. The intent was ultimately to produce some inundation in their home country from rather distant sources in order to measure the flow depth. The instructors lectured on the limitations of scaling the initial condition to such large values, and an effort will be made to allow creating *local* tsunami initial condition file through the ComMIT software in order to mitigate this temptation.

We, IOC Observer and Instructors, also discussed to combine lectures with practical hand on training for the next possible trainings. This might not only avoid distraction of participants' attention due to long hours of lectures but also it might help them to grab some concepts much more easily.

7. In Summary

- This third session of the inundation modelling training course has proven to be very successful, as was the first and second sessions.
- There are now a total of 47 people from 16 countries of the Indian Ocean who have been trained in inundation modelling and the use of the ComMIT modelling interface.
- The remaining countries of the Indian Ocean for whom no-one has been trained are Comoros, Kenya, East Timor, South Africa, Somalia, Iran and Malaysia.

APPENDIX A **-AGENDA**

UNESCO-IOC INTERNATIONAL TRAINING COURSE ON TSUNAMI NUMERICAL MODELLING
COURSE II: TSUNAMI INUNDATION MODELLING

25 – 31 August 2007, Jakarta, Indonesia

Saturday, August 25

8:30 – 9:00	Registration
9:15 – 9:45	Opening Address *Jan Sopaheluwakan, ICG/IOTWS Chairman*
9:45 – 10:10	Welcome from ICG/IOTWS & Overview of ICG/IOTWS goals; modelling goals & applications *Rezah Badal - ICG/IOTWS Secretariat*
10:10 – 10:15	Orientation, local arrangements & social events *Wahyu Pandoe, BPPT*
10:15 – 10:45	*Morning tea*
10:45 – 11:15	Background and structure of the Course *Chistopher Moore – NOAA/PMEL*
11:15 – 12:30	Generation and propagation of tsunamis: Course I overview *Utku Kanoglu - METU*
12:30 – 1:30	*Lunch*
1:30 – 3:00	Generation and propagation of tsunamis (continued) *Utku Kanoglu - METU*
3 - 3:30	*Afternoon tea*
3:30 – 5:00	Generation and propagation of tsunamis (continued) *Utku Kanoglu - METU*

Sunday, August 26

9:00 – 10:30	Generation and propagation of tsunamis (continued) *Utku Kanoglu - METU*
10:30 – 11:00	*Morning tea (including group photograph)*
11:00 – 12:30	Case Example & NOAA PMEL website *Utku Kanoglu – METU*
12:30 – 1:30	*Lunch*
1:30 – 3:00	Numerical modelling techniques and applications (continued) *Utku Kanoglu – METU*
3 - 3:30	*Afternoon tea*
3:30 – 5:00	Numerical modelling techniques and applications (continued) *Utku Kanoglu – METU*
5:30	*Ice-breaker*

Monday August 27

9:00 – 10:30	Overview of ComMIT *Chris Moore – NOAA/PMEL,*
10:30 – 11:00	*Morning tea*
11:00 – 12:30	ComMIT installation and setup *Chris Moore – NOAA/PMEL*
12:30 – 1:30	*Lunch*
1:30 – 3:00	Model bathymetry setup for individual countries *Chris Moore – NOAA/PMEL*
3 - 3:30	*Afternoon tea*
3:30 – 5:00	Model bathymetry setup for individual countries (cont.) *Chris Moore – NOAA/PMEL*

Tuesday, August 28

9:00 – 5:00	Application of ComMIT to selected regions of the Indian Ocean and case studies. *Workshop participants with help of instructors*

Wednesday, August 29

9:00 – 5:00	Application of ComMIT to selected regions of the Indian Ocean and case studies. *Workshop participants with help of instructors*

Thursday, August 30

9:00 – 5:00	Application of ComMIT to selected regions of the Indian Ocean and case studies. *Workshop participants with help of instructors*

Friday, August 31

9:00 - 12:00	Presentation of results by each participant (10 mins each)
12:00 – 1:30	*Lunch*
1:30 - 4:00	Completion of written report by each participant
4:00 – 4:30	Participants fill out feedback questionnaire
4:30 – 5:00	Award of Certificates, Closing Remarks
5:00	*Close*

APPENDIX B – Survey Summary

(1=Strongly Agree, 2=Agree, 3=Neither agree not disagree, 4=Disagree, 5=Strongly Disagree)

Overall view of the Training Programme:	**1**	**2**	**3**	**4**	**5**
The content of the course was relevant to my needs	9	8			
The trainers were supportive and encouraging	13	4			
There was appropriate balance between theory and practical	6	11			
The course material was easy to follow	8	9			
The course material was a useful resource	11	5	1		
The duration of the training programme was adequate	6	10	1		
The location and facilities were appropriate for the training programme	5	11	1		
I had sufficient time to prepare for the training course	5	8	4		
Benefits of the Training Programme:					
Tsunami inundation modelling					
I have improved my knowledge on tsunami inundation modelling	11	6			
I feel confident that I am able to undertake tsunami inundation modelling	9	6	2		
I am confident in my ability to pass knowledge to others	8	8	1		
The training subject matter will be useful in my job	11	6			
Tsunami inundation modelling concepts were clearly explained	8	7	2		
ComMIT software					
I found ComMIT easy to use and understand	12	4	1		
The different components of ComMIT was adequately explained	7	7	2	1	
I feel confident in using ComMIT to undertake inundation modelling in my country	8	5	4		
I feel able to help other users in my country in the use of ComMIT	10	7			
Percentage Summary (%)	51	42	7	0	0

1. Can you identify any skills or knowledge you gained on the course that you will be able to apply in your country?

- I can simulate tsunami propagation and inundation when tsunami occurs with ComMIT interface.
- Theory applied in MOST and ComMIT is useful
- Results produced during the course are useful.
- Yes I can. My skills or knowledge I have studied from the course that can be applied in my country are :
    - Making a propagation database
    - Making inundation map
    - Integration of my own bathymetry and topography map to the model
    - Convert data bathymetry and topography to the Commit format.
- Use a numerical modelling of tsunami for education purposes
- I didn't have any idea about Tsunami Numerical Modelling. By attending this training course I gained the idea of this model but due to the shortage of experience I may have the problem to run the model and accordingly studying impact. If I will get help from the related scientists and by continuous co-operation in this regard I will be able to apply this model in Bangladesh.
- Knowledge/skill in inundation modelling with relevant data available for Sri Lanka
- I am now be able to model tsunami propagation and inundation.
- After this training (course II) we have now an Operational tool for assessing Tsunami inundation vulnerability.
- I will be able to apply the knowledge and skills gained on the course in my country. But I need the adequate data to run the model.
- I should be able to apply Tsunami modelling in my country
- Being able to quickly prepare an inundation map to illustrate the areas most exposed to tsunami risk in Singapore.
- Yes, I am now to able to help other users in my country in the use of ComMIT.
- After incorporating the high resolution bathymetric data and running ComMIT, I would be in a position to produce better inundation maps for Indian coastline.
- I can create tsunami propagation and inundation modelling. The skills and knowledge that I get from this course can be applied to make hazard map in coastal area.
- All that was taught has increased my skills and knowledge that I will be able to apply in my country.

2. Is there any content from the course you have found particularly useful?

- Running ComMIT
- Nesting features allow to simulate tsunami to a high resolution
- Database of unit sources. Not only for ComMIT, it also useful for other models
- Gridtool

- Boundary cropping method
- Seismic information/ sources and propagation data
- Maximum inundation
- Maximum flow depth
- Yes the theory of tsunami propagation and the model issues
- The contents available in this course are all useful.
- Information on 2D data formats, conversions, processing etc
- Yes, that is friendly use software.
- Theory of tsunami modelling
- The concept of Tsunami inundation
- The time series which shows the arrival time is particularly useful.
- I had build relationship with everybody, and share information about earthquake and tsunami
- Picking up tips and information during the course of the practicals. Also, the general tsunami lectures at the start of the course were a nice overview.
- Model bathymetry setup.
- Application of ComMIT to selected regions of the Indian Ocean and case studies.
- I was particularly glad to note that initial conditions was available for the Makran coast which is very useful for inundation studies in the west coast of India. I feel India may be the one most utilising this initial conditions.
- Actually, ComMIT software developed by NOAA/PMEL is very useful for inundation modelling.
- The ComMIT software, which employs pre-run models, has been very useful in performing the modelling exercises.

3. Is there any content from the course you have found particularly difficult?

- Source Code MOST, source code to gridding bathymetry and topography
- No
- The troubleshooting of the error or warning
- Not at all
- The contents available are not practically difficult but require practice.
- NO
- NO
- Reading the ComMIT source codes.
- The input paramters of slip and minimum depth of offshore are difficult to identify for model running.
- I dont think so, but language is my problem
- Manipulating data generated by ComMIT for display and analysis.
- Generation and propagation of tsunamis.
- Numerical modelling techniques and applications.
- Nothing
- Nothing

- The MOST program, perhaps because it utilizes Fortran which I am not conversant with.

4. Was enough time spent on each topic?

- Yes, it was.
- Yes
- Yes, it was
- I think so
- Yes
- Yes
- Spent enough time on each topic.
- Yes, times allocated on lectures, presentations, practical sessions are well distributed.
- yes, it was
- Yes, within the scope of this course.
- Have more time about generation and propagation of tsunamis and numerical modelling.
- Yes
- Yes

5. Are there topics which were not covered? If so, which ones?

- No, there aren't
- No
- Bathymetry conversion method
- Setting up new seismic sources
- Yes, simulation of the land slide case
- Not found
- Details of the numerical model-governing equations, finite difference formulation etc.
- Yes, I think so.
- Yes
- No. Instructors provide references for in deep analysis
- All the topics were covered
- Yes there are, the propagation
- Not particularly.
- Yes, I think the topics were covered.
- No
- No
- Not particularly, but there could have been an attempt to use bathymetry data from the countries to exactly learn how to transform the data into the NetCDF format for use in modelling. Well of course the issue was that the data could have been of varying formats, but still if a set or two of data from the countries brought by the

students could have been tried that could have been a nice idea. Although a strong effort was put on explaining theoretically the various means of data conversion, but still a practical test would have been very useful.

6. How have you benefited from participating in this training programme, e.g. greater knowledge, increased confidence in tsunami modelling, access to software?

- Greater knowledge, increased confidence in tsunami modelling but not access to
- Software (source program, gridding program)
- Yes, I have better understand MOST and ComMIT and know how to use the software
- Some benefit can I got from this training program are:
- Easy to access NOAA programs and propagation databases
- Easy to understand the inundation mechanism
- Increasing capability to make inundation map
- Yes greater knowledge
- Gaining the knowledge from this course I will try to install the model in my organization and accordingly I will help others to run and study about this model.
- Yes
- Tsunami propagation modelling part has be to covered
- My participation in this training programme have increased my knowledge in tsunami measurement and modelling namely:
    - Measurement: NOAA DART Network
    - Modelling and forcasting: NOAA Tsunami forecast model (ComMIT)
    - Bathymetry data: use of Winbathtools.
- From participating in this programme, I got greater knowledge in tsunami modelling and wish to make further study in this software.
- All of them
- Yes. ComMIT is very well-designed for its purpose, so having access to it is a good thing. Gaining some insight to the state of research in tsunami modelling has been very helpful. Finally, simply being exposed to trainees from different nations at risk, and hearing about their successes and difficulties, has been very rewarding.
- This training programme has increased knowledge and confidence in tsunami modelling to me.
- Definitely I have benefited by participating in this training programme by improving my knowledge on tsunami modelling and could have enough hands on experience on running commit model. My special thanks and gratitude to organisers and especially to USAID for financial support.

- Actually this course is very important, after I get first course in Tsunami Propagation, and very interesting. For tsunami research and forecast the implementation of this course is much aspect, developing area and mitigation.

- In fact I have improved my knowledge in tsunami modelling. The ComMIT software is user friendly, and the pre-run ComMIT models makes life easier. So in addition to my knowledge of the Avinami program, I now feel more equipped in tsunami numerical modelling

7. Do you have any suggested improvements to the training programme?

- MOST and ComMit use more user friendly
- Some analysis software would be more useful to analyse the results
- To reduce the communication cost, it is suggested to distribute the seismic sources and propagation databases.
- At this time no
- This training programme is required to continue.
- Demonstrations of converting data brought by participants (in different formats) to format(s) accepted by model(s)
- The training improved my knowledge about Tsunami. The model ComMIT is very user friendly and easy to handle. It is improved my confidence in tsunami inundation and run-up modelling.
- Analysis of the results of ComMit using GIS or others analysis tools.
- No, I don't. The course performance is good
- The software is dependent on net connection and that was a bit iffy, so perhaps extra provisions could be made in the future.
- No, I have not. Participants should use more time with yourself to study continue.
- No, the arrangements were excellent
- No, the remarks this course was good.

8. Do you have any other comments?

- Thank you
- The course is much better than what I expected
- Classmates are very friendly
- In general, the training is very useful for me. The relationship between participants and lecturers, the lecturer and organizer, organizer and participants is OK.
- Yes, the DSA Daily Subsistence Allowance should be increased
- No.
- I would like to have information updates on further developments of ComMIT and associated software
- Tsunami propagation modelling part should be to included
- International modelling networking is necessary to transfer, maintain, and improve Tsunami forecast models.
- It is believed that if we have high resolution bathymetric data, the model result will serve better.
- Thanks for running this course!
- I thank you very much for this training from ICG/IOTWS secretariat and USAID.
- No

- No
- None
- This course involves international participants, so paying them in local currencies for those with fellowships is not very appropriate. Likewise, the amount paid should be reconsidered.
- Since this course has been conducted by IOC, then I would like to put forward a recommendation to IOC to kind of make the IO Coast Map Project familiar to us who really need the bathymetry data that they are trying to collect.