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The role and function of SOPs in tsunami warning chains

- Timeline-driven SOPs
- Warning Levels
- Critical issues

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ICG Indian Ocean Tsunami Warning & Mitigation System SOP Workshops July 2023:

Standard Operating Procedures (SOPs) for
National Tsunami Warning Centres (NTWCs) and
Disaster Management Organisations (DMOs)

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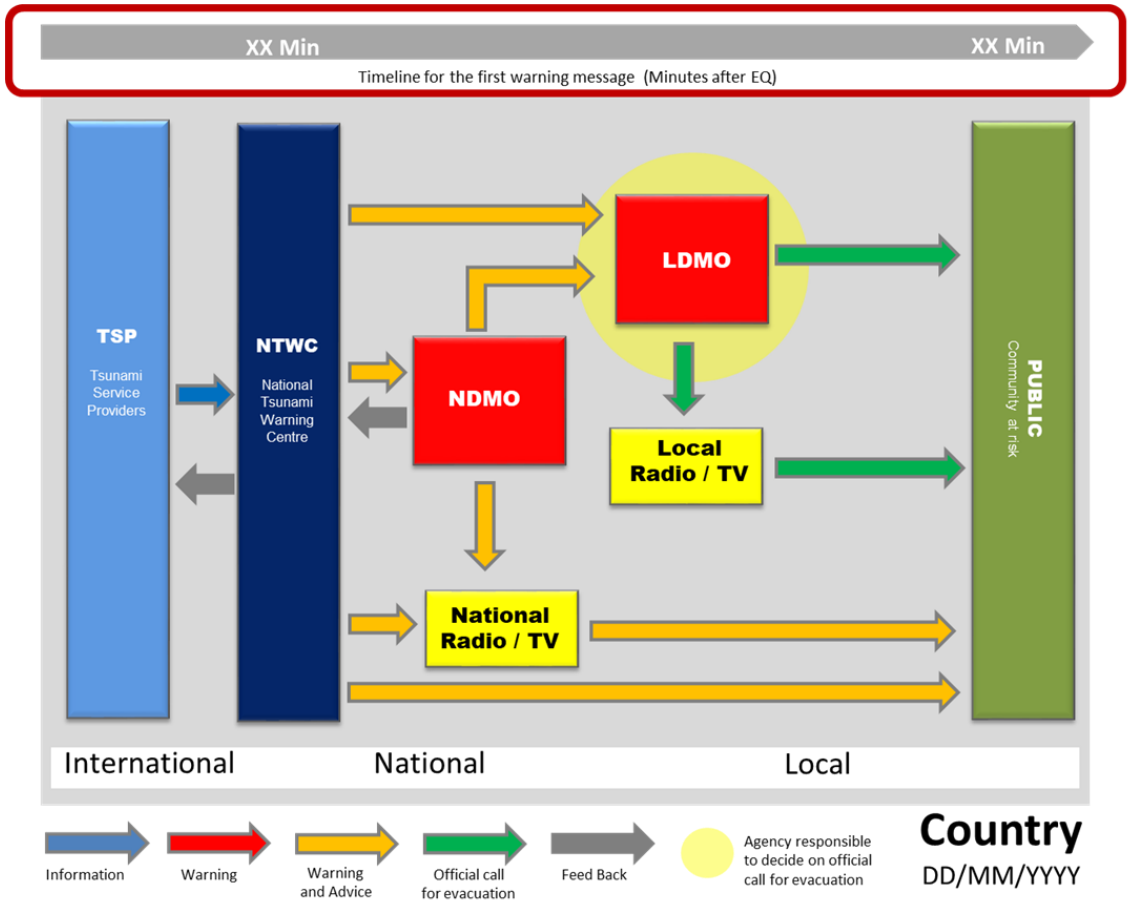
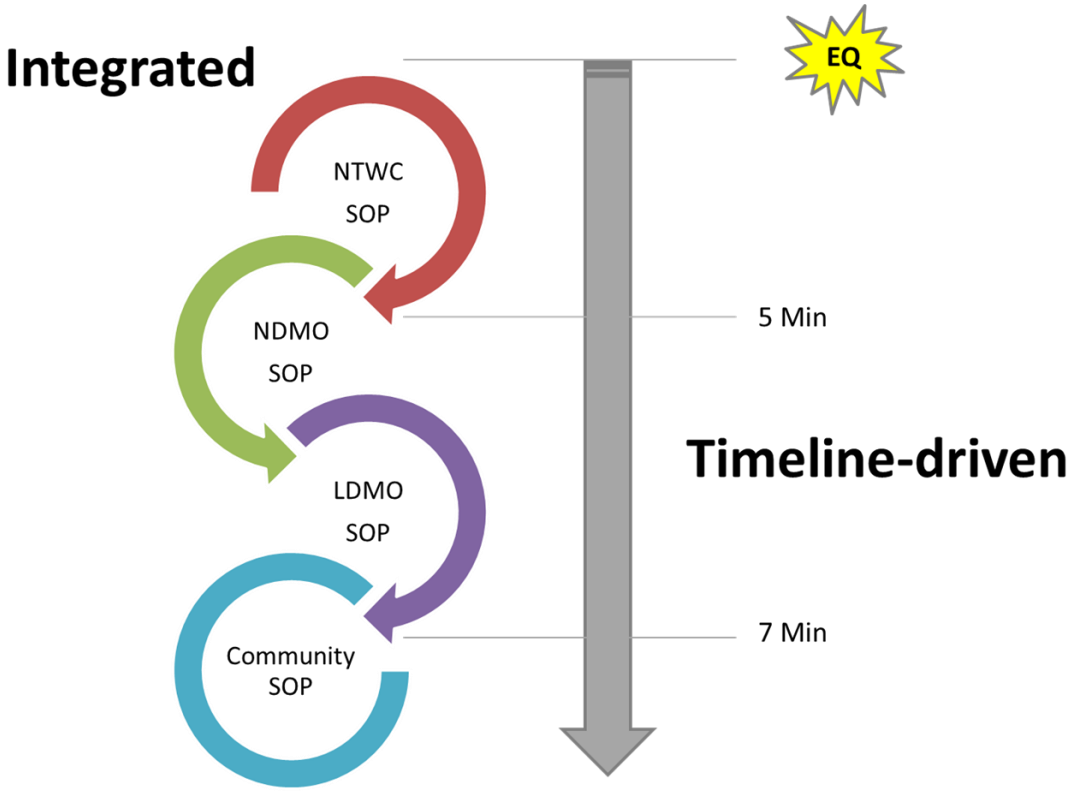
Near and distant tsunamis

TIMELINE DRIVEN SOPS

The timeline provides the framework…

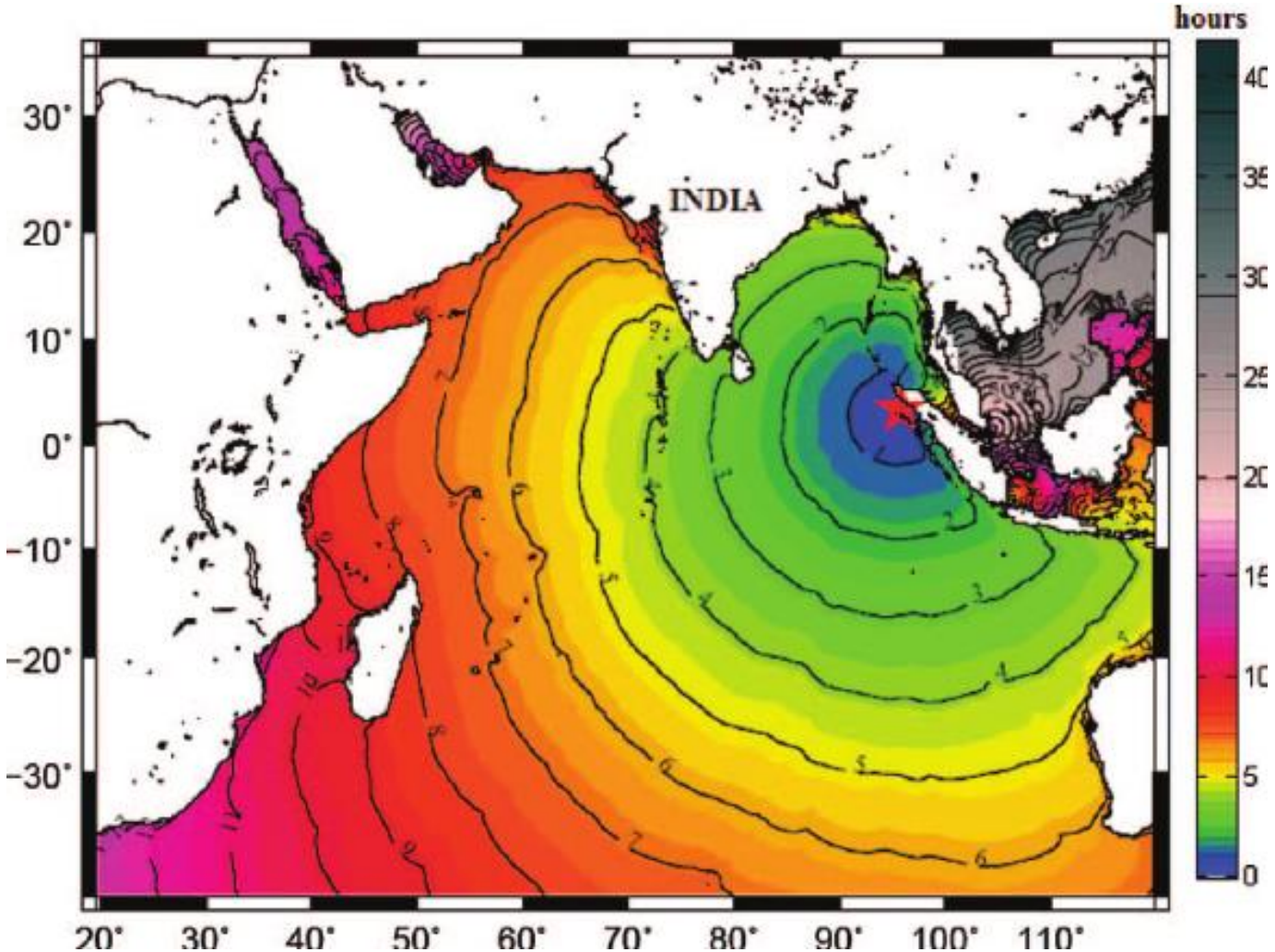




…and the need for integrated and timeline-driven SOPs

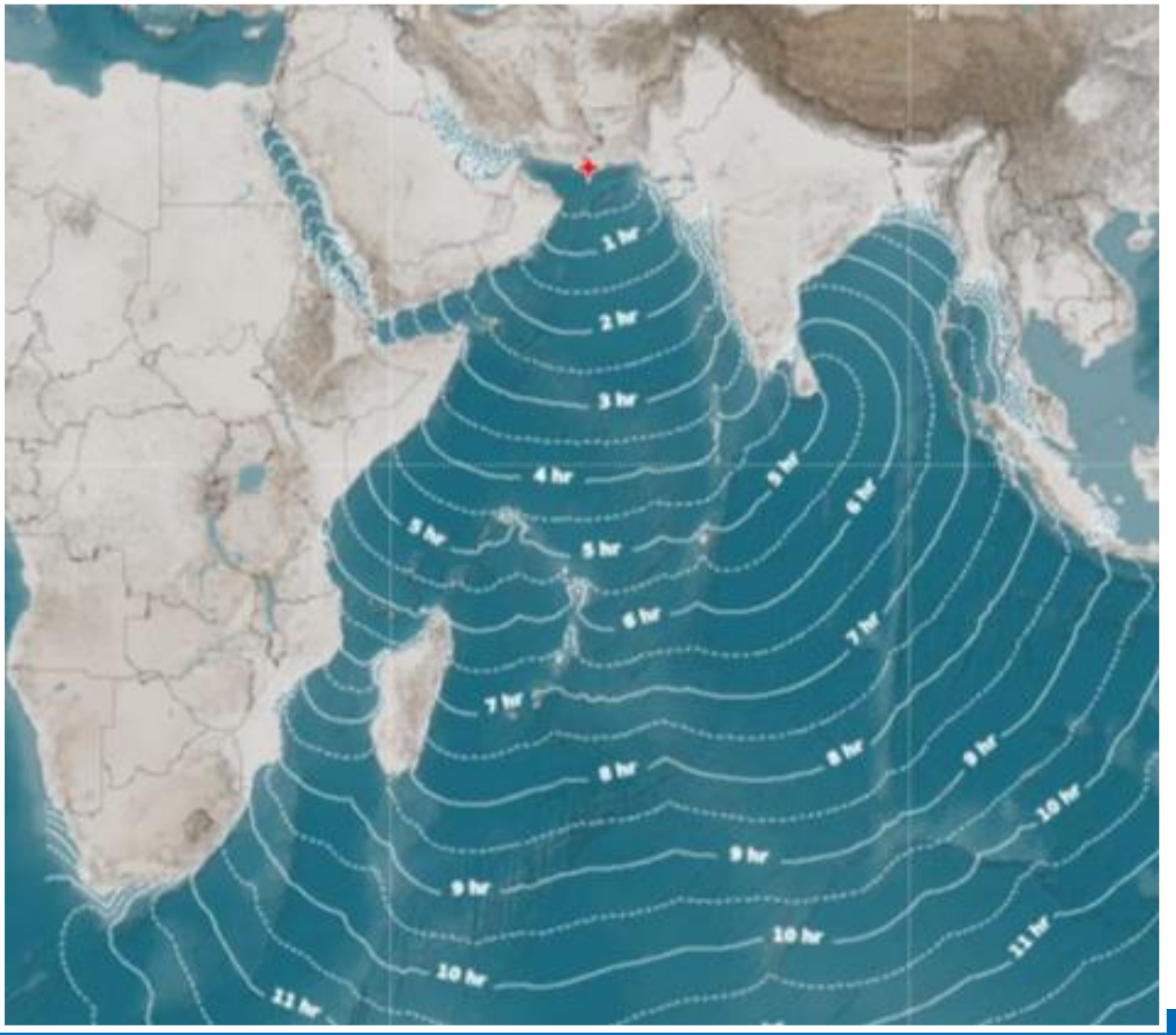
In line with time?

Travel times from Sunda Trench



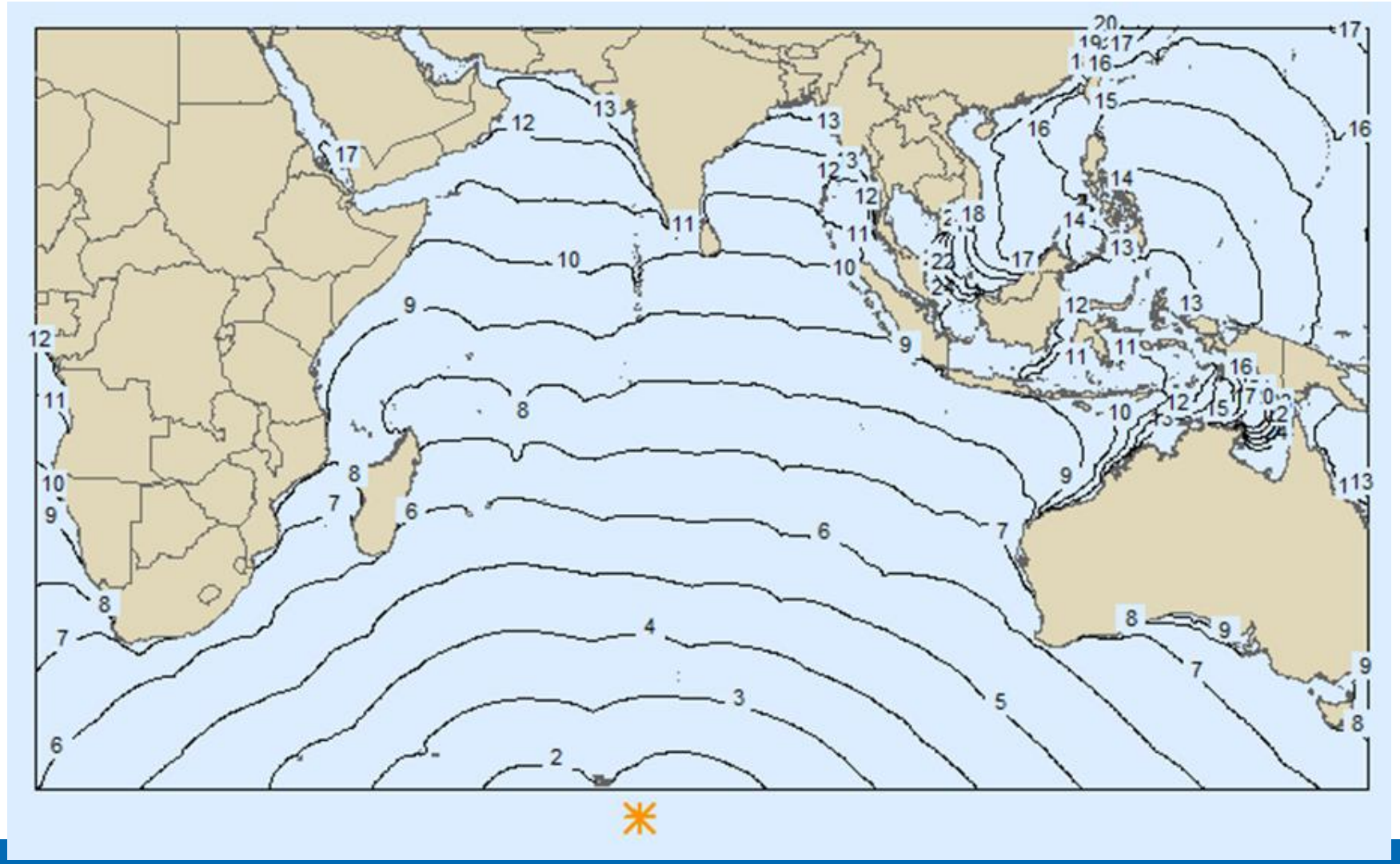
In line with time?

Travel times from Makran Subduction Zone



In line with time?

Travel times from Heard Island Volcano



In line with time?

TSP Timeline for seismic induced tsunamis

TSP 1
Earthquake Information

10 minutes

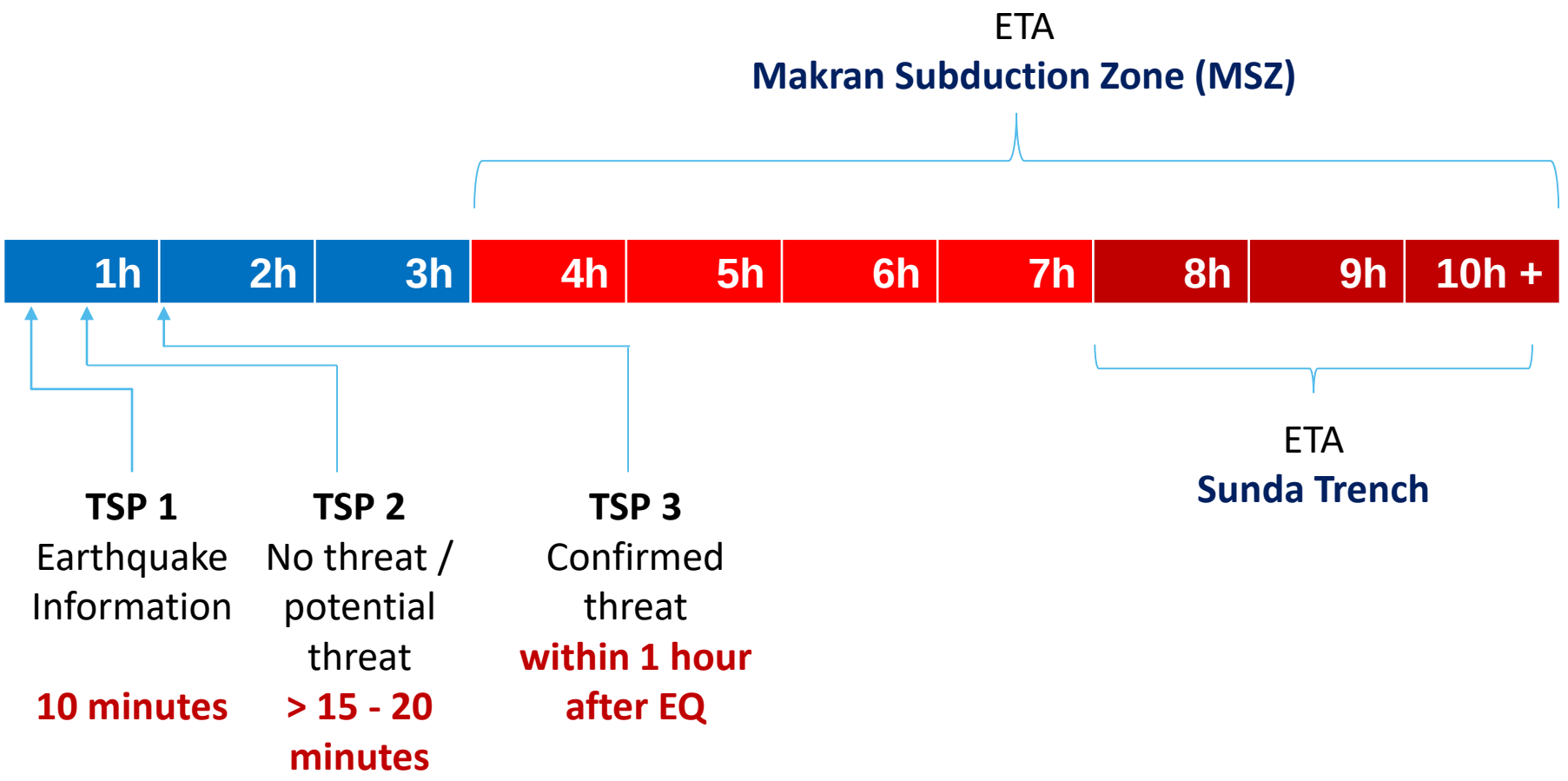
TSP 2
No threat / potential threat
> 15 - 20 minutes

TSP 3
Confirmed threat
probably within 1 hour after EQ

TSP 4
Final Bulletin
> 120 minutes after last arrival time in Indian Ocean of a wave over 0.5m or earlier in case of no threat

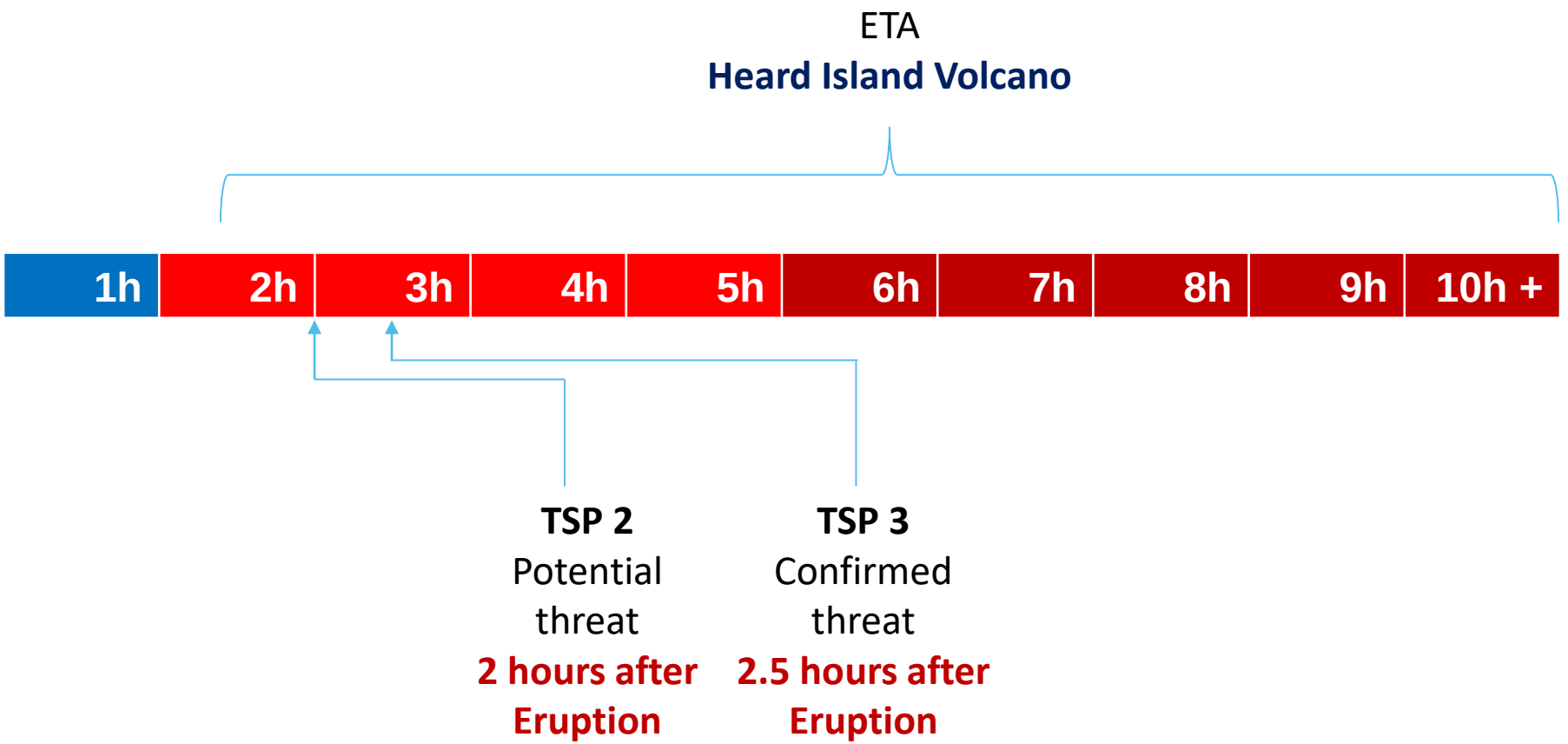
In line with time?

Availability of TSP information versus tsunami travel times for WIO countries



In line with time?

Availability of TSP information versus tsunami travel times for WIO countries



In line with time?

Approximate Estimated Times of Arrival (ETA) for WIO countries

ETA - **MSZ**						
Somalia		Kenya Seychelles	Comoros Madagascar Mozambique Tanzania	Mauritius Réunion		South Africa
3h	**4h**	**5h**	**6h**	**7h**	**8h**	**9h +**
ETA - **Sunda Trench**				Mauritius Réunion Seychelles Somalia	Comoros Kenya Madagascar Mozambique	Tanzania South Africa

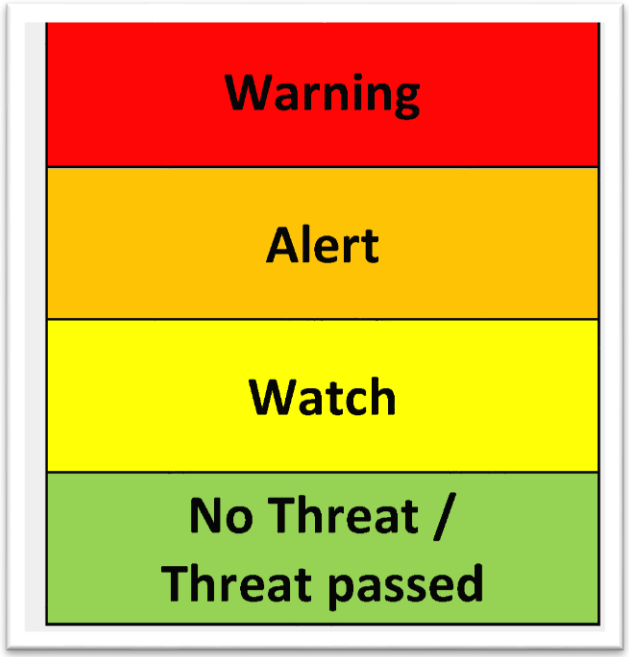
In line with time?

Approximate Estimated Times of Arrival (ETA) for WIO countries

ETA – **Heard Island Volcano**

1-3h	4h	5h	6h	7h	8h	9h +
Kerguelen Islands / France	Funk Seamount / South Africa		South Africa Madagascar Mauritius	Mozambique Seychelles	Comoros	Kenya Tanzania Somalia Yemen

WARNING LEVELS



Tsunami Threat Levels & Response

in accordance with **IOC/TOWS-WG VIII/3 March 2015** and
IOTWMS Users Guide for National Tsunami Warning Centers - Version 2.0 - 2019)

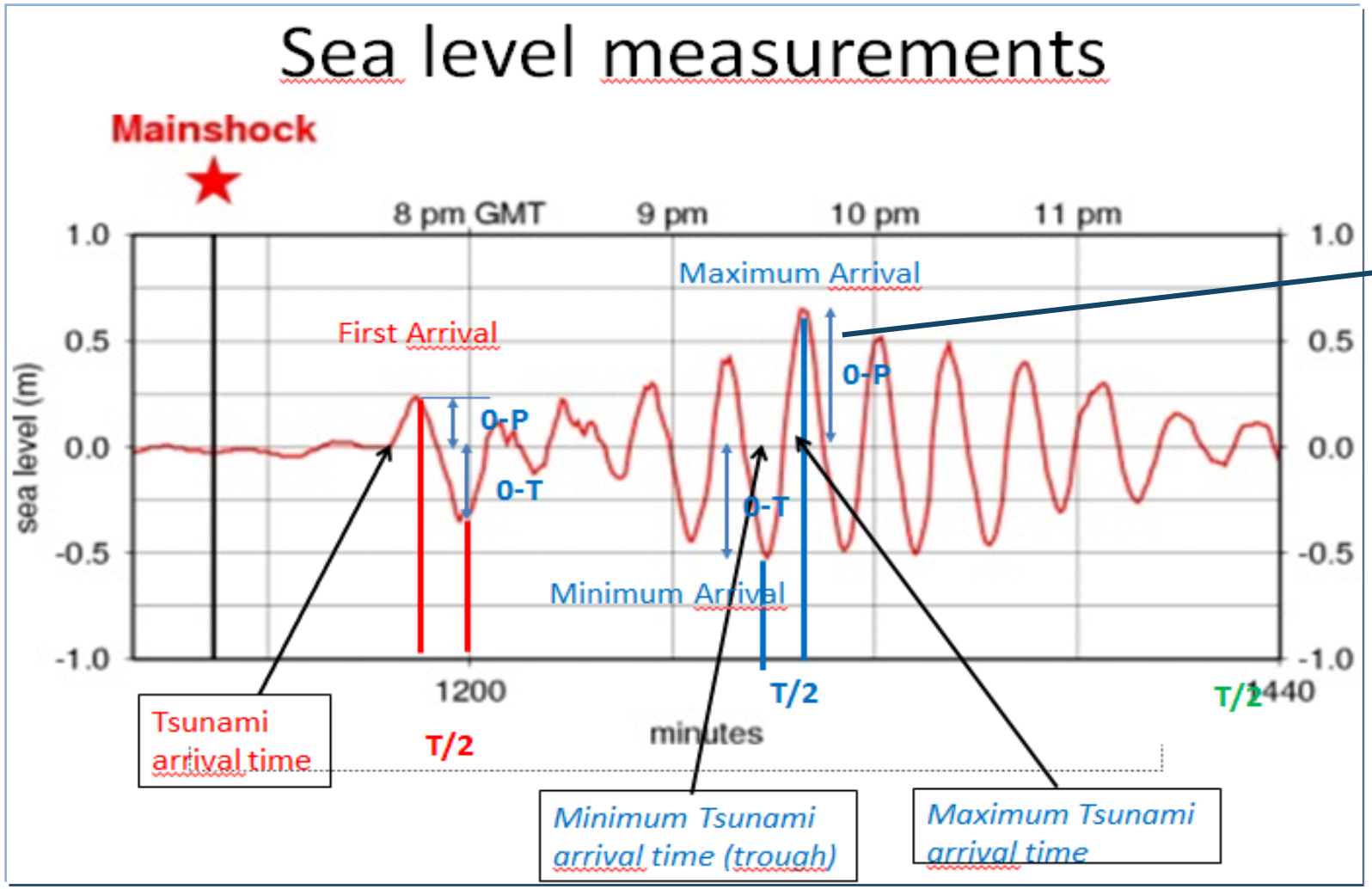
Levels of emergency public response	Threat Level	Potential Impact
People should evacuate tsunami hazard zones	3	**Land inundation threat:** tsunamis that can inundate coastal communities possibly causing significant damage
People should stay out of the water and away from the immediate foreshore including inlets of water	2	Tsunamis that are a **marine threat** may generate strong and unusual currents in coastal waters.
No immediate action is required until more information is available	1	**Potential land/marine threat** but are still under evaluation
No action necessary	0	No possibility of a tsunami or tsunamis that are generated but are not expected to cause damage or be a danger to people

Thresholds, Warning Levels & Color Codes

Example: Harmonized Approach in the NWIO

Oman		Pakistan		Iran		India				
as adjusted according to Country team		by PMD				**Potential threat** (before water level confirmation)			**Confirmed threat** (after water level confirmation)	
						Time > 60 min	Time ≤ 60 min			
> 3 m	Warning	> 2 m	Warning	> 2 m	Warning	--	> 2 m	Warning	> 2 m	Warning
0.5 – 2.9 m	Alert	0.5 – 1.9 m	Alert	0.5 – 2 m	Alert	> 2 m	0.5 – 2 m	Alert	0.5 – 2 m	Alert
0.2 – 0.5 m	Watch	0.2 – 0.5 m	Watch	0.2 – 0.5 m	Watch	0.5 – 2 m	0.2 – 0.5 m	Watch	0.2 – 0.5 m	Watch
< 0.2 m	No threat	not yet considered		not yet considered		not yet considered				
< 0.2 m	Threat Passed	< 0.2 m	"No threat"			0.2 – 0.5 m		Watch	< 0.2 m (T4 + 120 min)	Threat Passed

The threshold values shown refer to tsunami amplitude.



Amplitude

difference between a particular peak or trough of the tsunami and sea level at that time

or

half the difference between an adjacent trough and peak and can be corrected for the change of tide between that trough and peak

Source: IOTWMS TSP Service Definition Document

Example from India and Indonesia

WARNING LEVEL, ADVICE AND SOPs

NTWC SOP - India

Threat Status	Action to be taken	Dissemination to
WARNING	Public should be advised to move inland towards higher grounds. Vessels should move into deep Ocean	MoES, MHA, NDMA, NCMC, NDRF Battalions, SEOC, DEOC, Public, Media
ALERT	Public should be advised to avoid beaches and low-lying coastal areas. Vessels should move into deep Ocean	MoES, MHA, NDMA, NCMC, NDRF Battalions, SEOC, DEOC, Public, Media
WATCH	No immediate action is required	MoES, MHA, NDMA, NCMC, NDRF Battalions, SEOC, DEOC, Media
THREAT PASSED	All clear determination to be made by the local authorities	MoES, MHA, NDMA, NCMC, NDRF Battalions, SEOC, DEOC, Public, Media

Example of Indonesia

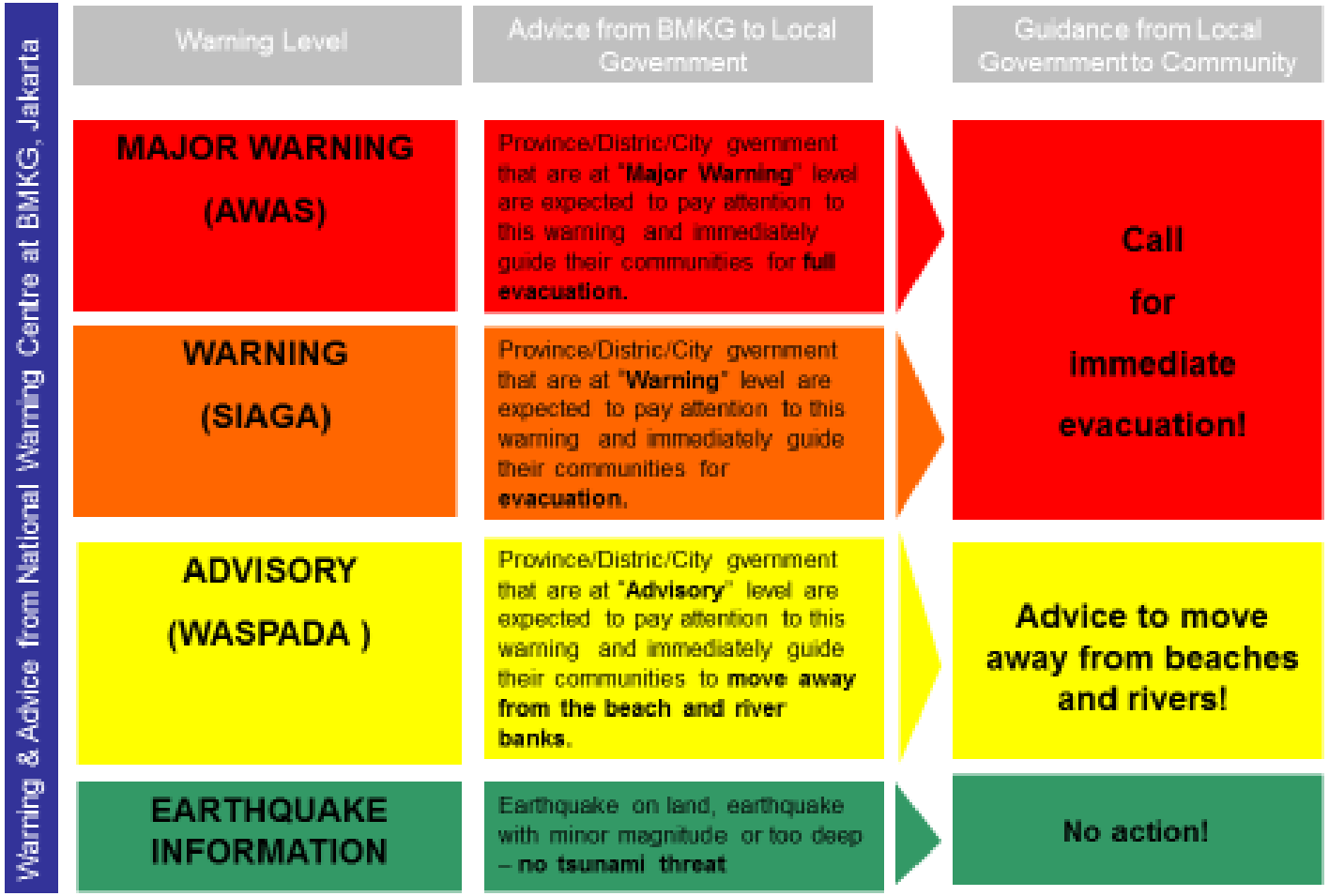
NTWC Warning & Advice to Local Governments

No.	Warning Level	Advice to Local Government by BMKG
1	**AWAS (Major Warning)**	Provincial/District/City Governments that are at "Major Warning" level are expected to pay attention to this warning and immediately guide their communities for full evacuation.
2	**SIAGA (Warning)**	Provincial/District/City Governments that are at "Warning" level are expected to pay attention to this warning and immediately guide their communities for evacuation.
3	**WASPADA (Advisory)**	Provincial/District/City Governments that are at "Advisory" level are expected to pay attention to this warning and immediately guide their communities to move away from beaches and river banks.

Source: Tsunami Early Warning Service Guidebook for InaTEWS, 2012
https://www.gitews.de/tsunami-kit/en/E3/tool/Tsunami%20Early%20Warning%20Service%20Guidebook%20for%20InaTEWS.pdf

Example of Indonesia

From Warning and Advice to Guidance for Communities



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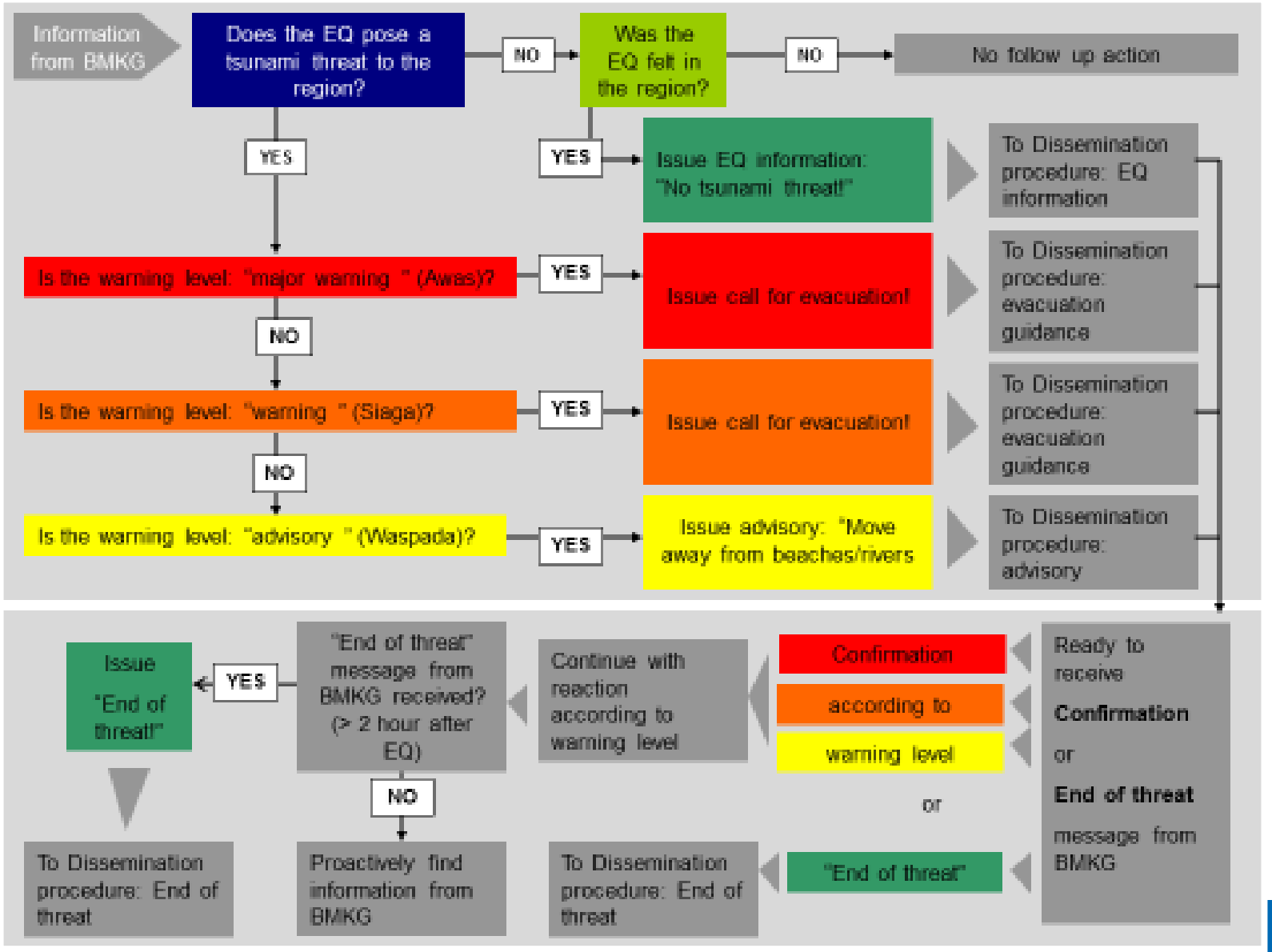
Example of Indonesia
LDMO SOP



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The importance of warning levels

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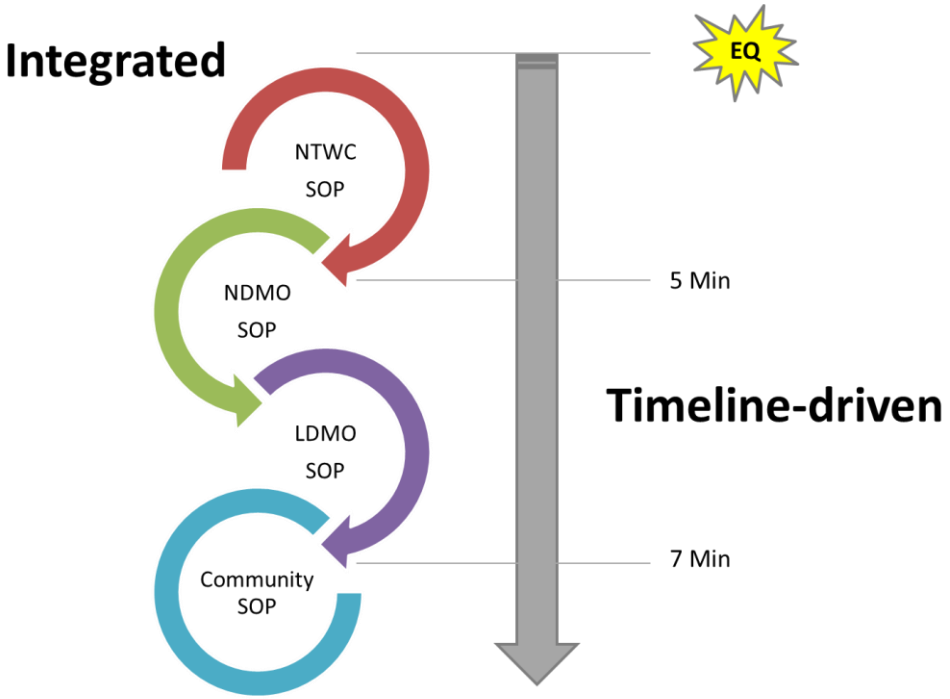
1. Warning levels allows to **link threat information to institutional and public response** in a clear and transparent way
2. By agreeing on warning levels among the relevant stakeholder it allows to establish a **joint framework** which combines **tsunami warning levels** (mandate of the NTWC) with the respective **response** (mandate of the DMOs) and provides clear indication whether to **call for evacuation** (mandate usually either by the NDMO or LDMO)
3. Then, warning levels can play a **key role in the SOP development** at all levels



CRITICAL ISSUES IN THE WARNING CHAIN

for disseminating warnings down to the community

Critical issues to have in mind…

Organization of warning chains

- Too many steps with many actors involved
- Unrealistic time lines
- Unclear roles and responsibilities
- translation from warning to guidance

Threat Status	Action to be taken	Dissemination to
WARNING	Public should be advised to move inland towards higher grounds. Vessels should move into deep Ocean	MoES, MHA, NDMA, NCMC, NDRF Battalions, SEOC, DEOC, Public, Media
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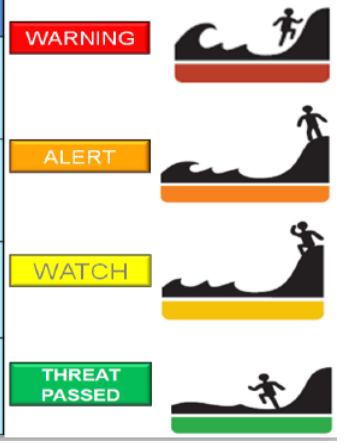


Decision making processes

- Respecting the mandates
- Decision making SOP
- Standard reaction scheme based on warning levels

Coverage at local level

- Broadcast media plays an important role, arrangements need to be strengthened
- Public alert systems (sirens) available usually only in few places
- Potential for use of new ICT (cell-broadcasting, social networks, smartphones applications)

Critical issues to have in mind…

Warning without providing guidance is not effective

- The warning and guidance might come from different institution (NTWC, N/LDMO) which may not always interlink to each other

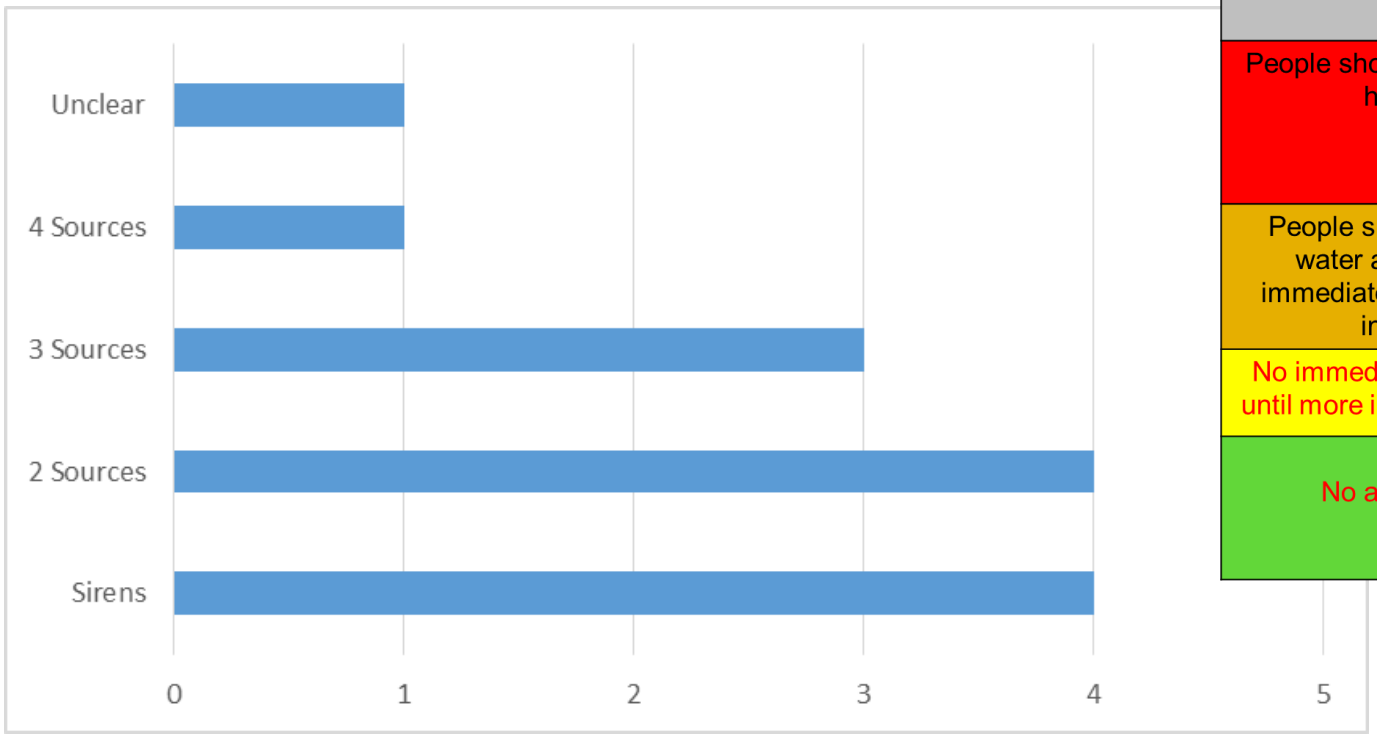
A core task in the warning chain is to decide whether to officially call for evacuation, i.e trigger public alert systems / sirens

- Assure that responsible institutions have the necessary information and capacity for timely (24/7) decision making and communicating it to the public and media

The warning chain is only as strong as its weakest link

Redundancy & Consistency of Warning Information

Does the community at risk receives the warning from multiple sources? Are the contents of messages from different sources well aligned?



Sources of official warnings reaching out directly to the Communities at Risk (NTWC, NDMO, LDMO, Media)

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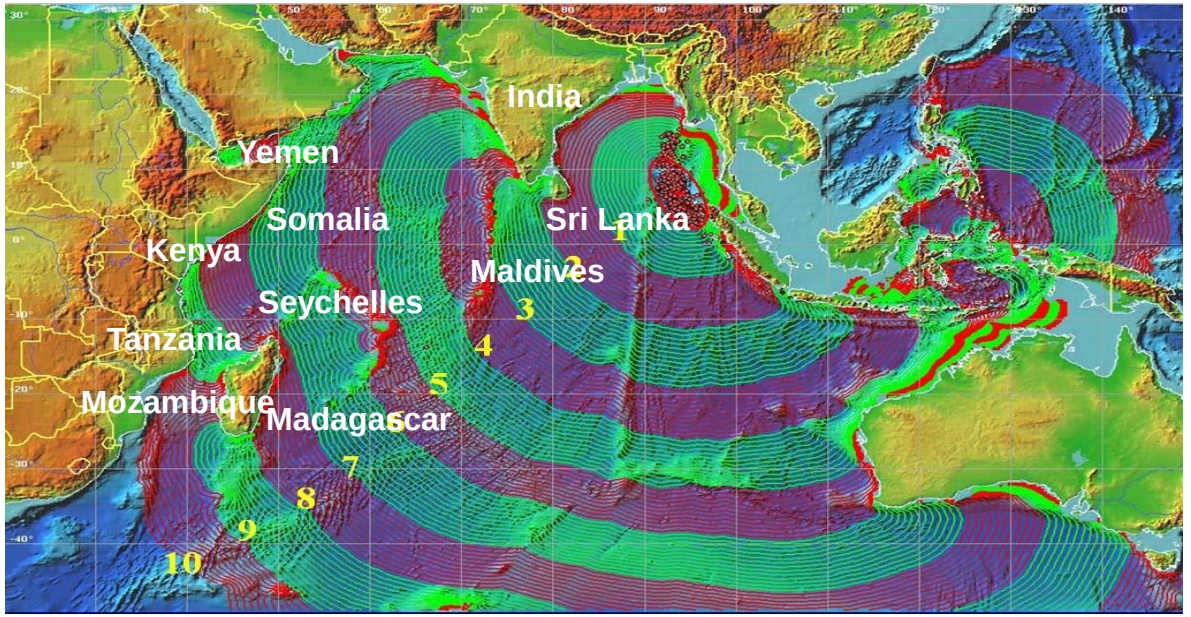
Some considerations for dealing with distant tsunamis

In principle there is enough time for WIO countries to wait for confirmation by the TSPs that a tsunami from a distant source has actually been generated before issuing a national warning by the NTWC



Nevertheless, policies and procedures must be designed in way to be executed realistically to enable people to evacuate orderly in time

Some considerations for dealing with distant tsunamis

Manage public information at all times of an incident

- People will learn about a potential distant threat from different sources
- Important for the national TEWS to **be the main source of information**
- Inform people about a possible threat even before a national warning has been issued and that a warning will be issued if necessary
- A **“no threat” message** is important once it comes clear that the incident does not pose a threat for the country
- In case a national warning has been issued, an **“all clear” message** is required once the tsunami threat is over

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THANK YOU