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Booklet on ‘Strengthening Tsunami Warning Chains - A visual-based approach to support multi-stakeholder work processes’

Harald Spahn

Invited Expert

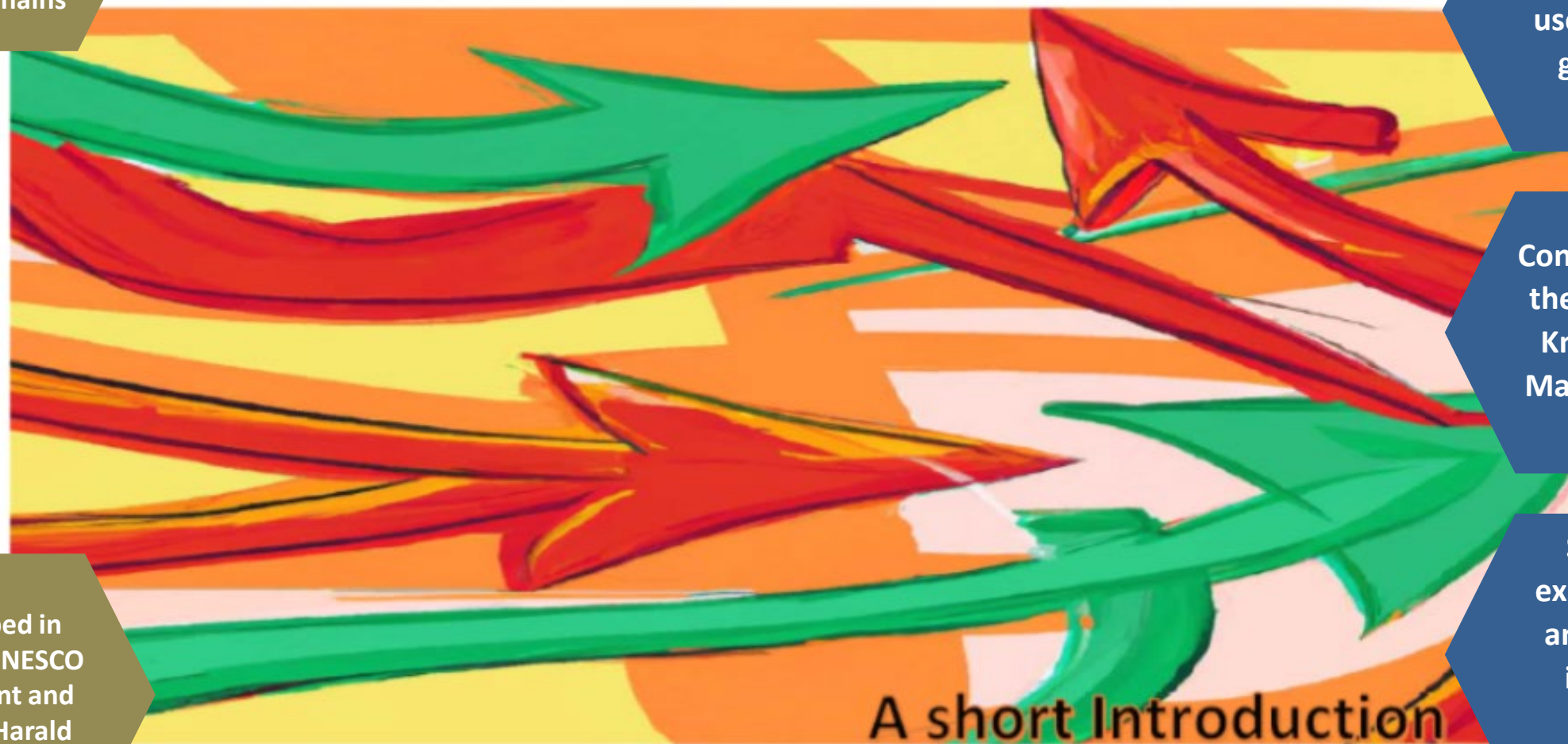
harald.spahn@web.de

Meeting of ICG/IOTWMS Working Group 1, online, 17 July 2025

A short booklet that explains how we use graphics to strengthen warning chains

Strengthening Tsunami Warning Chains

A visual-based approach to support multi-stakeholder work processes



A short Introduction

Quick reference for users of the graphics

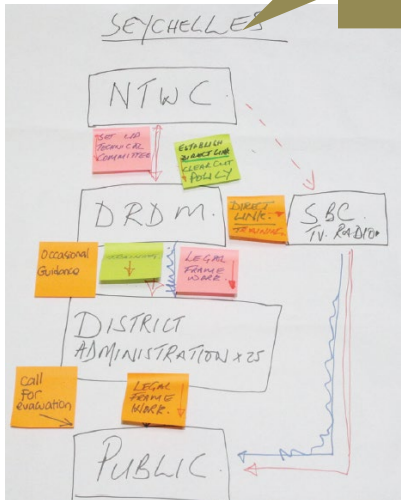
Contributes to the IOTWMS Knowledge Management

Sharing experiences and create interest beyond IOTWMS

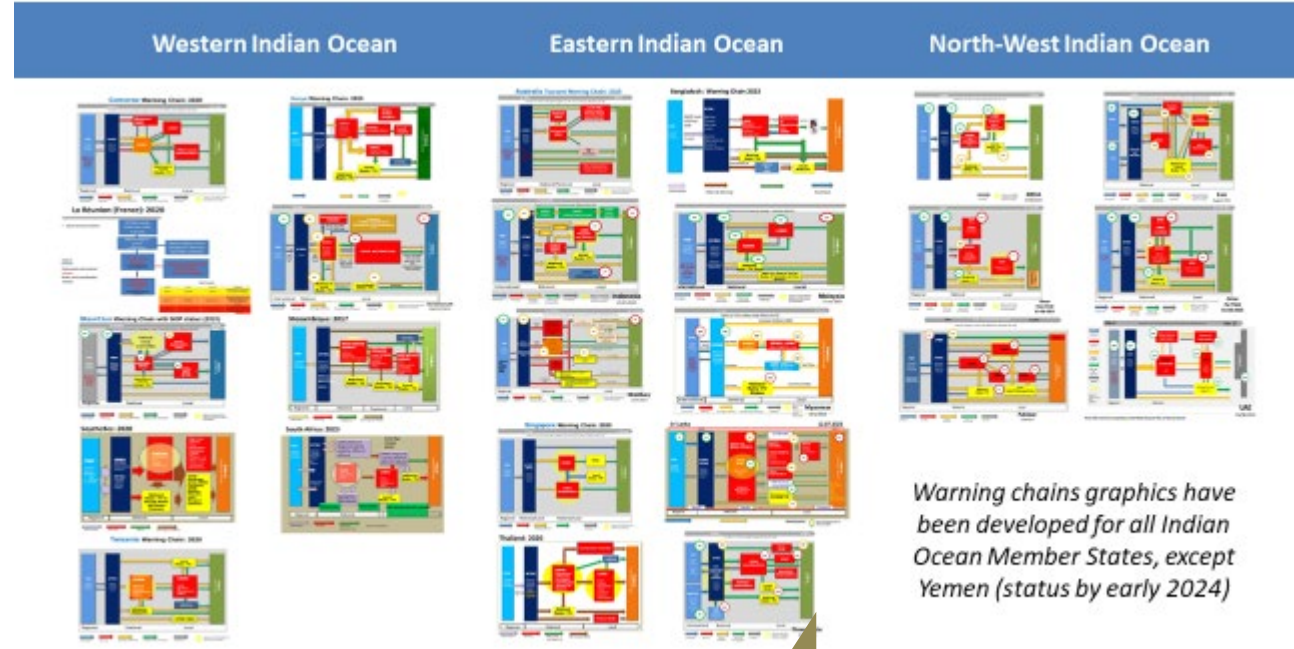
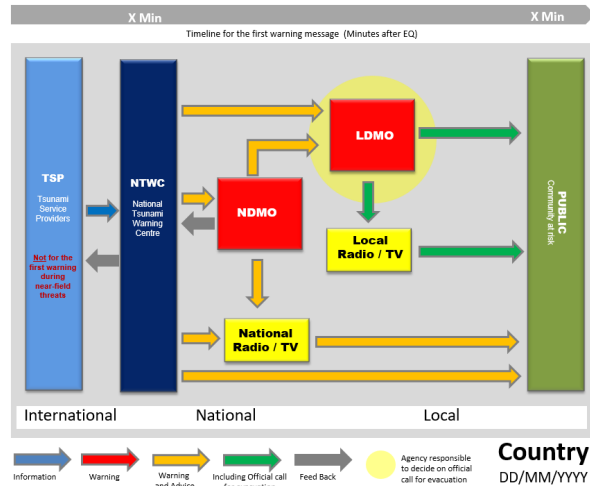
Developed in 2024 by UNESCO Consultant and Advisor Harald Spahn

The Booklet builds on the experiences of using graphics as a tool to work on Tsunami Warning Chains and SOP development in the IOTWMS

This is how it started in the SOP Workshop 2011 in Jakarta...



...and this is the template we use nowadays in the IOTWMS



Warning chains graphics have been developed for all Indian Ocean Member States, except Yemen (status by early 2024)

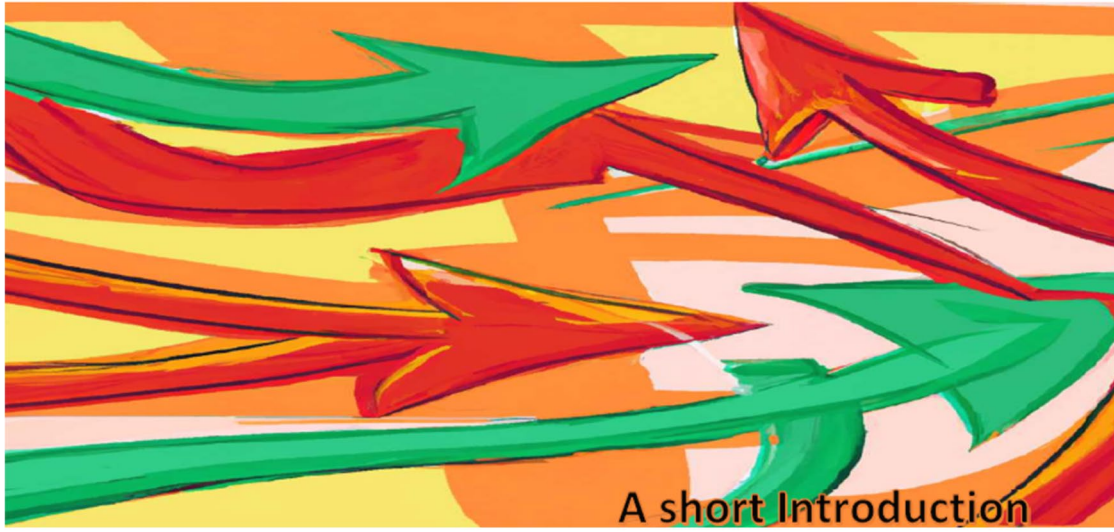
Warning chains and SOPs have so far been designed exclusively for seismically induced tsunamis. Possible non-seismic events still need to be taken into account

...applied by all Member States, except Yemen

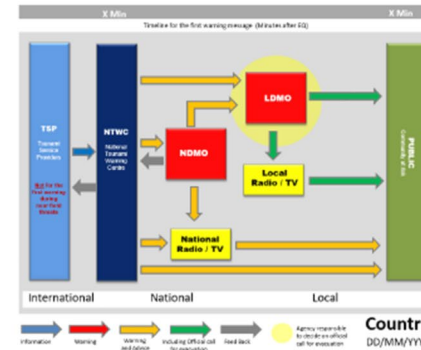
Design of the booklet

Strengthening Tsunami Warning Chains

A visual-based approach to support multi-stakeholder work processes

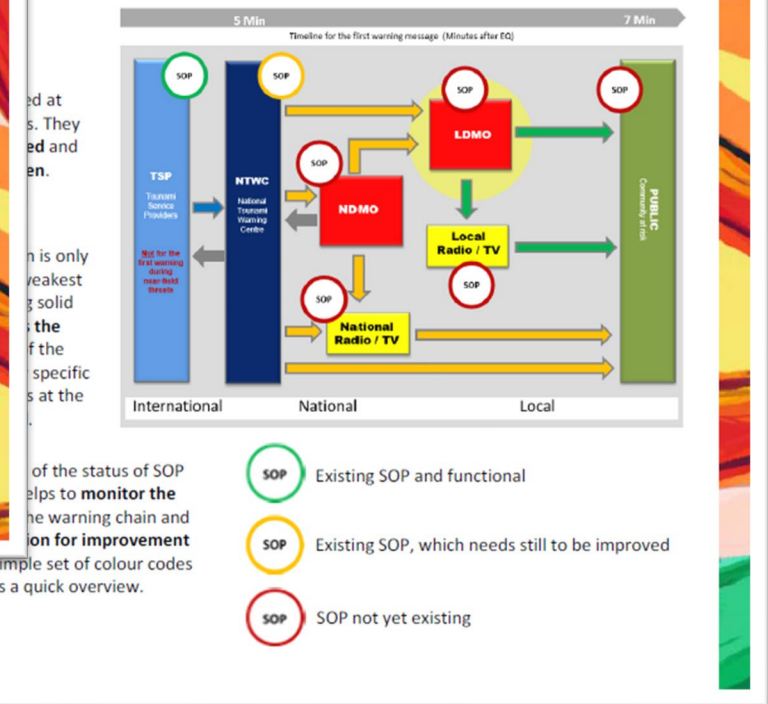


How does it work?



... that this is the most important and usually the most time-consuming part of the process. The responsibilities and the agreement on a short and practical solution are the main focus here.

Warning Chain



Short and informative - 12 pages including front and back cover

Clear and simple structure and bold headings

Ensure that it is consistent and easy to understand

Down to the point through key messages and short explanations

A good visualisation of the warning chain should be self-explanatory. Make sure that flows and colour codes are consistent. If an external person can read the warning chain correctly, everything is ok

graphic

Outline and Purposes of the Booklet (1)

Strengthening Tsunami Warning Chains

A visual-based approach to support multi-stakeholder work processes

A short Introduction

Warning Chain Challenges

Tsunami warning chains need collaboration from organisations at international, national, regional, and local levels. The broadcast media are crucial in disseminating warning messages.

- A multi stakeholder affair**
- Roles & Mandates**: The institutions involved have different roles and mandates, which is reflected in the contents of their warning messages. The call for evacuation (and the activation of sirens) is usually linked to a specific decision-making body (in some cases at local level).
- Warning plan Guidance**: Communities at risk and the general public need not only a warning, but also guidance on what to do, backed up if necessary by official calls for evacuation.
- Time pressure**: Tsunami warning chains must reliably transmit warnings in a very short time frame. With near-field threats, this is often a matter of minutes.
- Redundancy**: Robust warning chains include parallel flows of warnings to assure redundancy in case of failure at one point.
- Coherence**: The coherence of warning message contents from multiple sources should be ensured. This involves having a clear understanding of what the siren means (warning or evacuation?).

The visual-based approach

What is it about?

- A graphical representation of the warning chain**: A simplified graphical representation of the end-to-end warning chain, including all key players, is at the heart of the approach.
- Build common understanding of the warning chain**: As a visualisation tool it supports the development of a common understanding of the warning process for all key stakeholders. Specific colour codes are used to visualise different warning contents along the warning chain.
- Visualisation tool to improve the warning chain**: It serves as a basis for joint discussion among stakeholders on necessary adjustments to the warning chain to ensure redundancy and feasibility in the limited warning time available.

How does it work?

- Use the template as a starting point**: The starting point is an editable template that includes an exemplary warning chain and the actions that are typically involved.
- Adjust it to the set-up of your national warning chain**: As each country has its own particular set-up, the template needs to be adjusted to represent the respective national warning chain.
- Review and verify it with all stakeholders involved**: Experience shows that this is the most important and usually also the most time-consuming part of the process. The clarification of responsibilities and the agreement on a short and also practicable solution are the main focus here.
- Ensure that it is consistent and easy to understand**: A good visualisation of the warning chain should be self-explanatory. Make sure that flows and colour codes are consistent. If an external person can read the warning chain correctly, everything is ok.

The Warning Chain Template

Timeline for the first warning message (30 minutes after TSP)

Country DD/MM/YYYY

Colour Codes & Definitions

- Information from TSP**: Threat information by TSP to NTWC
- Warning only**: Warning by NTWC - no advice attached -
- Warning plus Advice**: Warning message that include an Advice, ideally this is issued already by NTWC, based on an agreement with the NDMO. Content of advice usually relates to the respective warning level.
- Official Call for Evacuation**: Warning / Advice messages that include an Official Call for Evacuation issued by the mandated authority in case it is required. This implies a separate decision making process by the respective authority and issuing a specific message which includes warning information and a call for evacuation if required.
- Feedback Loop**: Feedback information to confirm the receipt of warning messages and to inform about the situation

A yellow circle marks the agency responsible to decide on official call for evacuation

The **Timeline** indicates the targeted deadline to send out the first warning message by NTWC and the time when it should arrive at the community at risk. Particularly important in case of a near-field threats!

Explains the key issues of solid warning chains

Explains the approach and how to use it as a tool

Serves as a reference for users in the IOTWMS and beyond

Outline and Purposes of the Booklet (2)

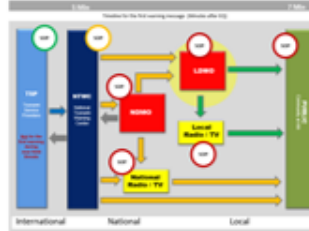
Consolidating the warning chain

Check these aspects

- Consistency**
 - Are the flows consistent? Decision making? Colour codes?
- In line with time?**
 - Does the proposed time line match calculated Minimum ETAs from hazard assessment? Does the time line allow enough time for community response?
- Can it be shortened?**
 - Warning chains should be as short as possible - especially for near field threats. Each step in the warning chain takes time and is a possible point of failure.
- Redundancy**
 - Robust warning chains include parallel flows of warnings to assure redundancy in case of failure at one point. Does the community at risk receives the warning from multiple sources? Are the contents of messages from different sources well aligned?
- Is it feasible in real life?**
 - Is the proposed flow of the warning chain feasible in the time available? Are all institutions 24/7? Do they have sufficient human resources to operate the warning chain?
- Agreed by all actors involved?**
 - Are all key actors considered and properly represented? Is the outline of the warning chain fully understood and accepted by all stakeholder involved?

Operating the Warning Chain


- SOPs are necessary to operate the warning chain**
 - SOPs are needed at institutional levels. They must be integrated and timeline-driven.
- Ensure that SOPs are functional at all levels**
 - The warning chain is only as strong as its weakest link. Developing solid SOPs requires the cooperation of the stakeholders. Pay specific attention to SOPs at the local level.
- Visualize the status in the warning chain graphic**
 - The visualization of the status of SOP development helps to monitor the functionality of the warning chain and shows where action for improvement is needed. A simple set of colour codes provides a quick overview.



- Existing SOP and functional
- Existing SOP, which needs still to be improved
- SOP not yet existing

Performance Evaluation

- Document the actual timelines...**
 - The graphic can be used to document observed times of receipt and transmission of warning information along the Tsunami Warning Chain.
- ...for the entire warning sequence**
 - It is recommended to document the flow for all outgoing NTWC warning messages with a separate copy of the graphic for each NTWC (message sent).
- Applicable for Exercises or Incidents**
 - Suitable to evaluate end-to-end tsunami exercises or any real tsunami incident where a warning was issued. All time data should be based on the information provided by the participating institutions and should result in a joint evaluation.



- Message SENT
- Message RECEIVED
- Time: Minutes after initial earthquake

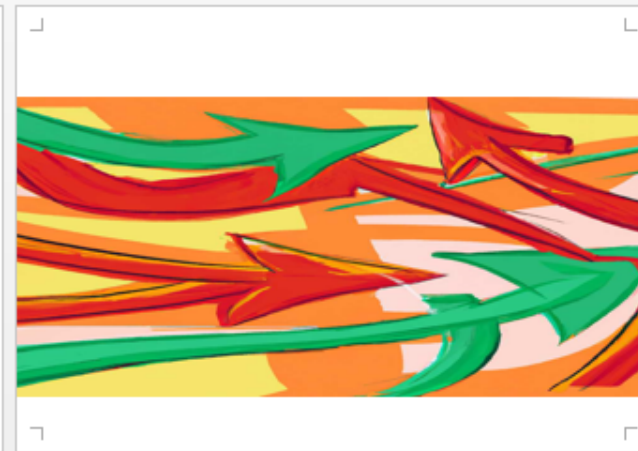
Our Experiences

- Successfully applied to the IOTWMS**
 - National warning chain graphics have been developed and are now used in 24 countries around the Indian Ocean rim.
- Proven to be easy and effective to use**
 - The visual and thus universal language facilitates a common understanding. It helps to focus the discussion on the essentials and at the same time documents any progress that has been made.
- Suitable for application in other ocean basins**
 - Since the challenges of developing tsunami warning chains are likely to be similar around the globe, the approach should be applicable in other regions without any problems. First countries in the NEANTWS are testing it already.
- Applicable also for other hazards**
 - Warning chains are a core element of any Early Warning System for natural hazards. This visual approach has already been adapted to hydrometeorological hazards and successfully applied in some countries in Europe and Latin America.

Acknowledgement

This brochure gives a short overview of the visual approach to support multi-stakeholder work processes to strengthen [warning chains](#), which has been developed and put into practice in the IOTWMS over many years.

Author: Harald Spain
September 2024



Provides hints how to consolidate warning chains

Explains how it links to SOPs and how to visualize them

Explains how the graphics can be used for performance evaluation

Follow-up Actions by Working Group 1

as agreed upon during Steering Group Meeting 19

- Review the draft booklet for adoption as an IOTWMS document
- Put it up to the TT-DMP for possible adoption as a global document