



Training Workshop on: "Coastal Hazard Assessment: Applications in Risk Assessment, Management and Mitigation"

Colombo, Sri Lanka
2–5 June, 2015

Workshop Report

Compiled by Russell Arthurton, UNESCO Consultant, in consultation with the Workshop Trainers and UNESCO/IOTWS Secretariat

Summary

The overall objectives of this four-day Training Workshop were to raise the levels of awareness and understanding of tsunami risk and mitigation within a context of Disaster Risk Reduction. The proceedings addressed the topics and issues as described in the Second Edition of the Guidelines, "Tsunami Risk Assessment and Mitigation for the Indian Ocean: knowing your tsunami risk – and what to do about it" shortly due to be published in the UNESCO-IOC Manuals and Guides Series. They reflected the Guidelines' structure, with a sequential treatment of the various aspects of the hazard, vulnerability and risk assessment processes followed by sections dealing with risk reduction through improved preparedness and mitigation. The proceedings included an additional topic, considering the institutional role in disaster risk reduction. The objective of the workshop was to establish understanding of the linkages in the risk assessment and management procedure as described in the revised Guidelines, also to demonstrate the relevance and importance of the processes described.

Training was delivered in sessions divided into modules that reflected the structure and content of the revised Guidelines. The Programme of Training Sessions as delivered is shown at Annex 1. The training sessions were supplemented by presentations of four national case studies – one each from Mozambique and Oman and two from Sri Lanka. Exercise modules were designed around a fictitious "Regional Training Scenario" depicted by layers of physical and socioeconomic information held in an open-source Geographical Information System (GIS), as used successfully in previous training workshops. The scenario provided trainees with a hands-on opportunity to appraise

vulnerability, preparedness and mitigation issues in the context of exposure to potential tsunami impacts from various sources.

The intention of the Task Team at the planning stage was that the workshop should aim at “training-the-trainer”, with participants selected on the understanding that they would relay their learnt training to trainees in their respective countries. In the event, this aim proved overambitious. The workshop is considered to have fallen short of achieving this goal in part because of the training approach used and in part because of a limited potential of the selected trainees as trainers.

Opening

The training programme was opened by Mr Tony Elliott (ICG/IOTWS Secretariat) who welcomed the participants and explained the context of the training event – that it was part of a project entitled: “Enhancing Tsunami Risk Assessment and Management, Strengthening Policy Support and Developing Guidelines for Tsunami Exercises in Indian Ocean Countries” for which IOC UNESCO has secured funding from UNESCAP’s Multi Donor Trust Fund. The workshop was presented under the guidance of Working Group 1 (WG1 – Tsunami Risk, Community Awareness and Preparedness) of the Intergovernmental Coordination Group (ICG) of the Indian Ocean Tsunami Warning and Mitigation System (IOTWS), led by Sam Hettiarachchi (University of Moratuwa, Sri Lanka, Ex-Chair of WG1). Following this opening, participants were invited in turns to introduce themselves, giving a brief resumé of their official roles in their respective countries. Lists of participants and trainers at the Workshop are given following the account of Proceedings.

Proceedings

The workshop commenced with Mr Elliott describing the establishment of the Indian Ocean Tsunami Warning and Mitigation System in the context of the global development of tsunami early warning under the aegis of the IOC, acting on its mandate following the disastrous Indian Ocean tsunami of 26 December 2004. Dr Hettiarachchi then provided an introduction to the subject of risk assessment as it relates to the hazards faced by coastal communities under threat of catastrophic inundation by the sea, in particular through the impacts of tsunamis or storm surges. Mr Russell Arthurton, the UNESCO consultant responsible for the compilation of the revised Guidelines “Tsunami Risk Assessment and Mitigation for the Indian Ocean” rounded off the introductory session (Session A) with a module explaining the intended correspondence of the respective training sessions of this workshop to the structure and content of those revised Guidelines, and reviewing the meanings of some of the key terms used in the risk assessment process.

Sessions B – E were devoted to the processes required for the risk assessment procedure; sessions F – I, to the processes for risk management and reduction. Session J provided trainees, working in groups, to engage in the assessment and management of a fictitious tsunami inundation scenario.

Session B – Assessing the Hazard – corresponding in broad content to Chapter B in the Guidelines while also introducing multi-hazard issues, was opened by Dr Phil Cummins who presented a module covering the basic tectonics and seismology relating to the earthquakes in subduction zones that were responsible for most tsunami occurrences. The following module, delivered by Dr Janaka Wijetunga, dealt with the suite of marine-derived hazards faced by coastal communities – storm surges, coastal erosion and sea-level rise – then, with Dr Cummins, focused on the assessments of the tsunami hazard using deterministic and probabilistic analytical methods. An intended exercise on the production of tsunami hazard maps did not take place. Instead the session was concluded by Dr Cummins dealing with tsunami inundation and explaining issues involved in accurate inundation modelling.

Session C corresponded to Chapter C in the Guidelines – “Assessing your vulnerability”. Mr Arthurton explained the procedure for assessing the vulnerability of coastal communities and their assets exposed to inundation. He showed the importance of the linkage between accurate inundation modelling and the estimation of exposure, then, using a GIS-based Regional Training Scenario, considered the susceptibility and potential damage and loss of people and their assets exposed to different levels of hazard. Dr Juan Carlos Villagran followed with a module explaining the different ways in which vulnerability could be assessed – by considering impacts on dimensions such as people or infrastructure, or on sectors of development such as education or transport. He described the use of remote sensing supported by ground-truthing in compiling vulnerability information.

Session D was about assessing preparedness. Dr Harkunti Rahayu described the approaches used to assess the state of preparedness of communities to anticipate and respond to potential tsunami inundation, with particular emphasis on the recognition of deficiencies in evacuation planning. This module was followed by an exercise led by Dr Rahayu and Dr Villagran that used the Regional Training Scenario to view vulnerability and preparedness from the perspective of local authorities. Working in groups and using role play, trainees were assigned sector responsibilities (such as hospitals or police) and presented reports to their “mayor” on their assessments of vulnerability and preparedness for the two sites (one near-field, the other far-field). The reporting was followed by a group discussion.

Session E, led by Dr Hettiarachchi, explained the process of risk evaluation – using an analysis of the assessments of hazard, vulnerability and preparedness to estimate the levels of risk of loss and damage through credible tsunami inundations over specified periods. Dr Hettiarachchi illustrated the process through a case study module comprising risk assessment in the port city of Galle in Sri Lanka, using an animation of the progressive inundation of the city by the second wave. The following module was a case study dealing with risk assessment in Oman presented by Dr Sultan Al-Yahyai. The study described the development of a multi-hazard Early Warning System and database that included mapped risk assessment for tsunamis and storm surges, both at the national scale and in detail for selected areas including Muscat.

The following sessions dealt with the reduction of tsunami risk. The procedure was introduced in a brief session (F) by Mr Arthurton, who noted that responses fell broadly into three categories – constraining or reducing exposure to inundation (the hazard); reducing the community’s vulnerability in respect of inundation; and improving a community’s capacity or preparedness to anticipate, respond to and recover from inundation. In reviewing the options, he emphasised the need to take demographic and environmental changes into account; also the need to promote the understanding of tsunami risk and its management at institutional levels so that a country’s functional capacity can enable the enhancement and application of technical capacity in respect of disaster risk reduction at the local authority level.

Session G was concerned with risk reduction by strategic management. It opened with a module on tsunami resilient infrastructure, presented by Dr Priyan Dias. He explained the use of fragility and vulnerability curves in calculating the resistance of buildings to tsunami inundation as well as measures for improving building resistance. The following module, delivered by Dr Hettiarachchi, reviewed the applicability of artificial (e.g., breakwaters or seawalls) and natural (e.g., coastal ecosystems) structural methods to mitigate the impact of a tsunami landfall. It was important to understand that risk could never be completely eliminated – there would always be residual risk. The session was concluded with a discussion regarding the reduction of vulnerability, led by Dr Villagran.

Session H covered actions for improving preparedness for tsunamis. The first module, presented by Dr Rahayu, dealt with key tasks in countries with tsunami risks. Deficiencies in preparedness need to be addressed by the community as a whole – active participation of community members contributes to better preparedness overall. Understanding early warning and evacuation planning were of paramount importance, including evacuation zones, routes, signage, and vertical evacuation shelters, as well as Standard Operating Procedures and their testing through exercises. The second module, delivered by Mr Ramal Jasinghe, explained the processes of disaster risk financing and insurance in respect of natural perils and catastrophes, noting the large growth in insurance business as a result of the 2004 Indian Ocean tsunami. His presentation covered the emerging reinsurance concept Capital Financing, with particular focus on Solvency Relief Quota Share (SRQS). He stressed the need for a long-term disaster risk management plan.

Session I – Institutional risk assessment and management within a DRR framework – was presented by Mr Rajesh Sharma who reviewed current and recent initiatives such as the Hyogo Framework for Action and the Sendai Framework for DRR aimed at improving the functional capacity of institutions that can enable and organise the provision of technical responses at local or community levels leading to DRR. Messages included the importance of mainstreaming DRR in national development plans and of the role of risk information in public investment decisions.

The final session – Applying the Guidelines (J) – comprised an exercise for the trainees assembled in groups of about six and focused on The Regional Training Scenario, a GIS-based tool which trainees accessed through laptop computers. The exercise was

conducted by Mr Arthurton with the technical support of Mr Janaka Bamunawala. Using the information in a database supplied, trainees assessed the likelihood and scale of a tsunami impact of two possible wave scenarios on their chosen coastal city, then plan their response to the threat of an inundation. The response was to be based on their assessment of tsunami risk and their decisions on risk reduction, minimising the cost to their community of damaged infrastructure and loss of lives. The trainees reported on the results of the risk assessment and explained the approaches used in reducing the risk.

The programme included an additional presentation on tsunami risk assessment in Sri Lanka given by Mr Srimal Samansiri, and illustrated by maps showing exposure, vulnerability and risk analyses for people.

List of Participants

Mr Jewel DAS, Institute of Marine Sciences and Fisheries, University of Chittagong,

Bangladesh

Dr Md Shafiqul ISLAM, Institute of Marine Sciences and Fisheries, University of Chittagong, **Bangladesh**

Mr Saifou-Dine ALIANI TOIHA, Agence Nationale de l'Aviation Civile et de la Météorologie, **Comoros**

Mr R S MAHENDRA, Indian National Centre for Ocean Information Services, **India**

Nambali Valsalan VINITHKUMAR, Andaman and Nicobar Centre for Ocean Science and Technology, **India**

Cahyo NUGROHO, Head of Tsunami Mitigation Sub Division, The Agency for Meteorology, Climatology and Geophysics, **Indonesia**

Mr Mohammad Hossein KAZEMINEZHAD, Iranian National Institute for Oceanography and Atmospheric Science, **Iran, Islamic Rep of**

Mr Paul OLOO, Kenya Meteorological Department, **Kenya**

Mr Sebastien TATANGIRAFENO, Institut Halieutique et des Sciences Marines, **Madagascar**

Dr Chai MUI FATT, Malaysian Meteorological Service, **Malaysia**

Mr Gopalkishan BEEGOO, Meteorologist, **Mauritius**

Mr. Aderito ARAMUGE, Meteorologist, **Mozambique**

Mr Nyi Nyi AUNG, Department of Meteorology and Hydrology, **Myanmar**

Mr Jamal ALHINAI, Meteorologist, **Oman**

Miss Hira LODHI, NED University of Engineering and Technology, **Pakistan**

Mr Mukhtar Admed MAGSI, Pakistan Meteorological Department, **Pakistan**

Mr Jean-Claude Helgea LABROSSE, Ministry of Environment, Energy & Climate Change, **Seychelles**

Mr Srimal Priyantha SAMANSIRI, Disaster Management Centre, **Sri Lanka**

Rear Admiral Nimal SARATHSENA, Disaster Management Centre, **Sri Lanka**

Dr Milali Ernest MACHUMU, Marine Parks and Reserves Unit, **Tanzania**

Ms. Jumlieng CHUTAB, Hydrologist, **Thailand**

Miss Surintra MAENPAYAK, National Disaster Warning Center, **Thailand**

Mr Luis Teofilo DA COSTA, Geo-Hazard Staff, Institute of Petroleum and Geology, **Timor-Leste**

Mr Martinho FATIMA, National Disaster Management Directorate, **Timor-Leste**

Trainers

Dr Sultan AL-YAHYAI, Mazoon Electricity Company, **Oman**

Mr Russell ARTHURTON, Coastal Geoscience, **United Kingdom**

Mr Janaka BAMUNAWALA, University of Moratuwa, **Sri Lanka**

Dr Phil CUMMINS, Australian National University, **Australia**

Dr Priyan DIAS, University of Moratuwa, **Sri Lanka**

Mr Tony ELLIOTT, Head of ICG/IOTWS Secretariat, Senior Programme Specialist
Intergovernmental Oceanographic Commission of UNESCO, IOC/UNESCO Perth
Programme Office, **Australia**

Dr Sam HETTIARACHCHI, University of Moratuwa, **Sri Lanka**

Mr Ramal JASINGHE, Asian Alliance Insurance, **Sri Lanka**

Dr Harkunti RAHAYU, Institut Teknologi Bandung (Bandung Institute of Technology)
Indonesia

Mr Rajesh SHARMA, UNDP Bangkok Regional Hub, **Thailand**

Dr Juan Carlos VILLAGRÁN DE LEÓN, United Nations Office for Outer Space Affairs,
Vienna, **Austria**

Dr Janaka WIJETUNGE, University of Peradeniya, **Sri Lanka**

Consultant/Observer

Mr Harald SPAHN, German International Cooperation (GIZ), **Germany**

Evaluation

Trainees' responses

The lectures, presentations and course materials were generally well received by the trainees. The hands-on exercises were particularly instructive. The venue and training facilities were appreciated by most participants as were the efforts of the local organiser including arrangements for obtaining Visas-on-Arrival.

On the negative side, many of the trainees found that the workshop as a whole and some individual modules were too short, permitting only superficial coverage of some topics and insufficient time for exercises and discussion. Some found a few modules overspecialised in content. Francophone trainees found difficulty in rapid delivery by presenters. The lack of a field excursion to a tsunami impact site was disappointing.

Specific questions in the evaluation questionnaire were answered as follows (numbers of responses in parentheses):

“Which materials were most useful?” Responses to this question included: materials in the USB pen drive (4); materials on inundation, hazard and vulnerability mapping and vulnerability assessment (3); materials related to the group exercises (3).

“Was enough time spent on each topic? If not, please list which topics needed more time.” Responses showed large range from “yes” to “no”. Topics for which more time was needed included: exercises (5); hazard assessment and modelling (4); preparedness (2); seismology (2); assessing vulnerability (1); disaster risk financing and insurance (1).

“Are there topics that were not covered? If so, which ones?” Responses included: map preparation (2); GIS tools (2); seismology (2); tsunami modelling (2); data and resources for risk assessment (1); coastal construction (1); socio-economic and environmental risks (1).

“What was good about the training?” Responses included: enhanced understanding of risk assessment methodology (5); the trainers (3); the presentations (3), interactive training and exercises (3); disaster risk financing and insurance (1).

“What was bad about the training?” Responses included: not enough time (4); presentations too fast and too detailed, difficult for francophone participants (4); too few exercises (2); lack of information about data collection for assessments (1); lack of field visit (1).

“What materials or activities are needed in order to improve the course?” Responses included: more practical work and exercises (6); field visits (3); improved training in use of GIS (2); training in data collection (1); all course materials to be made available in advance (1); reference material to be accessible immediately after each session (1); course duration should be extended to allow more time for specific topics (1).

“Other comments?” Responses included: a field visit would have been helpful (2); how can we arrange workshop to allow more practical time (1); some of the content (infrastructure, engineering) was too specific (1); there could have been more opportunity for discussion (1).

Trainers’ observations and conclusions

A challenge for this workshop was “training-the-trainer” – training trainers in the skills and methods for relaying in their own countries the procedures for tsunami risk assessment and mitigation as described in the revised Tsunami Risk Assessment Guidelines. However, this aim turned out to be overambitious and the course, as actually conducted, followed the more traditional path of training in technical procedures. In this context, the workshop was considered by trainers to have been well structured, reaching trainees who had very different levels of knowledge of tsunamis and tsunami risk. The inclusion in the training programme of the “new” topics of risk financing and the role of institutions was welcome.

The trainers acknowledge that the workshop structure was well aligned with the structure of the revised TRA Guidelines. In the event, it proved impossible to provide each trainee with a copy of the Guidelines as intended. However, trainers made efforts

throughout to ensure that trainees understood the logic of the procedural sequence. The programme of sessions and modules was set out for trainees in a Training Manual. For some modules there was a confusing mismatch between their descriptions in the Manual and what was actually presented by trainers, either because of programme alterations or a lack of appropriate copy submission by trainers. The content of Power point presentations should be edited to correspond more closely to the manual and be seen as a supplement to the manual.

The plenary lectures covering the various modules related to risk assessment and risk management dominated the workshop proceedings. This was sometimes to the exclusion of adequate opportunity for trainees to share their own experience through discussion and participation in exercises. Although a planned exercise on hazard mapping did not take place, two exercise modules with trainees working in groups with laptop GIS facilities proved successful. The exercises could be further improved by building in role-playing at all stages of the assessment and management procedure, including proposed actions or recommendations. Future workshops should either be longer (thus more expensive) or the number of modules or topic detail reduced.

In achieving our aim of training would-be trainers to train, we were unable to reach our hoped-for goals. The applicability of that training to the participants' existing jobs or roles was somewhat low (suggesting that the selected trainees were not the appropriate people to attend the workshop). The selection of the participants needed to have been more rigorous. Criteria for acceptance were set but these were not met by many of the applicants. To avoid selection of passive participants, there is a need to encourage Member States to closely follow the criteria for selection as outlined by the Secretariat. In the end, some weaker candidates were accepted because no alternative candidates could be enlisted in the time available. For future workshops there should be a selection committee to review applications, rejecting those that do not meet the criteria. If the concept is to succeed the countries' nominating authorities should understand the concept and nominate potential trainers. Sufficient time must be allowed for this process. It is suggested that a test or examination should be conducted at the end of each module to assess participants' understanding.

Besides ensuring that trainees existing work roles are appropriate to their participation in a "training-the-trainer" workshop, there is also a need to refocus the training mechanism to the prime task of training would-be trainers on how to train. There is a need to first develop training modules (as the TE team has done for the recent tsunami exercise workshop in Jakarta), placing more emphasis on ways and tips to train trainees. The TRA Revised Guidelines would provide the basic building blocks for developing such modules. At present there are no guidelines to train trainers. These would need to be developed. If the ICG decides to pursue this, then it should try to find further funding for a consultant to develop the modules as training tools.

While there is a general view among the trainers that the workshop fell short of fulfilling the "training-the-trainer" task, it is clear that doing a better job of this will require

considerably more resources. However, for what it must have cost, this training workshop is considered to have delivered good value.

Annex 1. Programme of training sessions and modules (as delivered)

Date and time	Session	Module	Presenter(s)
Tuesday 2 June			
A. Inaugural Session and Introduction			
9.00–9.45	A.1	Welcome Address, Introduction to the Training Workshop and Introduction of Participants	Mr Tony Elliott
9.45–10.15	A.2	Establishment of the Indian Ocean Tsunami Warning System – Ten Years of Progress	Mr Tony Elliott
10.15–10.45		<i>Tea</i>	
10.45–12.00	A.3	Introduction to risk assessment in the context of coastal hazards	Dr Sam Hettiarachchi
12.00–12.30	A.4	Introduction to the revised Guidelines for Tsunami Risk Assessment and Mitigation in the Indian Ocean	Mr Russell Arthurton
12.30–1.30		<i>Lunch</i>	
B. Assessing the Hazard			
1.30–2.30	B.1	Basic tectonics and seismology	Dr Phil Cummins
2.30–3.00		<i>Tea</i>	
3.00–4.00	B.2	Introduction to coastal hazards	Dr Janaka Wijetunga
4.00–5.00	B.3	Tsunami hazard assessment including case studies on Sri Lankan tsunami sources and propagation	Dr Phil Cummins and Dr Janaka Wijetunga
Wednesday 3 June			
9.00–10.00	B.4	Tsunami inundation modelling	Dr Phil Cummins
10.00–10.30		<i>Tea</i>	
C. Assessing Vulnerability			
10.30–11.30	C.1	Community assets and their vulnerability on exposure to inundation (including reference to GIS)	Mr Russell Arthurton and Mr Janaka Bamunawala
11.30–12.30	C.2	Dimensions of vulnerability	Dr Juan Carlos Villagran
12.30–1.30		<i>Lunch</i>	
D. Assessing your Preparedness			
1.30–2.30	D.1	Preparedness of communities to anticipate and respond capacity and resilience issues	Dr Harkunti Rahayu
2.30–3.00		<i>Tea</i>	
3.00–4.30	D.2	Exercise on assessment of vulnerability	Dr Juan Carlos Villagran

		and preparedness followed by group discussion	and Dr Harkunti Rahayu
Thursday 4 June			
	E. Evaluating the Risk		
9.00–9.45	E.1	Assembling the components of risk	Dr Sam Hettiarachchi
9.45–10.30	E.2	Case study on risk assessment – Galle, Sri Lanka	Dr Sam Hettiarachchi
<i>10.30–11.00</i>		<i>Tea</i>	
11.00–11.45	E.3	Case study on risk assessment – Coast of Oman	Dr Sultan Al-Yahyai
	F. Reducing your Tsunami Risk		
11.45–12.30	F.1	Introduction to Risk Reduction	Mr Russell Arthurton
<i>12.30–1.30</i>		<i>Lunch</i>	
	G. Reducing your Risk by Strategic Management		
1.30–2.15	G.1	Mitigating Coastal Hazards – Application of Artificial and Natural methods	Dr Sam Hettiarachchi
2.15–3.00	G.2	Tsunami Resilient Infrastructure	Dr Priyan Dias
<i>3.00–3.30</i>		<i>Tea</i>	
3.30–4.15	G.3	Discussion on Reducing Vulnerability	Dr Juan Carlos Villagran
	H. Improving your Preparedness for Tsunamis		
4.15–5.00	H.1 --	Improving Preparedness and Capacity Mozambique case study on tsunami sources and detection	Dr Harkunti Rahayu Mr Arderito Aramuge
Friday 5 June			
9.00–9.45	H.2	Disaster Risk Financing and Insurance	Mr Ramal Jasinghe
	I. Institutional Risk Assessment and Management within a DRR Framework		
9.45–10.30	I.1	Institutional Engagement in DRR	Mr Rajesh Sharma
<i>10.30–11.00</i>		<i>Tea</i>	
	J. Applying the Guidelines		
11.00–12.30	J.1	Group Exercise on Risk Assessment and Management using Quantum GIS	Mr Russell Arthurton and Mr Janaka Bamunawala
<i>12.30–1.30</i>		<i>Lunch</i>	
1.30–2.30	J.1	Group Exercise continued	
<i>2.30–3.00</i>		<i>Tea</i>	
3.00–4.30	J.2	Reporting on Group Exercise	Mr Russell Arthurton and Dr Hettiarachchi
	Conclusion		Mr Tony Elliott

