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Matters relating to the global goal on adaptation

Submission from WMO

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The Critical Role of Multi-hazard Early Warning Systems in Climate Adaptation

Multi-hazard Early Warning Systems (MHEWS) as Key to Climate Adaptation: MHEWS are critical for proactive climate adaptation, enabling vulnerable individuals and communities to respond to hazards and safeguard lives, livelihoods, and ecosystems, with EW4All driving global action by 2027.

Ensuring Continuous Improvement of MHEWS: Robust monitoring and accountability mechanisms within EW4All, integrated into climate reporting frameworks like NDCs, MHEWS evolve and support targeted adaptation interventions, fostering transparency and refining climate resilience strategies.

Aligning Climate Policy and Action with Climate Science: Latest climate data is needed to inform adaptation measures, including MHEWS, and National Meteorological and Hydrological Services have a key role to play in this regard, requiring their active engagement in climate policy and action.

Introduction

The increasing frequency and intensity of hazardous weather events such as floods, storms, droughts, and heatwaves are a testament to the profound impacts of climate change on communities worldwide. Particularly in vulnerable and exposed regions, proactive climate adaptation strategies are essential to reducing the adverse effects of these disasters¹. Multi-hazard Early Warnings Systems (MHEWS) are an integral tool for countries to adapt to the changing climate and to avert, minimize and address losses and damages caused by hazardous events².

MHEWS offer the critical information necessary for timely decision-making and action, aimed at protecting lives, livelihoods, and the environment, including infrastructure against hazardous weather events, many of which are changing as the climate changes. The Early Warnings for All (EW4All) initiative is a global effort aimed at universal coverage of MHEWS by 2027, with the goal of advancing international climate adaptation and resilience³. In this brief, we explore the importance of MHEWS as a pillar for climate adaptation, EW4All's role as a catalyst for global action, and the integration of science-based strategies and National Meteorological and Hydrological Services (NMHSs) in achieving these objectives.

¹ World Meteorological Organization. (2023). *State of the Global Climate 2023*. Retrieved from <https://wmo.int/publication-series/state-of-global-climate-2023>

² WASP. (2023). *Science for Adaptation Policy Brief No. 4*. Retrieved from https://wasp-adaptation.org/images/Resources/WASP_Science_for_Adaptation_Policy_Brief_No._4.pdf

³ Early Warnings for All. (2023). *Early Warnings for All Initiative*. Retrieved from <https://earlywarningsforall.org/site/early-warnings-all>



Multi-hazard Early Warning Systems as Pillars of Climate Adaptation

Hazardous weather events, often becoming increasingly frequent and intense due to climate change, are placing significant strain on communities and ecosystems. With less time between events, individuals have fewer opportunities to recover, leading to the exhaustion of traditional coping strategies. In response, practices that undermine long-term climate adaptation and resilience, such as selling productive assets and land use change, often emerge. This makes it essential to provide early warnings that allow individuals and communities to take proactive steps to address, mitigate, or avert the loss and damages associated with these hazardous events.

In the first half of 2024, hazardous events – including, but not limited to hydrometeorological events – have brought death and destruction to every part of the world. This is a continuation of a worrying trend highlighted by the World Meteorological Organization (WMO) in its latest State of the Global Climate Report, which states that in 2023, "extreme weather continued to lead to severe socio-economic impacts" (WMO, 2024a, p. ii). It also noted that there "were particularly devastating consequences for vulnerable populations who suffer disproportionate impacts" (WMO, 2024a, p. iii). While some countries were able to minimise the negative impacts of these events as a result of comprehensive Multi-Hazard Early Warning Systems (MHEWS), sadly others experienced significant losses – of lives, livelihoods, assets and infrastructure, with some of these impacts continuing months beyond the hazardous event itself.

In this context, MHEWS are key enablers of climate adaptation, providing critical information that helps decision-makers safeguard both people and the ecosystems they rely on. By informing timely actions in response to both sudden onset and slow-onset events, MHEWS directly contribute to resilience-building and adaptation, enabling communities to withstand, recover, and adapt to the changing climate.

The critical role of MHEWS in climate adaptation is firmly recognized within the **UNFCCC framework**. The **Paris Agreement** highlights the importance of enhancing adaptive capacity and reducing vulnerability to climate risks, and MHEWS are key to informing actions that avert and minimize losses. The **Global Stocktake (GST)** further reinforces this by assessing progress in adaptation efforts, ensuring that nations leverage MHEWS to close preparedness gaps. In the context of the **Loss and Damage Fund**, MHEWS are essential for helping vulnerable countries address the escalating impacts of hazardous events. Additionally, the **Santiago Network** aim to provides technical assistance for loss and damage, emphasizing the need for accessible, robust MHEWS to build resilience in developing nations. **Nationally Determined Contributions (NDCs)** also increasingly integrate MHEWS to strengthen national climate strategies and sectoral planning.

Beyond the UNFCCC, MHEWS deliver co-benefits to international frameworks like the **Sendai Framework for Disaster Risk Reduction (DRR)**, which promotes multi-hazard early warning systems to mitigate disaster risks. They also support the **Sustainable**



Development Goals (SDGs), particularly **Goal 13 (Climate Action)** and **Goal 11 (Sustainable Cities and Communities)**, by helping safeguard lives, ecosystems, and livelihoods from climate-induced disasters. This cross-cutting utility of MHEWS strengthens global efforts toward sustainability and resilience in a rapidly changing climate.

EW4All as a Catalyst for Global Action

Building effective MHEWS for adaptation is an interdisciplinary task requiring integrated system approach that incorporates climate change adaptation, DRR, and development processes. To effectively to this, a MHEWS approach is proposed with 4 pillars: risk knowledge; monitoring, forecasting, and warnings; communication, and dissemination; as well as preparedness and response to warnings. These are the four pillars that underpin the EW4All.

Despite some progress, gaps in MHEWS coverage persist. As of March 2024, 108 countries had reported the existence of MHEWS – 55 per cent of all countries in the world. The highest coverage remains in the Asia and Pacific region. The Americas and Caribbean region still lag behind.

Where MHEWS do exist, there may be gaps. Of the 108 countries reporting the existence of MHEWS, the majority (98 countries; 91 per cent) are reporting the existence of 'Warning dissemination and communication' (Pillar 3), with the lowest reporting on 'Disaster Risk Knowledge' (Pillar 1) with 53 countries (49 per cent) reporting non-zero scores⁴.

The EW4All initiative is a transformative approach to scaling global climate adaptation, spearheading efforts to ensure universal MHEWS coverage by 2027. This initiative, launched by the UN Secretary-General, integrates DRR, climate change adaptation, and sustainable development goals to enhance resilience. EW4All follows a structured MHEWS framework built on four core pillars. These elements ensure that communities receive timely and accurate warnings to take preventive actions against climate-induced hazards, making MHEWS a linchpin of adaptation strategies.

To date, 29 countries have held national EW4All launches, yielding national roadmaps detailing the country's vision and plan for action for MHEWS strengthening. The successful rollout of EW4All relies on multi-stakeholder partnerships, including the UN, civil society, academia, the private sector, and NGOs. These diverse entities contribute unique expertise and resources, fostering innovation and avoiding duplication of efforts.

Continued support for the initial EW4All up takers is paramount to ensuring the successful implementation of the EW4All initiative. These countries have already made significant progress in finalizing their national roadmaps and mobilizing resources for the deployment of MHEWS. Sustaining this momentum and providing ongoing assistance will be crucial as they work towards achieving universal coverage.

⁴ WMO and UNDRR, 2024. Global Status of Multi-Hazard Early Warning Systems 2024. Forthcoming



Simultaneously, efforts in 2024 and beyond focus on expanding the initiative beyond the initial focus countries based on the demand raised from other countries. Recognizing the urgent need for comprehensive early warning systems worldwide, EW4All is actively engaging with additional countries that express interest in participating. Once again unique range of partnerships will enable this scale up.

When examined alongside disaster-related mortality, Sendai Framework Monitor Target A and G data show that countries with 'limited' to 'moderate' MHEWS comprehensiveness have a six-times-higher disaster-related mortality ratio compared with that in the countries with 'substantial' to 'comprehensive' MHEWS.

Monitoring, Accountability, and Integration of Systems

To ensure that early warning systems are continuously improving and aligned with global climate adaptation goals, robust monitoring and accountability mechanisms are essential. Transparent data collection, reporting, and analysis allow for the effective tracking of MHEWS implementation. This, in turn, enables countries to adjust their climate adaptation strategies based on real-time insights and emerging trends.

Monitoring systems tied to EW4All can be integrated into broader climate reporting frameworks, such as NDCs, to ensure that countries' climate policies are informed by the latest data and early warning system performance. Data-driven insights can highlight gaps in preparedness, allowing for more targeted adaptation interventions. By fostering a culture of transparency and accountability, countries can refine their climate resilience strategies over time.

88 percent of LDCs and SIDS that have submitted their NDCs already identify MHEWS as a priority⁵.

The EW4All Monitoring and Evaluation (M&E) Framework⁶ follows a twin-track approach: global progress monitoring to provide an overview of early warning coverage and country-level monitoring on EW4All implementation in the kick-off countries.

A Toolkit for Monitoring & Evaluation of Early Warnings for All has been developed as a resource for countries and MHEWS implementing partners to align with the EW4ALL M&E Framework for projects, programmes, and services that aim to establish or improve end-to-end, people-centered multi-hazard early warning systems. The Toolkit socializes the

⁵ World Meteorological Organization. (2020). *State of Climate Services 2020: Risk Information and Early Warning Systems*. Retrieved from <https://library.wmo.int/records/item/57191-2020-state-of-climate-services-risk-information-and-early-warning-systems>

⁶ World Meteorological Organization. (n.d.). *Toolkit for Monitoring and Evaluation of Early Warnings for All*. Retrieved from <https://wmo.int/files/toolkit-monitoring-evaluation-of-early-warnings-all>



Sendai Framework Target G and EW4All Theory of Change and facilitates the adoption of a common set of indicators across the four pillars of MHEWS and cross-cutting enablers.

A continuous flow of monitoring data and comprehensive analysis, including case studies and anecdotal evidence, are ensured through the following two reporting tools:

- **EW4All Dashboard⁷**: Serving as the central data portal and information-sharing platform, the dashboard regularly monitors and visualizes data across the four pillars of multi-hazard early warning systems. The dashboard presents information across the following areas:
 - **Global Progress**: Metrics that assess the initiative's impact on delivering end-to-end, people centred MHEWS. Data is sourced from official reporting mechanisms such as the Sendai Framework Monitor (SFM).
 - **EW4All Implementation**: Indicators that track the implementation of the EW4All pillars, cross-cutting strategies, and major inter-pillar activities. Data is sourced from the SFM, WMO's monitoring system, ITU and the IFRC's Anticipatory Action Global Report.
 - **Country Capacity**: Baseline and progress data on countries' early warning capacities (currently focused on Pillar 2, with plans to expand to all pillars), sourced from WMO's monitoring system. This data will inform the development of a maturity index for tracking national capacity growth.
- **Annual Reports on the Global Status of Multi-Hazard Early Warning Systems⁸**: Released at each UNFCCC-COP, these reports provide periodic stocktakes of EW4All implementation progress. A thematic report on MHEWS in Least Developed Countries (LDCs) has also been developed, co-led with the UN Office of the High Representative for the LDCs, LLDCs, and SIDS (UN-OHRLLS)⁹.

Work is ongoing on the development of a maturity index on early warning capacity and effectiveness. As a first step, a **Pillar 2 Rapid Assessment** has been designed and is being applied in evaluating the hazard monitoring and forecasting capacity at the country level. The tool identifies areas with the largest capacity gaps, allowing for better-targeted technical assistance and investments.

Science-Based Adaptation Strategies and the Role of NMHSs

Progress on the EW4All initiative and the implementation of MHEWS hinges on strong linkages to the latest climate science. As the climate changes, hazardous events such as storms, floods, droughts, and heatwaves are becoming more frequent and intense, requiring early warning systems to be informed by the most up-to-date and accurate climate data. The ability to anticipate evolving climate patterns, understand emerging risks, and adapt to these changes is essential for designing effective early warnings. This requires integrating real-time data and projections from climate science into early warning

⁷ Early Warnings for All. (2023). *Early Warnings for All Dashboard*. Retrieved from <https://earlywarningsforall.org/site/early-warnings-all/early-warnings-all-dashboard>

⁸ World Meteorological Organization. (2023). *Global Status of Multi-Hazard Early Warning Systems 2023*. Retrieved from <https://wmo.int/publication-series/global-status-of-multi-hazard-early-warning-systems-2023>

⁹ United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States. (2021). *Multi-Hazard Early Warning Systems in Least Developed Countries*. Retrieved from https://www.un.org/ohrrls/sites/www.un.org.ohrrls/files/mhews_in_ldcs.pdf



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systems, allowing communities and policymakers to better address, mitigate, and avert the impacts of climate hazards.

The World Meteorological Organization (WMO) and its Members, particularly National Meteorological and Hydrological Services (NMHSs), play a central role in this effort. NMHSs provide the foundational climate data, analysis, and forecasts that underpin early warning systems. These national agencies are critical for translating complex climate information into actionable insights that inform disaster preparedness and response. In both policy and practice, NMHSs are key actors for climate action, as they ensure that early warning systems reflect the latest climate science. To ensure the success of EW4All, NMHSs must be included in the decision-making process, given their expertise and operational capacity in monitoring climate patterns and providing early warnings that help communities become more resilient to climate impacts.