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United Nations Educational, Scientific and Cultural Organization

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Организация Объединенных Наций по вопросам образования науки и культуры Intergovernmental Oceanographic

Commission

 Commission
 océanographique intergouvernementale

Comisión Oceanográfica Intergubernamental

Межправительственная океанографическая комиссия

Indian Ocean Tsunami Warning and Mitigation System (IOTWMS)

Agenda Item 8.1.2 02 July 2019

Presented by Prof. Dr. Dwikorita Karnawati, Chair, ICG/IOTWMS

Acknowledgements

Srinivasa Kumar Tummala, Head, ICG/IOTWMS Secretariat

IOTWMS - The Three Pillars

Risk Assessment and Reduction

Systematically collect data and undertake risk assessments

Detection Warning and Dissemination

Develop hazard detection, monitoring and early warning services

Communicate threat information and early warnings

Awareness and Response

Build national and community response capabilities







ICG/IOTWMS Member States



Pillar 1: Risk Assessment & Reduction

- Tools, Methods & Guidelines for Tsunami Risk Assessment published
- Indian Ocean Probabilistic Regional Tsunami Hazard Maps published
- Assessment and awareness of Makran tsunami hazards
- Regional Workshops on Tsunami Risk Assessment and Modelling
- Enhancing Tsunami Risk Assessment and Management, Strengthening Policy Support and Developing Guidelines for Tsunami Exercises in Indian Ocean Countries
- Expert Consultation on Tsunami Hazard Assessment of the MSZ
- Capacity Assessment of Tsunami Preparedness of IOTWMS Member States – Status Report 2019



Pillar 2: Detection, Warning & Dissemination



- Service Definition: AoS, Stations, Products, Thresholds, CFZs, Formats
- Interim Service JMA, PTWC
- Tsunami Service Framework
 - 3 inter-operable Tsunami Service
 Providers (Australia, India, Indonesia)
 - Network of NTWCs, TNCs, TWFPs
- Greatly expanded seismic and sea level monitoring networks
- Harmonised threat information by TSPs
- National warnings Sovereign responsibility of authorized national agencies
- Several Events Palu, Sunda Strait
- Yearly performance assessments
 against Key Performance Indicators
- 6-monthly communications test to identify and fix any issues

Pillar 3: Awareness & Response



- Education Material for NTWCs, emergency managers, communities, schools, tourism, etc in multiple languages
- Indian Ocean-wide (IOWave) Exercises held every two years
- Piloting of Indian Ocean Tsunami Ready (IOTR) Programme
- 3 Trainings on Tsunami Emergency Maps, Plans and Procedures (TEMPP) for NTWC and DMO staff
- Over 100 capacity development workshops on Standard Operating Procedures for NTWC, DMO, staff and/or Media
- CABARET & INTERFACE Projects Warning Chains, SOPs
- Documenting the impacts of past Tsunamis Makran, Ambon, Flores, East Java
- 70th Anniversary of 1945 Makran Tsunami commemorative events
- World Tsunami Awareness Day (WTAD) 05 November
- Indian Ocean Tsunami Information Center (IOTIC) supported by

BMKG, Indonesia (2017-2022)









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Status of Monitoring Networks



Performance of the IOTWMS **COMMs Tests and KPIs**







	Service Level 1 EQ Bulletins					Service Level 2 Threat / No Threat Bulletins		
TSP	KPI 1	KPI 2	KPI 3	KPI 4	KPI 5	KPI 6	KPI 7	KPI 8
	ET First EQ Bull	POD IO EQs GE M6.8	EQ Mag	EQ Depth	EQ Location	ET First Threat Bull	POD Tsunami Waves	Tsunami Height Accuracy
	Target: 10 mins (% met)	Target: 100%	Target: 0.3 (% met)	Target: 30 km (% met)	Target: 30 km (% met)	Target: 20 mins (% met)	Target: 100%	Target: Factor of 2
Australia	13.7 min (12.5%)	n/a	0.13 (94.3%)	15.1 (86.7%)	16.5 (90.6%)	22 min (50.0%)	n/a	n/a
India	11.3 min (40.9%)	n/a	0.16 (90.0%)	15.6 (90.0%)	13.6 (86.6%)	25 min (0.0%)	n/a	n/a
Indonesia	11.6 min (64.1%)	n/a	0.26 (69.2%)	25.0 (74.4%)	26.5 (64.1%)	38 min (0.0%)	n/a	n/a
TSP Key Performance Indicators - 2018 Meets Near Misses								

Target

Target

Target

TSP Key Performance Indicators - 2018 KPI 2: No IO events >= M6.8

KPI 6: Australia issued 4 Potential Threat, 2 Confirmed Threat, 2 Final Bulletins

India issued 1 No Threat Bulletins Indonesia issued 1 No Threat Bulletins

Exercise Indian Ocean Wave 2018







- In the Indian Ocean, five IOWave Exercises have been conducted in 2009, 2011, 2014, 2016 and 2018
- IOWave18 during Sep 2018 All 24 Indian Ocean Member States involved their NTWCs and 11 involved Communities in IOWave18
- ~ 116,000 persons evacuated

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- India and Oman evaluated their community preparedness against Indian Ocean Tsunami Ready Indicators
- International Observers in Iran (APDIM-UNESCAP) and Sri Lanka (Univ. of Huddersfield)
- TSP Australia launched a public website to display the summary of national tsunami warnings issued by countries in the Indian Ocean was launched during the Exercise.
- IOC-UNESCO conducted on online assessment that was co-ordinated
 in-country by the IOWave18 National Contacts.

Member State	Evacuations (# of persons)		
India	104,326		
Sri Lanka	4,147		
Oman	3,225		
Indonesia	2,941		
Mauritius	553		
Tanzania	300		
Thailand	300		
Kenya	200		
Iran	200		
Pakistan	55		
Seychelles	12		
TOTAL	115,959		

Indian Ocean Tsunami Ready (IOTR)

Finalised Indian Ocean Tsunami Ready Guidelines and pilot implementation plan

India

- Piloted in 6 villages of Odisha
- OSDMA plans to implement in all
 328 tsunami prone communities in
 Odisha
- National Board set up by INCOIS for implementing IOTR in India
- International recognition by IOC UNESCO will help mobilise resources for implementing in rest of the communities.



Guidelines for Indian Ocean Tsunami Ready (IOTR) Programme Indicator, Checklin, National Recognition and Piot Implementation Plan

India and Oman piloted IOTR indicators in 7 communities during IOWave18

Oman

- Piloted IOTR in AlSawadi village
- First time conducting tsunami exercise to the community level
- Challenge in community interest
- To continue piloting IOTR taking advantage of IOWave exercises
- To establish National Committee for Tsunami Ready
- Adoption of indicators (Community – LDMO)

Font		Paragraph	Drawing	Tsunami Read	dy Indicators	TSUNAMI HAZARD ZONE	
Season DITION Recommendation		PURI DISTRICT TSURARIPRONE VELAGES when inter Proceeduring	martin =	CTRI 1	Have Community Tsunami Risk Reduction Plan	امي الم	مجتمع مستعد للتسوز
TO TO	NOLIANUAGAON MARINE FIRRERMEN RETTLEMENT		Mar Maria	CTRI 2	Have designated and mapped tsunami hazard – inundation zones		
A A	New Marine		J- Later	CTRI 3	Have a public display of tsunami information	IN CASE OF EARTHQUAKE, GO TO HIGH GROUND OR INLAND	20 20 20
		And the second second	CTRI 4	Produce easily understood tsunami evacuation maps as determined to be appropriate by local authorities in collaboration with communities	Tsunami Witness and history of Oman	مر دلوله کنیه وطاع رسید الحوالی دره ارضیا	
	and the state of t	*	CTRI 5	Develop and distribute outreach and public education materials	ال حمر 21 مار بله العل في من عند ماد مرد و القرابي و الموادية أمرادي. التري مرد 12 مار بله العل في من عند ماد مرد و القرابي و المرد مرد الموادية المرد مرد الموادي المرد مرد المرد م		
		10		CTRI 6	Hold at least three outreach or educational activities annually	Since the state of the state o	🖤 🔽 🚩
	NERAMAN DETECT		CTRI 7	Conduct an annual tsunami community exercise	الم مراجع است است التي مورد وله دارات في المراجع التي في التي في التي التي التي التي التي التي التي الت		
mane M-			There and any other	CTRI 8	Address tsunami hazards in the community's Emergency Operations Plan (EOP)	Aun for high ground Colou exergency instructions.	
			CTRI 9	Commit to supporting the Emergency Operations Centre (EOC) during a tsunami incident, if an EOC is open and activated.	Advisory Noble after and forgeneral and conserved and forgeneral		
			CTRI 10	Have redundant and reliable means for a 24-hour warning point (and EOC if activated) to receive official tsunami threats	Societa de total margeno Annenia fanges Anenia fanges Anenia fanges Watch Watch		
			CTRI 11	Have redundant and reliable means for a 24-hour warning point and/or EOC to disseminate official tsunami alerts to the public			

Palu and Sunda Strait Tsunamis

Palu Tsunami, 28 Sep 2018

- Deaths 2,100; Missing 680; Injured 4,612; and Displaced 78,994
- Complex Event Strike Slip Earthquake, Extensive Liquefaction, Coastal / Submarine Landslides, Bay
- Tsunami Warning issued by BMKG in 5 Minutes
- Tsunami Waves of Several Metres arrived within 2 4 minutes
- No time for communities to receive official warning
- **IOC-UNESCO** International Tsunami Survey Teams



Lessons Learnt in the Downstream

- False sense of security in the community
- Sustained preparedness, awareness, and education in local context
- Importance of evacuation plans, routes and shelters
- Importance of internalizing past experience

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Self-Evacuation is the key to safety - "near field"

Sunda Strait Tsunami, 22 Dec 2018

- Deaths 430; Missing 128; Injured 1,459; and Displaced 5,695
- Caused by flank collapse due to eruption of Anak Krakatau volcano
- No Tsunami Early Warning issued
- Tsunami waves arrived in succession following the eruptions patterns, and avalanches.
- Tsunami confirmed only by recognizing wave anomaly at near-by tide-gauges



December 11, 2018 At 17:28 WIB

December 27, 2018 At 17:28 WIB

Challenges in the Upstream

- Gaps in Hazard Assessment
- "Uncertainties" in tsunami early warning
- Warning systems not suited for "near-field", "atypical" sources
- Failure of tsunami early warning chain

ICG/IOTWMS-XII, 09-12 March 2019, Iran Key Challenges and Future Plans

 Detection Warning and Dissemination Seismic & Sea level networks – determine optimal networks, enhance station density, promote data sharing and adopt new technologies (GNSS, Under-sea cables, etc), Continuing issues with Vandalism of Tsunami Buoys Importance of Coastal Bathymetry & Topography data for accurate modelling and forecasting of tsunamis Palu & Sunda Strait Tsunamis - Very complex from early warning perspective, investigate methods for hazard assessment and early warning for tsunamis from such near-field, atypical sources (landslides, volcanoes, etc.) 	 Capacity development Organise Indian Ocean Tsunami Exercise in late-2020 (IOWave20) Continue to conduct NTWC/DMO/Media regional trainings on Standard Operating Procedures Organise in-country trainings of Tsunami Evacuation Maps, Plans and Procedures (TEMPP) Organise Palu & Sunda Strait Lessons Learnt Workshop in 2019 and post-IOWave20 Workshop in 2020 Prioritise future CD activities based on results of the survey on Operative Accessent of Tsunami Drependence 			
 Tsunami Risk Assessment, Awareness & Response Review Warning Chains/SOPs and enhance Community Preparedness for near-field tsunamis with emphasis on self- evacuation Emphasise role of DMOs in strengthening Warning Chains and importance of their participation in tsunami governance and technical forums Continue piloting of Indian Ocean Tsunami Ready (IOTR) in vulnerable communities, with IOC-UNESCO recognition 	 Governance Continue existing Working Groups on Tsunami Risk, Community Awareness and Preparedness Tsunami Detection, Warning and Dissemination Sub-Regional Working Group for the North West Indian Ocea Three new inter-sessional Task Teams on Tsunami Preparedness for a near-field Tsunami Hazard Scientific Tsunami Hazard Assessment of the MSZ Exercise Indian Ocean Wave 2020 Adopted the Medium Term Strategy (2019 – 24), Status Report Service Definition Document and NTWC User Guide 			
 North-West Indian Ocean Region Strengthen end-to-end TEWS in the NWIO – Hazard Assessment, Observing Networks, near-field Warning Chains Implement recommendations of the MSZ Expert Consultation (8 March 2019) Implement UNESCAP project on "Strengthening tsunami early warning in the NWIO region through regional cooperation" 				

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Summary of Inter-sessional Activities 2017-2019

- 1. ICG/IOTWMS XI, 18 20 April 2017, Malaysia
- 2. 1st Integrated Meetings, 04 17 September 2017, Indonesia
 - Inter-sessional meetings of Task Team Capacity Assessment of Tsunami Preparedness, Task Team -IOWave 18, WG-1, WG-2, 12th Steering Group + Regional Workshops on SOPs and IOTR
- 3. Tsunami Emergency Maps Plans and Procedures (TEMPP-1), Nov 17, Indonesia
- 4. 2nd Integrated Meetings, June 26 July 14 2018, India
 - Inter-sessional meetings of Task Team Capacity Assessment of Tsunami Preparedness, Task Team -IOWave 18, WG-1, WG-2, WG-NWIO + Regional Workshops on TEMPP-2 and SOP
- 5. Capacity Assessment of Tsunami Preparedness, Oct 2018
- 6. Exercise IOWave 18, 04 05 September 2018
- 7. Post-IOWave 18 Workshop, November 2018, Indonesia
- 8. 13th Steering Group Meeting, November 2018, Indonesia
- 9. Training on TEMPP-3, 2018, Indonesia
- 10. Expert Consultation on Makran, 8 March 2019, Iran
- 11. ICG/IOTWMS XII, 9 12 March 2019, Iran

Important Upcoming Activities

- International Conference on Lessons Learnt from the 2018 Tsunamis in Palu and Sunda Strait, 26 – 28, Sep 2019
- ICG/IOTWMS WG + TT + SG Meetings, 29 Sep 2 Oct 2019 Venue – BMKG, Jakarta, Indonesia

International Symposium

on the Lessons Learnt from the 2018 Tsunamis in Palu and Sunda Strait Jakarta, Indonesia | 26-28 September 2019

The Background

The aim of this symposium: Critical and scientific dialogue on tsunami science, based on lessons learnt from Palu-Donggala and Sunda Strait events

- Report of the ITST team survey results, analysis and conclusion.
 Report from other National and International survey results, analysis and conclusion.
- Critical dialogue on future direction of the Tsunami Early Warning and Mitigation System, especially for effective warning chain for events with short warning times.
- Develop public dialogue and translation of scientific findings to policies and actions at government and community level for tsunamis
- Improve public and multistakeholders understanding.
- Review, consider, and recommend ways of enhancing tsunami preparedness and mitigation.

Indonesia was hit by two destructive tsunamis in late 2018, which challenged our traditional understanding of tsunami hazard, warning and response mechanisms. The first event was the Palu and Donogala tsunam of 28 September 2018, following the 7.5 magnitude earthquake in Centra Sulawesi, that killed about 4,340 people. The second was the Sunda Strait tsunami of 22 December 2018, following an eruption and partial collapse of the Anak Krakatau volcano, that killed about 426 people. Following the Palu and Donggala tsunami, the UNESCO's Intergovernmental Oceanographi Commission (IOC) in collaboration with Indonesian authorities led by the Coordinating Ministry for Maritime Affairs coordinated post-tsunam surveys by International Tsunami Survey Teams (ITST), These surveys, along with national surveys by Indonesia, were intended to contribute to the understanding of the characteristics and impacts of the tsunami, and to provide information to the Government of Indonesia for enhancement of tsunami risk management practices. The Symposium will make these results available to a broader audience, also from the wider region

The UNESCOLOD's Intergovermental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICO/IOTWMS), in its 12th session held in Kah Island, Taro (March 2019) recognised the Palu and Sunda Strait tsunamis as being very complex from an early warning perspective, emphasising the urgent need to update hazard assessments, strengthen warning capabilities and enhance community response. This is not only of relevance for Indonesia, but also for many other countries in the Indian Ocean region which are affected by tsunami threats.

In commemoration of one year of the Palu and Dongpale tsurami, the Doordinating Ministry for Maritime Affairs (DMMA), the Ministry of Research, Technology, and Higher Education (MORTHE), the Agency for Meteorology, Olimatology, and Geophysics (BMKG) jointly with the Indian Ocean Tsurami Information Centru (OITO) and ICC/IOTIWMS secretariat of UNESDO-HOD and the Indian Ocean Rim Association (IDRA), supported by Deutsche Geellschaft für Internationale Zumammeraheth (IGZ), as well as the Indonesian Tsunami Experts Association (IATS) will hold an International Symposium on Lessons Learnt from the 2018 Tsunamis in Palu and Sunda Start' on ZeAS Beptember in Indonesia.





United Nations Educational, Scientific and Cultural Organization Intergovernmental Oceanographic Commission



www.ioc-tsunami.org/iotwms



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