



# Report: Testbed 2

## Zambia

### April 2025

# REPORT

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## Executive Summary

This report outlines the activities and outcomes of the first intensive phase of the King-size WISER-EWSA Testbed, referred to as T2-Z (Zambia and Zuid Afrika), which took place in-person in Lusaka from January 30th to February 7th 2025. This is part of the broader King-size Testbed under the WISER-EWSA project, with a second intensive phase (T2-M in Mozambique) to be documented in a future report update.

T2-Z brought together 73 participants from 9 countries—Zambia, South Africa, Mozambique, Zimbabwe, Malawi, Germany, the UK, Switzerland and Finland—including forecasters, researchers, , community engagement specialists, and representatives from regional and international organisations. Activities were hosted at the Zambia Air Force (ZAF) facilities, with ZMD and INAM forecasters leading operations on-site. Although SAWS forecasters were unable to join in person due to the impact of a cyberattack, they engaged remotely when possible. Community observers from Zambia, South Africa, and Mozambique actively participated, providing structured feedback using a Google form.

Daily Operations ran continuously over a nine-day period, with 24-hour nowcasting conducted for Kanyama, Zambia. Nowcasts were issued every two hours, resulting in approximately 150 nowcasts and synoptic forecasts. These were disseminated to community observers through WhatsApp, with structured feedback collected via Google Forms and chat messages three times a day. When needed, unscheduled updates were also issued in response to evolving weather conditions. Nowcasts for Boane (Mozambique) and Katlehong (South Africa) were only issued when necessary.

Evaluation of nowcasts was conducted during the 9-day testbed using a case study methodology co-led by forecasters and researchers. Daily review meetings supported reflection on nowcast accuracy, communication methods, and the practical utility of alerts. Feedback from observers and user engagement teams confirmed improved community understanding of forecasts and increased capacity to respond to warnings.

A number of special events were held during the testbed:

- An Open Day on February 5th welcomed over 60 visitors from the Zambian government, disaster management agencies, NGOs, and media to the ZAF hub. Attendees learned about the testbed, observed live nowcasting operations, and interacted with forecasters, community observers and technical leads.
- A Cross-Project Reflection Day was held on February 7th, allowing teams from across WISER-EWSA work packages to share learnings, challenges, and recommendations to refine future testbed operations.

Overall, the T2-Z Testbed demonstrated substantial progress in collaborative forecasting, user engagement, and co-production of early warnings. Lessons learned from this phase will directly inform the design and implementation of future nowcasting initiatives in Southern Africa.

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# 1. Introduction

The WISER-EWSA Testbed 2 (T-2), also known as the "King-size Testbed," represents a significant step forward in the development and implementation of early warning systems (EWS) for severe weather in Southern Africa. The King-size testbed was designed to cover the entire Southern African rainy season, from 1st October 2024 to 30th April 2025. The objective of this extensive period is to ensure that testbed operations capture a wide range of weather conditions, provide valuable insights into the effectiveness of early warning systems and the sustainability of nowcasting processes within National Meteorological and Hydrological Services (NMHS). The King-size testbed was divided into two main phases: the extended and intensive phases.

During the extended phase, nowcasting activities are being conducted on an as-needed basis, triggered by the anticipation of severe weather events. If severe weather is expected to impact these partner communities, it will be classified as an Intensive Nowcasting Event (INE). A decision tree protocol was followed to determine when an INE would be activated, based on daily outlook forecasts produced by lead forecasters from Instituto Nacional de Meteorologia of Mozambique (INAM), South Africa Weather Services (SAWS) and Zambia Meteorological Department (ZMD). These forecasts are reviewed during online daily briefing meetings between forecasters, meteorologists, academics and user engagement specialists from Mozambique, South Africa, Zambia, the UK and Switzerland. In these meetings, the lead forecasters of each NMHS initiate INEs when severe weather is expected to impact the partner communities in Mozambique (Boane), Zambia (Kanyama), or South Africa (Katlehong). If the INEs occur before 16:00 CAT, the INEs are analysed in an online review meeting. The extended period also includes weekly handover meetings to ensure smooth transitions between forecasting teams and to review weather conditions from the previous week.

In the intensive phases, the WISER EWSA team met in person to issue nowcasts intensively, and evaluate the nowcasting information using case study methodologies that include analysing the feedback from community observers in each community. Initially, the plan was to have a single intensive phase where the WISER EWSA team would gather in Maputo, Mozambique, to conduct an in-person two week intensive period of nowcasting and user engagement in the peak of the rainy season in 2025. However, due to political instability that followed the presidential elections in October, 2024, this plan was restructured into two separate intensive phases:

1. T2-Z (Zambia and Zuid Afrika): Conducted from 30th January to 7th February 2025 in Lusaka, Zambia, preceded by a 3-day forecaster-training event (27th-29th January) to prepare forecasters for the intensive activities.
2. T2-M (Mozambique): Rescheduled for 22nd-27th March 2025, and a 2-day pre-testbed training for forecasters (20th-21st March, 2025) with a focus on nowcasting and community engagement in Boane (Maputo).

This restructuring into two intensive phases enabled the continuation of the project in Zambia and South Africa while allowing time to prepare for a safe and productive testbed in Mozambique once political conditions stabilised. The extended period of operations, combined with the two intensive phases, provided a comprehensive framework for testing and refining short-range early warning systems across Southern Africa, while maintaining flexibility to adapt to unforeseen challenges. The involvement of a wide range of participants, including community observers from our partner communities, highlights WISER EWSA's commitment

to co-production and inclusivity in reducing disaster risks rendered from high-impact weather events.

## **1.1 Overview of T2-Z (Zambia and Zuid-Afrika)**

T2-Z brought together the WISER-EWSA team in Lusaka at the Zambia Meteorological Department's (ZMD) testbed hub, located at the Zambia Air Force (ZAF) base in Lusaka. The team comprised forecasters, meteorologists, researchers, academics, economists, social scientists, and user-engagement specialists from South Africa, Zambia, Mozambique, Switzerland and the UK.

Additionally, community observers from Kanyama which are now part of the Satellite Disaster Management Committee (SMDC), played a critical role during T2-Z. In parallel to the operations in the testbed hub, the WP1 team organised community-based activities in Kanyama, which were led by SDMC. The 'technical team' (forecasters, meteorologists, researchers, and academics) joined SDMCs in Kanyama, in activities that include:

- Raising awareness about weather information among community residents
- Developing critical feedback on the nowcasting templates and providing specific recommendations to improve clarity of nowcasts
- Demonstrate how SMDCs disseminate weather information among their neighbours, including households with members with disabilities.

Through these activities, WISER-EWSA technical teams worked alongside Kanyama community members, gaining valuable insights into how weather information is received and used at the local level. This direct engagement helped forecasters and researchers better understand community needs, which led to improvements in early warning communication and accessibility.

## **2. Summary of Pre-testbed Training**

The training workshop was hosted from the 27<sup>th</sup> to the 29<sup>th</sup> of January 2025, at the Zambia Air Force (ZAF). The training was led and delivered by Ms. Cynthia Nemitudi. The official opening of the workshop was done on behalf of the Ministry of Green Economy and the Environment and the Zambian Meteorological Office PR Office, by the Office of the Chief Director. The total number of forecasters targeted for the 3 (three) day training programme was 40 (forty), from the Mozambican and Zambian Met Offices, with the support of the SAWS Regional Training Centre and Research and Development departments, respectively.

The aim was to enhance forecaster nowcasting skills whilst also making sure that the impact-based forecasting and Common Alerting Protocol (CAP), capabilities were adequately imparted to all trainees to issue the necessary nowcast warnings. Existing gaps in nowcasting and Impact based forecasting were addressed. The Nowcasting Standard Operating Procedure (SOP) was reviewed. The focus and emphasis were on the guidelines for issuing 6-hour and 2-hour risk maps, operationally. Participants were also refreshed on CAP knowledge, of which it was noted that the ZMD and INAM were constantly issuing CAP messages as previously trained in October 2024, in Maputo.

They created the impact-based warnings for various regions in the two study countries, which were later subjected to in depth verifications of the reports on observational data and presented imagery work.



**ZMD and INAM Forecasters, Group Work Session**

University of Leeds presented new nowcasting products earmarked for the Testbed. The CEH portal was presented. The forecasters reviewed the products and provided positive feedback on the products after being introduced to this portal. The training concluded with a comprehensive case study presentation, outlining the participants' roles, responsibilities, and expected outcomes to get the Certificate of Achievement. The testbed case study preparation was a key task for the 3<sup>rd</sup> day. The Moodle Exam scheduled for day 3 was cancelled due to SAWS Cyber-attack. All SAWS servers were encrypted and the backups of these servers at another backup site were damaged. The process is still ongoing to salvage them.

	<b>Trainee Organisations</b>	<b>Number of Officers Trained</b>	<b>Guests</b>
1	Zambian Met Department (ZMD)	34	
2	Mozambique Met Office (INAM)	6	
3	University of Zambia	2	
4	Tomorrow IO (Kenya)		2
5	Leeds University (UK)		7

6	Germany		1
7	WMO (Geneva)		1
	Total attendees:	42	11

**Training Workshop Trainees and Guests**

### 3. Technical Details: Key Personnel, Locations and Infrastructure

[Itzel, Denise]

#### 3.1 Key Personnel & Roles: Summary of participants and responsibilities.

The successful operations of T2-Z relied on coordinated efforts across multiple work packages (WP1, WP2, WP3) and institutions. Below is an overview of the core team and their responsibilities:

##### Leadership & Strategic Oversight

- Doug Parker (NCAS, University of Leeds) – Overall scientific and technical leadership, ensuring alignment with WISER-EWSA objectives.
- Katharine Vincent (Kulima) – Co-leadership, focusing on stakeholder engagement and impact integration.

##### Testbed Planning, Coordination and Support

- **Testbed Leadership:** Itzel San Roman Pineda, Hellen Msemo, Simon Ageet. Day-to-day planning, agenda design, and facilitation of testbed activities.
- **Testbed Coordinator:** Denise Groves, Jabulani Khumalo. Logistical coordination, scheduling, and liaison between teams.
- **Regional NMHS Leads:** Nico Kroese (SAWS, South Africa); Micah Namukoko (ZMD, Zambia); Goncalves Junior (INAM, Mozambique).
- **Technical & IT Support:** Alex Roberts and ZMD's IT team. Managing IT infrastructure, data platforms, and troubleshooting.

The testbed brought together 73 participants from 10 countries, with a strong international presence (47 attendees, 64%) complementing Zambia's core team (26 participants, 36%). In addition to those attending T2-Z in-person, several partners, including forecasters and researchers from INAM, SAWS, and international institutions like WMO and UK Met Office, joined the daily meetings remotely, contributing to evaluation, and learning processes throughout the testbed.

Institution/Organization	Participants	Key Roles
ZMD	23	Forecasters, IT team, focal point

Institution/Organization	Participants	Key Roles
SAWS	9	Forecasters, researchers, coordination
INAM	6	Forecasters, focal point
University of Leeds	14	Leadership, researchers, technical support
Kulima	6	WP1 engagement, communications
Karlsruhe Institute of Technology	1	Testbed leadership
UKCEH	2	Nowcasting research
TomorrowNow	2	Visitors
WMO	1	Testbed oversight
University of Birmingham	1	Visiting researcher
UNZA	2	Postgraduate researchers
Malawi Dept of Climate & Met.	2	Forecasters
Zimbabwe Met Dept	2	Forecasters
Finnish Meteorological Institute	1	economic analysis, WP1
Tyrsky Consulting	1	economic analysis, WP1
<b>Total</b>	<b>73</b>	

### 3.2 Locations, Infrastructure and Technical Considerations

The technical setup for T2-Z was carefully planned based on previous experience by staff at the University of Leeds, ZMD and SAWS. Given Zambia’s ongoing power instability—exacerbated by drought-related challenges affecting hydroelectric generation—reliable backup systems were essential. The relocation of operations to the Zambia Air Force (ZAF) facilities provided a more spacious and better-equipped environment, including a dedicated power plant that significantly reduced the risk of outages. Most participants worked from battery-powered laptops, minimizing the impact of any short-term power drops.

The initial plan to procure a Starlink system for ZMD was reconsidered and ultimately not pursued. Instead, the University of Leeds loaned a Starlink system to ensure consistent internet connectivity. Additionally, a 5G router with local SIM cards was used as a backup, capitalizing on Lusaka’s 5G signal to maintain stable internet access throughout the testbed. This proactive approach to logistics—covering internet, power, and facilities—ensured uninterrupted forecasting and nowcasting operations during the intensive testbed period.

To facilitate access to data and tools, a central online platform was created: WISER-EWSA Testbed Portal, which provided easy access to forecast products and operational

documentation. In addition, a shared Google Drive folder hosted all reports, alerts, and operational files. Access was managed by the WP4 coordination team, and participants could request access with the logistics coordinator.

## 4. Activities T2-Z (Zambia and Zuid-Afrika)

The T2-Z Intensive Testbed, centred its forecasting operations at the ZMD's testbed hub within Zambia Air Force (ZAF) facilities, and community engagement activities in Kanyama. At T2-Z hub, forecasters from INAM, ZMD, and SAWS, and researchers and academics from the UK, Switzerland, Zambia and South Africa, collaborated across three core teams—synoptic forecasting, nowcasting, and evaluation—working in rotating shifts to generate synoptic forecasts and nowcasts, and validate outputs. These teams engaged in rigorous discussions to refine the accuracy and clarity of disseminated weather information, using products like CRR, RDT, and AI-driven models being tested. At Kanyama, members of the Satellite Disaster Management Committees (SDMCs) led community engagement activities for residents in Kanyama with the participation of the WISER-EWSA team. T2-Z's final three days were characterised by the integration between the community and technical teams: SDMCs joined the technical hub to observe forecasting processes firsthand, gaining insight into the "behind-closed-doors" work of meteorologists. This interaction allowed forecasters and community observers to jointly evaluate communication gaps, with SDMCs offering actionable feedback to improve nowcasting templates, to enhance the accessibility of weather information among people with disabilities.

### 4.1 Team Structure and Operational Shifts

The T2-Z organised its technical team - comprising meteorologists, forecasters, and researchers from ZMD, INAM, SAWS, and UK institutions - into specialised teams working in coordinated shifts. Additionally, forecasters from Zimbabwe and Malawi joined the testbed operations from Monday, February 3rd to Friday, February 7th. Daytime operations took place from 08:00 to 17:00 CAT, while nowcasting operated continuously through three overlapping shifts: the main daytime shift (08:00-17:00 CAT), evening coverage (16:00-01:00 CAT), and overnight monitoring (00:00-09:00 CAT).

The **Synoptic Team**, consisting of ZMD, INAM and SAWS forecasters, carried the responsibility for generating 12-48 hour NWP forecasts to contextualize nowcasting operations.

The **Nowcasting team**, consisting of forecasters from INAM, ZMD, SAWS, Malawi and Zimbabwe, with UK and South Africa researchers, produced and disseminated nowcasts every two hours. They used nowcasting products available in the Testbed portal. Nowcasts were disseminated via WhatsApp to Kanyama's SDMC group, using the WISER-EWSA nowcasting template, SMS-like messages and voice notes in English and local languages.

The **Evaluation Team**, composed of forecasters from all three NMHSs and our visitors from Malawi and Zimbabwe, alongside Zambian, South African and UK researchers, implemented a case-study methodology to validate nowcast performance, using satellite observations, rain gauge data and community observers (SDMCs) feedback sent three times a day via a Google Form and WhatsApp messages, photos, and videos.

To facilitate the smooth execution of activities during the intensive testbed period, two key daily **Management Roles** were established. The **Floor Leader and Deputy** were assigned each day to chair meetings, guide the schedule, oversee decision-making, and ensure the overall progress of operations. Supporting them, the **Scientific Secretary** was responsible for documenting meeting notes, maintaining and updating shared folders, managing digital outputs such as daily highlights and summaries, and ensuring effective internal communications.

The T2-Z Intensive Testbed operated over nine consecutive days, including one weekend. Operations ran on a 24-hour basis through three coordinated nowcasting shifts, overlapping one hour to facilitate smooth transitions between shifts:

- **Day Shift** (08:00–17:00 CAT): Synoptic, Nowcasting I, and Evaluation Teams conducted primary forecasting, nowcast production and dissemination, and verification of nowcasts.
- **Evening Shift** (16:00–01:00 CAT): Nowcasting Team II maintained nowcast operations.
- **Night Shift** (00:00–08:00 CAT): Nowcasting Team III provided overnight nowcasting coverage.

The evening and night nowcasting shifts were exclusively maintained by ZMD forecasters. INAM forecasters participated in the day shift across all three teams (synoptic, nowcasting and evaluation). While INAM's forecasting team produced nowcasts every two-hours during this period, they only issued them if intensive nowcasting events (INEs) would affect Boane, Mozambique. SAWS team faced operational constraints due to the January 2025 cyberattack, which prevented their forecasters in South Africa from joining the meetings online. However, the SAWS forecasting team attending T2-Z produced, disseminated, and evaluated nowcasts only when INE's affected Katshehong. SAWS team also supported the synoptic forecasting, nowcasting, and evaluation teams.

## 4.2 ZMD's Testbed Hub Activities

Daily activities consisted of hybrid meetings, enabling remote participation by partners that could not join the testbed in person.

- **All-Testbed Meeting** (12:00 CAT): In this meeting, the evaluation team selected nowcasts issued by the Nowcasting II and/or Nowcasting III teams from ZMD and assessed the quality of the nowcasts issued. In the case of INAM they would present the validation of the last nowcasts issued by INAM forecasters in the previous day. Then the Synoptic forecasting team presented the outlook forecasts
- **Daily Review Meeting** (16:30 CAT): In this meeting the evaluation team presented their analysis regarding the nowcasts issued
- A **weekly review** was held on February 3rd, and a closing **Final Review Meeting** on February 7th, both at 16:00 CAT.

Additional to the daily meetings, during the T2-Z we had special events and sessions including the following:

- **Kick-off Briefing Meeting** (January 30th): In this meeting, the T2-Z was launched with opening remarks from ZMD's PR Edson Nkonde and WMO's Hellen Msemo, followed by Prof. Douglas Parker outlining key objectives of WISER-EWSA. Country

perspectives were presented by INAM and SAWS, while work package leads covered testbed operations, user engagement, evaluation, and training outcomes.

- **Open Day** (February 5th): This event bridged science and practice by connecting SDMCs, media representatives, government ministries, and intermediate organisations (FAO, WFP, GIZ, Red Cross, People Living with Disabilities, and the Farmers Union of Zambia) with forecasters and scientists. Following opening remarks from ZMD, the Ministry of Green Economy, and WMO (emphasizing the Early Warnings for All initiative), Prof. John Marsham provided an overview of the WISER-EWSA project. University of Leeds PhD students then provided a 'tour-guide' through the testbed. This interactive session allowed direct dialogue between forecasters in the synoptic, nowcasting, and evaluation regarding the production of weather information, and fostered discussion about enhancing warning communication among forecasters and stakeholders.
- **Cross-Project Day** (February 6th): This day, representatives from different work packages presented their progress. For WP4, PhD students from Leeds leading the King-Size evaluation presented preliminary findings and future actions. WP1 shared reflections and progress made during the king-size testbed. Adriaan Perrels presented preliminary findings of the cost-benefit analysis of nowcasting for Zambia. Nico Kroese and WMO's Daniela Cuellar linked the WISER-EWSA efforts to the global EW4ALL framework. The hybrid format enabled dynamic discussions between Lusaka-based teams and international partners on refining early warning systems through interdisciplinary collaboration.
- **Closing day** (February 7th): The testbed concluded with Lightning Research Talks featuring postgraduate researchers from the University of Leeds, Zambia, and UKCEH presenting cutting-edge nowcasting research to operational forecasters. The WP1 team and SDMCs shared their key reflections and lessons learned from T2-Z. Throughout the day, WP2 gathered feedback from both in-person and online participants using Padlet, which was then discussed during the final reflection session to identify improvements for the remainder of the King-Size testbed and future testbeds.
- **Special Presentations:** In addition to the dedicated event days, the testbed featured several technical presentations throughout the nine-day period. These included: 'Case Study: Supercell Storms' and 'Nowcasting Research at SAWS' by SAWS team members; and SDMC Feedback on Nowcasting Templates. These sessions provided valuable opportunities for knowledge exchange between forecasters, researchers, and community representatives.

### 4.3 Community engagement activities in Kanyama

A varied programme of activities was developed for the community hubs to serve the purposes of (a) ensuring ongoing verification feedback on nowcasts, (b) providing feedback on the content and presentation of nowcasts and forecasts and (c) raising community awareness on weather information.

Each of the three Kanyama wards in which the project operates (Kanyama ward 13, Makeni Villa ward 14 and Chinika ward 11) had a half day session attended by community members (with SDMCs placing particular focus on women and people with disabilities) at which ZMD provided an overview of the weather information products available, and then feedback was gathered in a comparative exercise of different impact-based forecast and nowcast presentations from South Africa, Mozambique and Zambia.

Field visits were undertaken to each of the three wards to see the flood risk context, and to visit with members of the community; and also to Chinika Secondary School to raise awareness of weather information with advanced level geography students. Experiences of community mobilisers in South Africa and Mozambique were shared, and Zambia SDMCs developed a presentation of their own approaches to be shared in return.

On the final three days of the testbed, Satellite Disaster Management Committee (SDMC) members joined the main testbed site in Lusaka. During that time they received demonstrations from the forecasting and nowcasting desks so they could better understand the upstream process that goes into generating the information that they receive. They were able to present “model” nowcasts and lists of recommendations for how to present nowcasts in a way that would be accessible to their communities (and the diverse needs within them). A social network mapping exercise was also conducted to track the onward reach of forecasts and nowcasts that are received by SDMCs.

For the remainder of the kingsize testbed, SDMCs will continue regular meetings and visiting individuals in their communities to identify people with disabilities and their particular weather information needs. They will also try to increase the number of people who receive information directly from ZMD (e.g. through getting people to sign up directly to ZMD’s whatsapp group and SMS list) to free up their time to transmit information by word-of-mouth to those who cannot follow these options. They will also endeavour to provide daily verification feedback through the GoogleForm, whether or not there has been rain (this is in contrast to the period October-January, when feedback was only requested on days when there had been rain). They will also continue - and expand - their engagement with key community leaders, including councillors, Ward Development Committees and chairpersons.



*SDMCs reflect on the kingsize testbed thus far, and plan for the remaining months*

## **5. User Feedback and Evaluation**

15 SDMCs completed the evaluation of the intensive testbed; 8 females and 7 males, in the age ranges 18-30 to 51-60. None of them report having a disability.

All reported that involvement in the testbed has improved their knowledge of weather and climate information; 60% to a great extent and 40% to some extent. All of the sessions were

reported to be useful. However notably four sessions were unanimously evaluated as very useful: the ward-specific community sessions, the sharing of experiences of South African and Mozambican community mobilisers, preparing a fictional nowcast with presentational aspects that they like, and visiting the ZMD team to learn more about nowcasts and forecasts and present the fictional forecasts

In terms of what they learned, participants spoke of learning how weather information is generated, how to explain weather information to their community, the role of feedback in improving accuracy, the importance of timely and clear communication in disseminating weather alerts, and communication skills for working with the community, especially persons living with disabilities. One person's answer was notable for covering all of these aspects, "Being an SDMC and participating in the testbed has given me valuable insights into community engagement, early warning systems (EWS), and disaster preparedness. Specifically, I have learned: The importance of timely and clear communication in disseminating weather alerts, how to mobilize communities effectively, ensuring that people understand and act on forecasts, the challenges of last-mile communication, especially in vulnerable areas like Kanyama, the role of real-time data collection and feedback in improving forecast accuracy, collaboration with local disaster management teams enhances preparedness and response strategies and the need for continuous capacity building to strengthen community resilience."

In terms of how they intend to use the information learned, all said they would share information with their community (specifying family, friends, church and people with disabilities), whilst two people also mentioned providing feedback to meteorological services on forecast effectiveness and areas for improvement. All said they are willing to continue providing feedback even after the end of the project.

In additional comments, many participants expressed happiness to be part of the project, and that they want to continue receiving information to be able to give it to their community. One person noted how they would like to be able to spend more time at ZMD. Another summarised the impact of the information by saying "The project has helped me and my community at large in a good way"

## **6. Nowcasting and Verification**

### **6.1 Nowcasting Process**

The nowcasting teams produced and disseminated nowcasts following up the Nowcasting Standard Operating Procedure (SOPs) refined before the testbed. A key innovation in T2-Z was the inclusion of an observer in this team—typically a PhD researcher from the University of Leeds—who conducted participant observation, documented the decision-making process of the forecasters during nowcasting, to support the evaluation team.

Just before the start of T2-Z, SAWS cyberattack disrupted access to the RSMC website, which required a quick adaptation by the team. In response, the nowcasting and evaluation teams diversified the products normally used, turning to new products such as CRR, RDT, DWD, RoA and UK CEH portal. This unplanned shift helped encourage the use of a broader range of nowcasting tools and highlighted the importance of flexibility and innovation in real-time forecasting operations.

## 6.2 Evaluation: Verification of nowcasts

The evaluation team implemented a case study approach to assess the accuracy and effectiveness of issued nowcasts. Their activities consisted in cross-referencing issued nowcasts against multiple sources including satellite observations, rain gauge networks, and direct feedback from community observers.

The teams selected one significant nowcast for Mozambique, Zambia and if issued, South Africa, issued in the previous shift, prioritising high-impact weather events. The analysis combined SDMC and community observers' feedback from the WhatsApp groups and Google Forms with technical data including satellite imagery, rain gauge measurements, and nowcasting products (observations and propagation).

Using these sources, the evaluation team made a qualitative assessment and classified the results as hits, misses, false alarms, or correct rejections. The case study approach allowed identifying the best-performing products for different weather scenarios, as the team was able to identify how different products performed in each case.

## 7. Lessons Learned & Recommendations

### 7.1 What Worked Well : Key achievements.

**Skill Development and access to new products:** T2-Z contributed to the development of nowcasting and verification skills. In a post-testbed survey, forecasters reported improved confidence and ability in nowcasting, along with growing familiarity and positive feedback on tools such as CRR, RDT, and RoA, which usage was enhanced by the cyberattack affecting the RSMC portal. Unlike Testbed 1, where Leeds researchers led the evaluation efforts, in T2-Z forecasters took a more prominent role in leading evaluations alongside researchers. Forecasters highlighted that access to new products (e.g., FASTA), combined with observational data and community feedback, was valuable in validating the accuracy of nowcasts and assessing their relevance for end-users.

**Disability inclusion.** Having spent the kingsize testbed with SDMCs identifying vulnerable people within their communities, these were invited to participate in the awareness raising sessions in the community hub and thus there was very high representation. We also learned from last year's experiences about inclusion in the venue and the content of the sessions (although they are always limited by the availability of venues in Kanyama). Transport was arranged to ensure everyone was able to safely access the venue from collection points in each ward.

**Closing the loop of feedback.** Based on feedback provided from the community hub about accessibility of nowcast messages, ZMD started sending nowcasts in two languages (English and Nyanja) and also recording audio voice notes. There was also an attempt to modify the nowcasting template to reflect detailed feedback on it which had been provided through exercises in the community hub. Changes in practice are sometimes slow to be consistently applied, but there was evidence that actionable feedback from users was taken onboard.

**The expanded roles of the community mobilisers** (done by SDMCs in Zambia) has been effective in raising awareness of, and stimulating demand for, weather information in Kanyama. Many SDMC members are now like "weather influencers" or "weather

ambassadors” and are regularly approached for information (for more details, see submitted story of change). By integrating former community observers into the SDMCs, this has also helped to strengthen this critical community level disaster management structure.

**The process of consent and evaluations** is challenging. Whilst these issues are obviously important, in the past we have relied on verbal consent for data and a tick box in the sign in sheet for photos, after providing detail about the nature of data collection, management and use. This time, community mobilisers were asked to sign a Northern-style written consent form for data, and community members were asked to sign written consent forms for photos and videos. These consent forms are lengthy, contain language that is not familiar (even though it is also verbally explained), and the practice of having to sign something raised suspicions and questions on what people were signing. Similarly the process of evaluating events with differentiated audiences has always been challenging. In the past we had a simpler process for community members and a more complex one for end user and intermediary organisations, however it has typically been difficult to administer with people not knowing which one they should use etc. To rectify this confusion, this time we had one form (which included a section only for organisations) and we trained SDMCs to help administer it at the end of the sessions with community members. Despite that, we found that questions were not all well completed (for example there was a sliding scale question where people could choose one of five options, with three of them elaborated - and in practice people only chose those three). Feedback is also always overwhelmingly positive and raises questions about how meaningful these findings are for logframe reporting.

## 7.2 Challenges & Improvements Needed

**Addressing Data Gaps:** Data completeness remains a challenge that affects the evaluation of King-size testbed. Gaps in the Outlook Forecast Table—particularly missing entries or inconsistent use of colour codes, and registering INEs decisions—undermine the ability to assess how much synoptic forecasts allows identifying potential INEs. Similarly, incomplete feedback from community observers, especially regarding confirmation of rainfall or impact/no impact reports, limits our ability to fully evaluate the effectiveness of nowcasts. Ensuring more consistent reporting on both the meteorological and community sides is a key priority for strengthening evaluation outcomes in future testbeds. WP4’s coordination team is consistently encouraging forecasters and community engagement leads for daily feedback to reduce this gap.

**Post-Testbed Engagement:** Multiple respondents cited reduced participation after T2-Z due to time constraints and limited guidance or follow-up. Forecasters balancing nowcasting with their daily duties struggled to monitor events continuously, particularly during weekends. Additionally, ZMD forecasters indicated that unmet logistical promises (e.g., unpaid allowances)

**Internet & Power Instability:** While most reported stable internet access during the testbed, some flagged ongoing technical issues post-testbed that hinder access to products to produce nowcasts as well as reduction of connectivity to disseminate the alerts. .

**Training Gaps:** Several forecasters mentioned the need for further training—especially on nowcasting products, maps, and statistical verification methods.

**Uptake of Improved Nowcasting Template:** Following valuable feedback from community observers, the nowcasting template was revised to improve clarity and accessibility, including

the addition of a pictorial "recommendations" section. While the updated template was shared with ZMD forecasters, its full adoption is still in progress, as some forecasters continue to use the earlier version. To avoid similar delays during T2-M, the new nowcasting template was introduced ahead of the testbed and shared with INAM forecasters. This proactive approach aimed to ensure consistency and encourage full adoption during the intensive period.

## **Conclusions and Recommendations for Future Testbeds**

Building on the lessons from T2-Z, several lessons have emerged to guide improvements in future testbeds and for the remainder of the king-size testbed.

**Integration of Feedback into Operations:** One recurring challenge during T2-Z was the time required for agreed improvements—such as updates to the nowcasting templates—to be fully implemented in practice. While there was better evidence of integration this year compared to Testbed 1, progress remained slow and inconsistent, and uptake of some practices has tapered off following the intensive phase of T2-Z. Even with strong collaboration and shared commitments, operational changes often require additional capacity and sustained follow-up to take root consistently across teams. This underscores the importance of allowing sufficient lead time between planning, agreement, and execution, as well as the need to strengthen internal communication channels within participating organisations.

**Evaluation of new AI and ML products.** First, there is a strong recommendation to continue expanding and evaluating the use of diverse forecasting tools, including AI prediction models, Lightning Observations, K-Index, RoA, and MTG data. While these tools show promise, their accuracy should be quantitatively assessed. Integrating forecaster feedback into the development of new nowcasting products will ensure tools remain practical and user-friendly.

**Training** remains a key focus area. As new products are introduced, tailored training sessions should be embedded into the testbed schedules to ensure forecasters are well-equipped to interpret and use these products. Training should emphasize the purpose and limits of nowcasting products to enhance forecasters' uptake of these products. Additionally, researchers' presentations (lightning talks) should take place at the start of the testbed, so that forecasters gain insights into emerging technologies and methodologies.

**Feedback mechanisms** must be enhanced. The daily validation process by forecasters, supported by community insights, should be formalised to close the loop between forecast generation and user relevance. Implementing these recommendations would improve forecast reliability, strengthen user engagement, and ensure more inclusive and actionable early warning systems.

**Legacy and continuation of African testbeds** has been identified as a key future priority. While formal discussions are yet to take place, the upcoming Joint Conference of AfMS-WMO will provide an opportunity for the PRs of our African partners—INAM, SAWS, and ZMD—to raise the importance of sustaining and expanding the testbed model beyond the current project. WISER EWSA has allowed INAM, SAWS and ZMD to develop their capabilities and experience to spearhead the continuation of testbeds in Southern Africa.

**Forecast Validation and Statistical Tools:** ZMD expressed a clear interest in enhancing forecast validation through statistical analysis, including the use of programming tools such as Python. While this demonstrates a forward-looking approach and a desire to strengthen local

technical capabilities, the 9-day timeframe of the intensive testbed was insufficient to support in-depth statistical validation. Future testbeds may consider integrating preparatory training or extended post-event analysis to enable this type of methodological development.

## Annexes

### Annex 1. Daily reports of community hub activities

#### Community hub daily activity report - 30th January 2025

Katharine Vincent

The WP1 user engagement team, communications team, forecasters from INAM in Mozambique and a Leeds project coordinator visited Chinika Secondary School in Kanyama. This followed on from a visit with geography learners during the co-production and testbed preparatory co-design workshop in August 2024. Ten boys and five girls in grades 11 and 12 (many of the same learners) participated in the meeting.

The group explained what weather is like in Kanyama, particularly highlighting the risk of heavy rainfall and flooding. They were able to raise some key questions with the WISER EWSA team, including advice on which weather apps to use, seeking clarification on why rainfall patterns can vary significantly over space and over time, and asking about the relevance of the project to climate change.

One of the [weather advisory posters](#) developed by WISER EWSA has been posted in the school. Learners were asked for their suggestions on a follow up poster targeting youth. In terms of content, the priority was on actions to reduce risk, including:

- Carrying rainwear at all times in the rainy season, knowing that weather can be unpredictable
- Being careful not to shelter under trees during lightning
- Not playing in and around water due to contamination risk
- Switching off electrical appliances in instances of lightning and heavy rain (where there is a flood risk).

In terms of presentation, the priority should be a visually appealing, bright poster that contains text in both English and vernacular language (Nyanja).

Learners were also keen to highlight their potential role in communicating weather advisory and early warning information in their communities. They noted the potential for social media, videos, theatre - recognising that they have the advantage of greater access to technology relative to the older population. They also expressed interest in developing a school club on weather and climate and receiving further training from ZMD.

All learners took up the option to leave their phone number to be added to the ZMD Kanyama WhatsApp group, in which forecasts and nowcasts are shared. A separate group was also created to share the illustrated icons that communicate advisories in the face of particular weather risks ([https://drive.google.com/drive/folders/1dNBMGHn0RA7g7KQdlLJ29KtT\\_DuK2dxE?usp=drive\\_link](https://drive.google.com/drive/folders/1dNBMGHn0RA7g7KQdlLJ29KtT_DuK2dxE?usp=drive_link)), as learners were keen to use this when sharing forecasts and nowcasts.

#### Community hub daily activity report - 31st January 2025 morning

Gilda Monjane

Twenty three community members from Chinika Ward 11, together with the 4 Satellite Disaster Management Committee (SDMC) members (who play the role of community mobilisers), participated in the community hub in Kanyama on 31st January in the morning. The group had a high proportion

of women and included a variety of ages and a high proportion of persons with disabilities, including mobility, sight and hearing.

After an introduction to the project, a Zambia Meteorological Department forecaster presented an introduction to the weather and climate, how forecasts are generated and an overview of the meteorological product and services in Zambia and how to access them. Participants indicated that this was their first time to interact with a forecaster. They asked questions about the accuracy of weather information - particularly on why the seasonal forecast was not correct from October to December (in their perception), the underuse of cellphone communications channels to share information, and the lack of forecast availability in local languages. Questions were also asked about what to do to protect oneself in a thunderstorm from lightning. Only a minority of participants use weather forecasts, which they receive from the radio and television, with some stating that they simply observe the sky.

This was followed by a groupwork exercise where participants were given examples of nowcasts and impact-based forecasts issued by Zambia, Mozambique and South Africa during the kingsize testbed (since 1st October 2024) and asked to explain what they understood by them, and reflect on what is not clear and what could be improved.

Visual imagery and graphics were cited as useful, with particular interest expressed in maps that show the location of intended weather. The impact table from the impact-based forecast was not well understood, although the intuitive nature of the traffic light risk levels colouring was well appreciated and understood. However the inclusion of recommended actions and advisories in the impact-based forecast examples were liked. There were also suggestions on communicating the in local languages and sending through voicenotes to better reach persons with disabilities who cannot see to read.



Groups discussed nowcasts issued during the kingsize testbed



Each group presented back a summary of their discussion (with simultaneous interpretation in English-Nyanja and sign language)

**WISER** EWSA (Early Warnings for Southern Africa)  
**Nowcasting information sheet - Mozambique**  
 INAM Date: 2024-11-11 Data time: 15:30 UTC Issue time: 17:30 UTC

### 6 hr Outlook

Region	Mozambique
Date	2024-11-11
Time	15:30 - 17:30
Data	GFS model ; Synoptic outlook ; ECMWF Model rainfall, hail, lightning, instability forecasts ; WISER

Level 6 alert for storms in the provinces of Maputo and Gaza Strong instability is observed and the models show the continuation of the storm and propagating from east to northwest in the next 2 hours with greater impact.

### 2 hr Nowcast Risk

Region	Mozambique
Date	Provide date 11.11.2024
Time	Provide time 15:30
Data	Provide sources of data used for outlook

GFS model ; Synoptic outlook ; ECMWF Model rainfall, hail, lightning, instability forecasts ; WISER

Likelihood	High	2	6	6	6
	Medium	1	5	5	5
	Low		4	4	4
	Very Low		3	3	3
		Minimal	Minor	Major/Local	Severe

**Impact**

**Level 6 impacts**

- Injuries and danger to life
- Damage or loss of infrastructure, settlements (formal and informal), property, vehicles, livelihood and livestock
- Major travel disruptions (incl route obstructions) and incidents
- Disruption of municipal and other essential services (Education, health, communication and power supply)
- Loss of agricultural production

**Level 2:**

- Localised damage to infrastructure, settlements (informal), property, vehicles, livelihood and livestock
- Localised and short term disruption to municipal and other essential services (Education, health, communication and power supply)
- Localised loss of agricultural production

### Local timelines

Location	Valid time	T	T+1hr	T+2hr	T+3hr	Outlook (T+4 to T+6)
Maputo		2	2	2	2	6 6 6 6
Gaza		2	2	2	2	6 6 6 6
Boane		2	2	6	6	6



WISER EWSA team with some of the SDMCs and community members

### **Community hub daily activity report - 31st January 2025 afternoon**

Miriam Murambadoro

Twenty four community members from Makeni Villa Ward 14, together with the 4 Satellite Disaster Management Committee (SDMC) members (who play the role of community mobilisers), participated in the community hub in Kanyama on 31st January in the afternoon. The group was majority women (20) and included a variety of ages and a high proportion of persons with disabilities, including mobility and hearing.

After a brief introduction to the project and an overview of the role of the Satellite Disaster Management Committee, a Zambia Meteorological Department forecaster presented an introduction to the weather and climate, how forecasts are generated and an overview of the meteorological product and services in Zambia and how to access them.

This was followed by a groupwork exercise where participants were given examples of nowcasts and impact-based forecasts issued by Zambia, Mozambique and South Africa during the kingsize testbed (since 1st October 2024) and asked to explain what they understood by them, and reflect on what is not clear and what could be improved.

The following comments were received on the specific formats.

## Zambia nowcast issued on 21st January 2025



Republic of Zambia  
Ministry of Green Economy and Environment  
Zambia Meteorological Department

### Kanyama nowcast

**TIME ISSUED:** 10:00 CAT  
**DATE PREPARED:** 21<sup>ST</sup> JANUARY, 2025  
**VALIDITY PERIOD:** 14 - 16 HOURS

There is a high likelihood of **heavy and continuous** rainfall affecting Kanyama compound during the forecast period.

There is very high risk of flooding on susceptible roads.

Be advised to **avoid crossing flooded points** and moving around in rainy weather conditions.

*This nowcast is*

*Produced by the Zambia Meteorological Department,*

*Ministry of Green Economy and Environment*

**LEVEL 6 WARNING: HIGH LIKELIHOOD OF OCCURANCE WITH A SIGNIFICANT IMPACT**

The warning was clear but could be enhanced by having graphics showing the hazard type and a map showing the location of the target area. There was a suggestion to add more advisory information on what to do in response to the warning.

## Mozambique nowcast issued on 21st November 2024

The warning was clear and the map and images were well appreciated. However, a section on the table with data sources was considered irrelevant for the general public as they did not understand it and could not relate to it. The warning alert level was 6 but the colour was yellow which didn't correspond with the IBF matrix or the similar alert issued by ZMD for level 6 which was orange.

## South Africa impact-based forecast, warning and nowcast

<p>Issued 14th October 2024 (example 1)</p>	<p>Issued 22nd October 2024 (example 2)</p>	<p>Issued 7th November 2024 (example 3)</p>
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The warning was considered clear and included the hazard type. Warning 1 was clear but did not include advisory information and did not include a map. Warning 2 was clear and included information on what to do but the warning level number is difficult to understand without explanation or a key. Example 3 (the nowcast) included a map image but without a key and scale it was difficult to interpret.

As well as maps and advisory information, other suggestions for improvement included availability in local languages and more images to assist those who cannot read. There was a request for more capacity building initiatives to improve understanding of weather and weather forecasts.

## **Community hub daily activity report - 1st February 2025**

With inputs from Gilda Monjane, Itzel San Roman Pineda, Greg Dritschel, Joey Smith, Katharine Vincent and others

The Satellite Disaster Management Committee (SDMC) members who are playing the role of community mobilisers guided tours of our three Kanyama wards: Chinika ward 11, Kanyama ward 13 and Makeni Villa ward 14. Rain started towards the end of each visit, and highlighted how relatively light rain can rapidly lead to overflowing drainage channels and flooded roads.

### **Chinika ward 11**

Chinika ward 11 contains houses that were built in the 1960s. Whilst walking through the neighbourhood, the team visited the water tank and an adapted drainage system that was made by the community. Water is a problem - when it is flooded around the tap there is no access to clean water. The team spoke with a young boy in a wheelchair and people who live close to the tap that floods. They also spoke with the chairperson of a group for persons living with disabilities, and invited him to attend the community hub meeting on Monday.

In general, a lot of people do not understand the importance of good weather forecasting. In the past there have been issues with reliability, and conversations suggested that education on weather forecasting would get people more interested. One of the SDMC members observed that the WISER EWSA project is having a positive effect on people's trust in forecasts. Forecasts are available on radio twice daily, but most people consider that phones and social media are the best communication channels - although recognising the need for adaptations for disability inclusion (e.g. voice notes). The chairperson of the group for persons living with disabilities said that special phones are given for transmitting messages to their members by SMS.



Contrasting drainage styles in Chinika ward 11



Team members tour Chinika ward 11 with an SDMC member

### **Kanyama ward 13**

The team met with several community members and discussed weather information.

The mother of a boy with a hearing disability who cannot speak explained how she receives weather information from various channels and communicates it to her son. She is a member of a whatsapp group which sends written text and voice notes - but requires her to be connected to the internet, which is not always possible. When her phone is off, she observes the clouds to determine the

weather. Her main livelihood is selling fritters. She also pays 50c for 20 litres of water from the local taps. Her son used to attend a special education school but stopped as he would prefer to be in a larger school, but that is further from home and more expensive to get to. Cholera affects some parts of the ward (e.g. the Mutanda Bantu market area) but not where she lives.

A middle aged widow with six children explained how her husband passed away seven years ago. Her main livelihood is piece work, e.g. washing and cleaning for people, for which she typically earns K50 per day. Water poses challenges to them. They obtain drinking water from the local tap, but the tap was stolen yesterday (and the meter has previously been stolen), and these thefts are regular occurrences. When it rains, water enters her house, and when they have to walk through flooded streets, they are at risk of developing sores on their feet and between their toes. She receives weather information when there is electricity, but otherwise observes the clouds to determine weather.

The team also observed the WISER EWSA weather awareness raising posters at the Aunty Mercy lodge and the clinic.



The team meet community members in Kanyama ward 13



The team find the poster at Aunt Mercy lodge in Kanyama ward 13

#### **Makeni Villa ward 14**

The team spoke with residents from two households, including persons with disabilities. These residents explained that they had been receiving weather information from SDMCs and community observers, which they found valuable as it helps them plan their activities better—for instance, avoiding travel or trips to the shops when rain is forecasted, as it can lead to flooding and difficult conditions for travel.

Some of the streets we visited were flooded or partially flooded. Since the roads are unpaved, they become extremely muddy and difficult to walk on. Additionally, many roads are uneven and contain sharp stones, which become hidden under floodwaters, making them particularly hazardous for people with mobility impairments. Despite these challenges, many residents still have to cross these flooded streets.

The team also observed open sewers that are often poorly maintained and clogged with waste materials. Some small drainage ditches have recently been dug through social work programmes in an attempt to channel rainwater off the roads and properties, but these channels are often incomplete, leading to stagnant water accumulation. During heavy rainfall, they appear insufficient to prevent flooding, contributing to health and sanitation risks.

The team also visited the health post, which provides primary care to the community, including vaccinations and maternal care. It is displaying one of the WISER EWSA weather awareness raising posters, alongside information about the M pox outbreak in Africa.

Weather forecasts, nowcasts, and early warnings help community members take action to prepare for impactful weather events. However, walking through this ward made it evident that addressing flooding problems requires proper drainage systems, to effectively mitigate flood risks.



SDMCs show how to navigate flooded streets in Makeni Villa ward 14

### **Community hub daily activity report - 2nd February 2025**

Today the team took the Satellite Disaster Management Committee members (SDMCs) who are performing the role of community mobilisers out of Kanyama. The purpose was to undertake interviews for the forthcoming video and also to find out more about how they have individually been undertaking their roles as community mobilisers.

Overall, the utility of weather information is widely appreciated. When commencing their roles, most were not accessing weather information at all. However there are now many examples of how they are using the forecasts and nowcasts that they receive to alter daily activity patterns, commercial activities, and agricultural practices. As part of the expanded mobiliser role in the kingsize testbed, SDMCs have also been actively spreading weather messages around their communities. Many report positive reactions and increasing demand, with neighbours and relatives approaching them to know what the weather is going to be. Furthermore they also report increasing reliability of weather information from ZMD.

Interviews will be continuing throughout the rest of the intensive testbed.

### **Community hub daily activity report - 3rd February 2025**

Thirty three community members from Kanyama Ward 13 (20 female and 13 male), together with the 10 Satellite Disaster Management Committee (SDMC) members (who play the role of community mobilisers) participated in the community hub in Kanyama on 3rd February in the morning. The group included a variety of ages and a high proportion of persons with disabilities, including mobility, sight and hearing. The group was joined by representatives of various intermediary and end user organisations (11 female and 6 male), including Zambia Association of Persons with Disabilities, Zambia Federation of the Deaf, Youth and Disability Inclusion and the Ward Development Committees for both Kanyama ward 13 and Makeni Villa ward 14.

After an introduction to the project, a Zambia Meteorological Department forecaster presented an introduction to the weather and climate, how forecasts are generated and an overview of the meteorological product and services in Zambia and how to access them. There was a subsequent discussion on the nature of data and observations that are used to generate forecasts, and reasons why forecasts can change over time (e.g. why the seasonal forecast evolves over the season).

This was followed by a groupwork exercise where participants were given examples of nowcasts and impact-based forecasts issued by Zambia, Mozambique and South Africa during the kingsize testbed (since 1st October 2024) and asked to explain what they understood by them, and reflect on what is not clear and what could be improved.

As in similar exercises earlier in the intensive testbed, groups were not always clear on the meaning of symbols (e.g. for rain and thunderstorms) or the colour coding in the impact table. The satellite image in the example from SAWS was not clear, and neither was the language of likelihood (in contrast to the impact tables). In the Mozambique example, groups felt there was too much information. Several participants highlighted that text and images should be larger, noting also the special accessibility needs of people with disabilities.

There was a lot of commonality between the groups in the ideal presentation. This was widely believed to be a combination of text and visuals. Text would be most useful in English and local languages, and visuals are most useful when there is a legend. One group also highlighted the wish to see a clearer separation of the time and amount of rainfall.

In the afternoon session, Miriam Murambadoro presented the experience of the Katlehong community observers, and Gilda Monjane presented the experience of the Boane community mobilisers. Before the end of the testbed, the SDMCs will prepare a reciprocal presentation on their experience to be shared with their counterparts in South Africa and Mozambique.



Groups discussed nowcasts issued during the kingsize testbed



Each group presented back a summary of their discussion (with simultaneous interpretation in English-Nyanja and sign language)



Gilda Monjane presented the experience of the Boane community mobilisers

## Community hub daily activity report - 4th February 2025

Katharine Vincent

Fifteen of the Satellite Disaster Management Committee (SDMC) members (who play the role of community mobilisers) participated in a half day session in the community hub in Kanyama on 4th February.

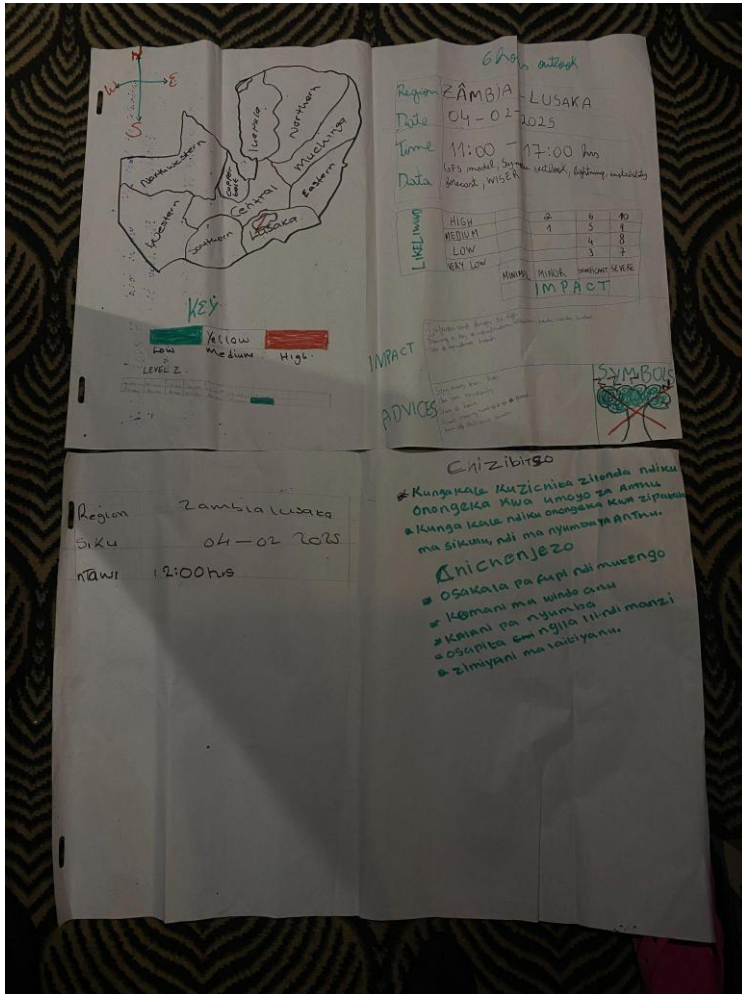
Over the last few days, community sessions have been held for each of the three wards in Kanyama in which we work - Chinika Ward 11, Makeni Villa Ward 14 and Kanyama Ward 13. During these community sessions, groups debated and critiqued different nowcast and impact-based forecast formulations, coming up with a common list of positive attributes (see reports for 31st January and 3rd February). In today's session, the SDMCs consolidated the recommendations and developed their own fictional nowcasts that apply the presentational features that they found useful.

The fictional nowcasts all contained the key attributes that had been preferred. This includes a combination of text and visuals (typically a map, and use of symbols to indicate weather), use of the impact-based table (with a key), use of traffic light colour to indicate risk levels, prominent headers on the level of the warning, clear recommendations/advisories and use of two languages (English and Nyanja - although it was noted that there are 7 major language groups in Zambia and ideally information should be available in all to ensure universal accessibility).

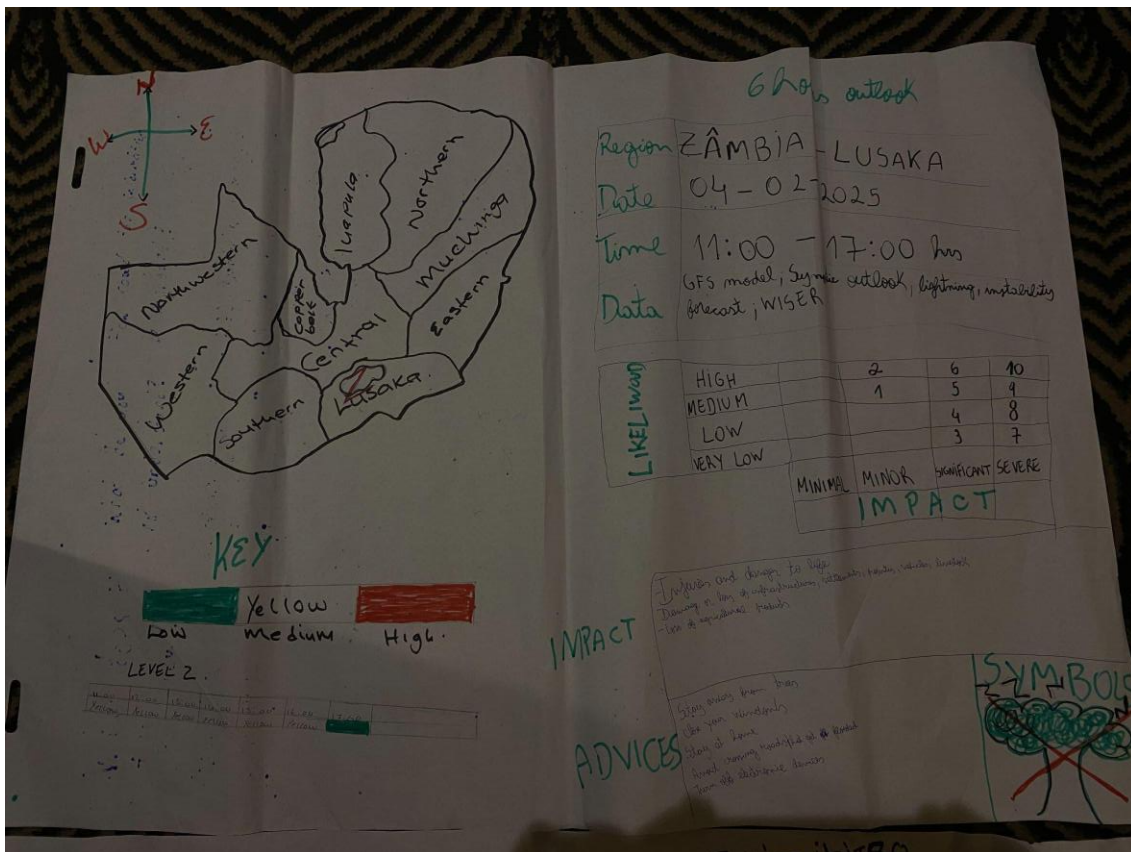
These nowcasts will be presented in tomorrow's main hub at ZMD.

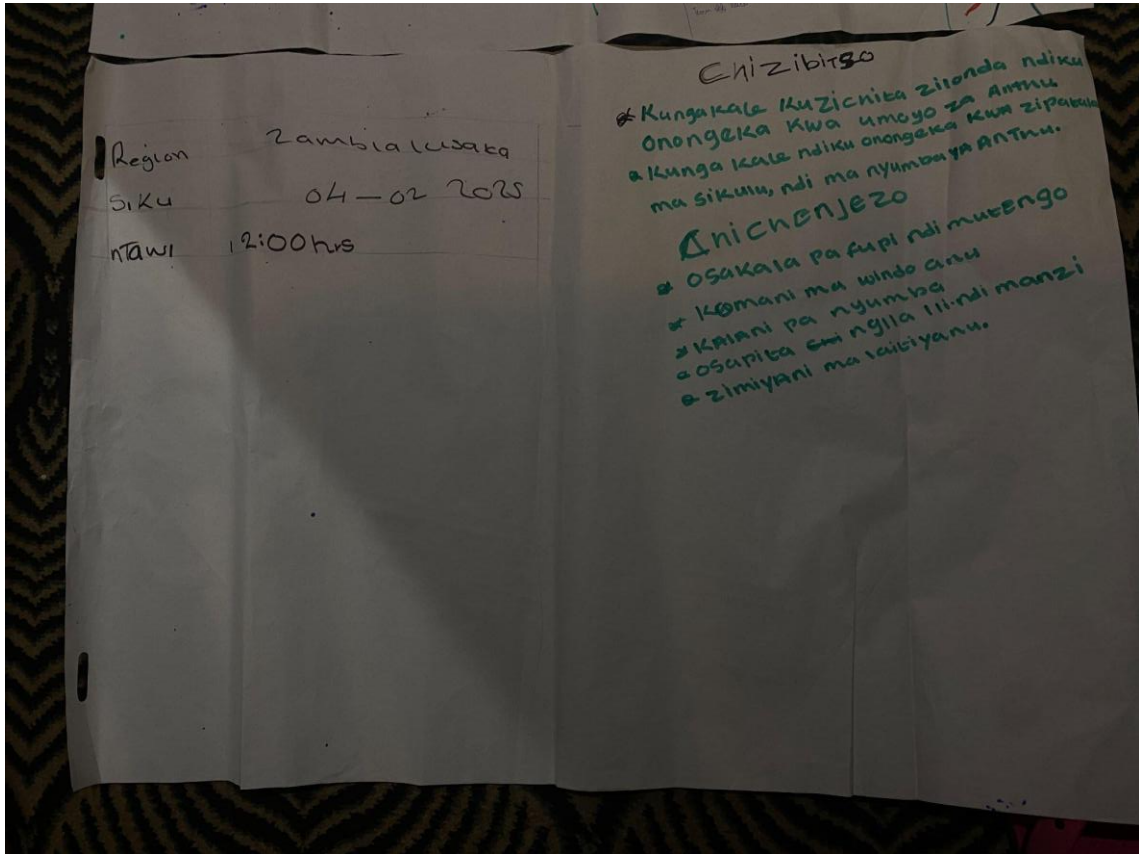


One of the SDMC teams presents their fictional nowcast



English and Nyanja presentations of a nowcast from one group





English and Nyanja nowcasts from another group

1) <sup>POS</sup> KANYAMA NOWCAST

• LEVEL 6 WARNING: HIGH LIKELIHOOD OF OCCURRING SIGNIFICANT IMPACT.

2) Actual time

• correct time e.g. Local area

3) instead of writing Likelihood they better put the word chance.

• instead of forecast they better put the word report.

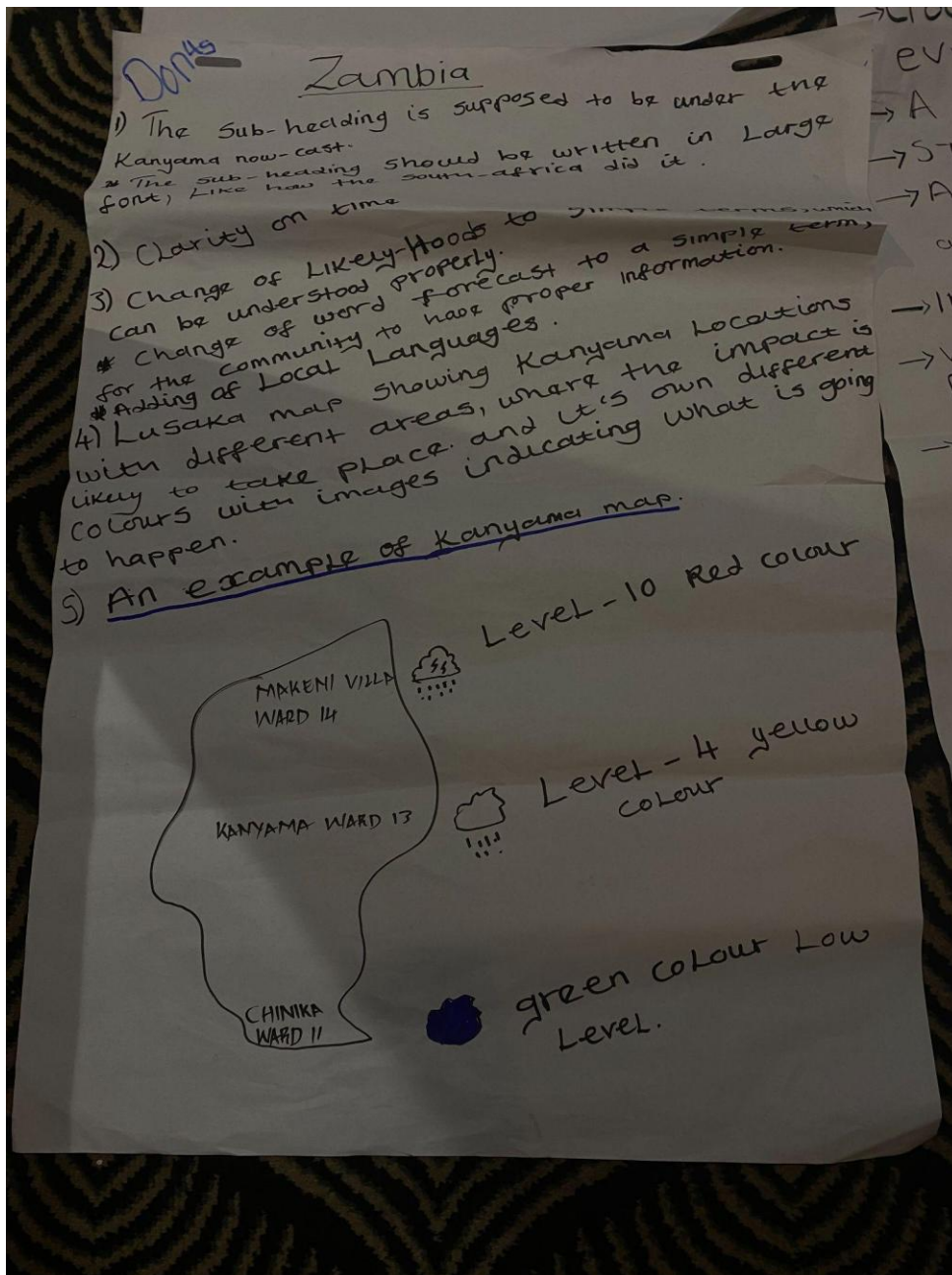
• In terms reporting a time. They need to

Put it in full, e.g. T+1hr. The context of these terms must be written like, time 2 or 1hr

• For Kanyama, the key message should change for easily understanding ~~with~~ the community.

• We need have three colours, which are; green, yellow and Red for easy understanding to the community.

(They should engage field work (mobile-sensstation)).



Recommendations on presentation from one group

### Community hub daily activity report - 5th February 2025

Katharine Vincent

Sixteen of the Satellite Disaster Management Committee (SDMC) members (who play the role of community mobilisers) travelled into Lusaka to join the technical centre of the testbed on 5th February.

The morning saw the official opening ceremony of the testbed, with presentations from ZMD director Mr Edson Nkonde, Acting PS in the Ministry of Green Economy and Environment Mr Ranford Simumbwe, and WISER EWSA representatives Hellen Msemo (WMO) and John Marsham (University of Leeds). The opening was followed by tours of the nowcasting and synoptic forecasting testbed

stations. This provided the SDMCs with the opportunity to gain insights into the process of analysing data to inform product development, to understand the challenges of predicting rainfall at high resolution, and to appreciate the process that is followed to generate the information that is then received on their cellphones.

In the afternoon, the SDMC members presented their example nowcasts and lists of recommendations that had been developed in the session on 4th February. This prompted a varied discussion. Comments included commendation for closing the feedback loop in the co-production process and for the level of understanding of weather and early warnings shown by the SDMCs. Questions included:

- clarification on the use of CAP messaging in Zambia (which forecasters confirmed is applied),
- the nature of a key for the impact table,
- the scope of training received by SDMCs (which includes sessions from forecasters during the intensive testbed and other sessions throughout the kingsize and intensive testbed, and training by DMMU on their roles as SDMCs),
- whether there would be scope in Kanyama for police to disseminate messages through loudspeakers on vehicles (this was refuted on the grounds that the police in Kanyama only have one vehicle which is already overstretched),
- how and to whom nowcasts are further disseminated (through word of mouth, whatsapp and meetings in churches)

The final session of the day was a refresher on safeguarding and culminated in collective agreement on principles to guide the work of SDMCs and standards for behaviour whilst in role.

### **Community hub daily activity report - 6th February 2025**

Katharine Vincent

Sixteen of the Satellite Disaster Management Committee (SDMC) members (who play the role of community mobilisers) travelled into Lusaka to join the technical centre of the testbed on 6th February.

In the morning the group undertook a social network mapping exercise to try and track the onward reach of forecasts and nowcasts that are received by the SDMCs from ZMD. Each SDMC forwards the messages directly to between 10 and 1408 people, taking into account face to face and electronic transmission. Primary communication occurs with family members, tenants, work colleagues, churches and their congregations, schools, persons with disability and whatsapp groups (based on politics, sport, community and friends). Efforts were also made to identify the next stage of transmission, whereby these recipients further disseminate the information among their own networks.

The group then compiled a powerpoint presentation which outlines how they conduct their work, and some of the activities that they have undertaken during the kingsize testbed. Counterparts in Boane and Katlehong had developed similar such presentations, which were facilitated by the relevant community engagement leads in each country, who then shared them during the intensive testbed. The reciprocal presentation from the Kanyama SDMCs will be shared in South Africa and Mozambique in the coming weeks as part of regional exchange and learning.

In the afternoon, after listening to presentations on different aspects of the project's work - including evaluation of intensive nowcasting events during the kingsize testbed using their feedback, the group commenced reflecting on the testbed (kingsize and intensive) to date, and future plans. They also participated in individual interviews to elaborate their motivations for undertaking the voluntary roles of community mobilisation and SDMCs, and to give personal examples of how they have used weather information to date.



SDMCs participate in the technical testbed hub in Lusaka

### **Community hub daily activity report - 7th February 2025**

Katharine Vincent

Sixteen of the Satellite Disaster Management Committee (SDMC) members (who play the role of community mobilisers) travelled into Lusaka to join the technical centre of the testbed on 7th February.

In the morning the group undertook formal evaluations of the intensive testbed. They then had a reflection and learning session to take stock of activities in the kingsize testbed (including the intensive testbed). To date in the kingsize testbed, SDMCs have been meeting regularly (fortnightly) and visiting individuals in their communities to identify the persons with disabilities and their particular weather information needs. Based on a suggestion from one of these meetings, they have been visiting churches in Kanyama to share weather information. They have also been verifying the occurrence of rainfall on a daily basis through a Googleform. Feedback received to date is that the Kanyama community members are appreciating receiving weather information, with some people actively seeking out the SDMCs for updates, demonstrating increased demand.

For the remainder of the kingsize testbed, they will continue this approach with some minor modifications. The first step will be to try and increase the number of people who receive weather information directly from ZMD. This will be done by encouraging people with smartphones to join the ZMD WISER EWSA Kanyama SDMC Whatsapp group, on which forecasts and nowcasts are disseminated, and collecting phone numbers of those without smartphones to provide to ZMD so they

can be manually added to the SMS list (which currently is only available for self subscription by people with smartphones). This will free up the time of SDMCs to share information by word of mouth with the most marginalised members of the community who cannot follow either of these options (e.g. a blind person without a smartphone - as voice notes are only available on smartphones). ZMD has committed to send text only versions of the nowcasts (as well as the forecasts) to the SMS list as well as the full version on Whatsapp.

For the remainder of the rainy season, SDMCs will endeavour to provide daily feedback on the Googleform - whether or not there has been rain. This is in response to a request from nowcast evaluators to verify dry conditions as well as wet. They will also continue - and ramp up - their engagement with key community leaders (including councillors, Ward Development Committees, and chairpersons). Feedback will be sought from community members on forecasts and nowcasts, taking into account the need to do so in line with sound ethical and safeguarding practices.



SDMCs reflect on the kingsize testbed thus far, and plan for the remaining months

## Annex 2. Weekly WP4 reports of T2-Z activities

### Intensive Testbed Weekly Summary: January 27th–February 3rd, 2025

Dear colleagues,

We officially launched the **T2-Z Intensive Testbed** on **January 30th**, which will run until **February 7th, 2025**. Prior to the start, a **three-day training programme** (January 27–29) was led by WP3, with **Cynthia Nemutudi from SAWS**, where forecasters from ZMD and INAM received training on **nowcasting products, Impact Based forecasting, CAP messages and the standard operations procedures (SOPs) for nowcasting and synoptic forecasting in preparation for T2-Z**.

For T2-Z, **forecasters from ZMD, INAM, and SAWS** were assigned to teams focusing on **synoptic forecasting, nowcasting, evaluation, and community engagement in Kanyama**. The **ZMD nowcasting team operates 24 hours**, with three shifts:

- **08:00–17:00 CAT** (main shift)
- **16:00–01:00 CAT**
- **00:00–09:00 CAT**

During T2-Z, ZMD will be issuing nowcasts for **Kanyama every 2 hours**, and **community observers (SMDCs)** will provide structured feedback via **Google Forms, WhatsApp messages, photos, and videos** three times a day.

INAM will be issuing **daily weather updates** to Boane's community observers and will provide **nowcasts when an Intensive Nowcasting Event (INE) occurs** in Mozambique. When necessary, these nowcasts will be distributed nationally. Additionally, **INAM will be sending daily rain gauge data** to facilitate the evaluation and verification of nowcasts.

During the first week of T2-Z, SAWS forecasters were unable to join due to **a network disruption at their offices**. However, starting from today, **Monday, February 3rd**, forecasters from SAWS joined online and resume issuing nowcasts for Katlehong.

### Kick-off Meeting Highlights

The Testbed was officially launched with a **speech by Mr Edson Nkonde, PR Zambia Meteorological Department**, followed by opening remarks from:

- **Doug Parker** (WISER-EWSA PI, University of Leeds)
- **Hellen Msemo** (WMO representative)
- **Nico Kroese** (SAWS, WISER-EWSA representative)

During the kick-off meeting, it was emphasized that **international collaboration** is a key driver in advancing **scientific research and forecasting applications**. Additionally, the **adoption of new technologies** is essential for improving **forecasts and warnings in Southern Africa**. Finally, **community engagement through co-production** plays a crucial role in enhancing adaptation to extreme weather events, ensuring that **weather information, including nowcasts, is valuable and actionable for end-users**.

### Key Achievements – Week 1 of the Intensive Testbed

- **ZMD introduced voice notes in English, Nyanja, and other local languages**, to disseminate nowcasts, improving the accessibility of weather information for a broader audience.
- **Nowcasting teams** are utilizing a diverse range of forecasting products, including **CRR, RDT, RoA, and Lightning data**, to enhance the accuracy of nowcasts.
- **Forecasters from ZMD and INAM** are actively engaged in the **evaluation of nowcasts**, contributing to improving forecast accuracy.
- **The evaluation team is conducting:**
  - **Cross-validation of retrieval products** against **rain gauge data** to assess accuracy.
  - **Assessment of forward prediction models** (CRR, RoA) to understand **their performance and limitations** in capturing nowcasted events.
  - **Analysis of AI-driven nowcasting models**, including **Jawairaa's CNN-based nowcast of convective cores**, to evaluate their effectiveness in predicting convective rainfall development.
- **Evaluation of the King-size Testbed** (from October 1<sup>st</sup>, 2024 to January 27<sup>th</sup>, 2025) is **underway**, to assess the effectiveness of nowcasting operations during this period.

### Looking Ahead

- **Continued daily nowcasting operations** and evaluation of forecast accuracy.
- **Assessing the accessibility of nowcasts** – ensuring that **maps, warnings, and advisories are clear and understandable** to all users.
- **Refining the nowcasting template** based on feedback from **community observers** in response to nowcasts issued by **SAWS, INAM, and ZMD**.
- **Addressing time constraints** – the current nowcast template is time-consuming, leading to lost opportunities for monitoring real-time weather developments.
  - Possible improvements include **simplifying the process**, incorporating **colour-coded rainfall intensity**, and ensuring long-term **sustainability of nowcasting operations**.
- **Expanding capacity-building for SDMCs** to support the dissemination of nowcasting information more effectively.
- **Integrating AI prediction models** for improved nowcasting through **intercomparison of new products** developed by the team's scientists.
- **Enhancing training opportunities** for forecasters on new nowcasting models:
  - **Facilitating collaboration** between model developers and forecasters.
  - **Sharing instructional materials** through different platforms.
  - **Inviting PhD students to provide training sessions**.
  - **Incorporating training materials into platforms like Moodle** for long-term learning.

Thank you for your collaboration in ensuring the **smooth kick-off** of the T2-Z Intensive Testbed! We look forward to make further progress during this week.

## Intensive Testbed Weekly Summary: February 3rd–7th, 2025

Dear colleagues,

This week in the T2-Z Intensive Testbed was marked by significant knowledge exchange and engagement, including the participation of colleagues from Malawi and Zimbabwe, who actively contributed to the nowcasting and evaluation teams. Key events included the Open Day, Cross-Project Day, and a final session featuring PhD students and researchers from Zambia and the UK, who presented state-of-the-art research on AI-driven nowcasting.

During the week we had very productive discussions on nowcasting evaluation, verification of new products, debates impact-based forecasting and making stronger synergies between researchers, forecasters and community members. A major focus of the discussions this week was on sustainability beyond the project's completion, highlighting the need for continued leadership from national meteorological services in Southern Africa.

### Open Day Highlights

The Open Day was an opportunity for government institutions in Zambia, partner agencies, and community observers to experience the testbed in action. Key moments included:

- **Welcoming remarks** by ZMD PR, the Ministry of Green Economy and Environment, WMO, and WISER-EWSA.
- **WMO's emphasis** on the global mandate for Early Warnings for All (EWSA) by 2027 and how WISER-EWSA is uniquely bridging social science with meteorology to improve early warning systems.
- **WISER-EWSA overview**, discussing the importance of nowcasting for high-impact weather events and its potential for long-term forecasting improvements in the region.
- **'Guided-Tour of the testbed'** by PhD students from Leeds led a guided tour of the testbed for community observers and intermediary organizations, offering a behind-the-scenes look at its operations and demonstrating how scientific advancements are integrated into real-world forecasting and decision-making.

### Cross-project Day Highlights

During our **Cross-Project Day**, we heard important updates from various work packages, highlighting key advancements and reflections. WP4 presented preliminary results of the **evaluation of the King-Size Testbed**, assessing progress and identifying areas for refinement. WP1 provided **insights on community engagement**, sharing lessons learned from working with local stakeholders. A **socio-economic analysis** explored the broader impacts of nowcasting, emphasizing its role in reducing economic and social vulnerabilities. Finally, we had a presentation on **WISER and EW4ALL** (Nico Kroese and WMO's Daniela Cuellar), discussing ongoing efforts to strengthen early warning systems and their alignment with global resilience initiatives.

### Key Developments

#### Nowcasting & Evaluation

- **Forecasters from ZMD and INAM** emphasized the need for **developing country-specific impact tables** to replace reliance on SAWS frameworks. These must be tailored to local hazards and user needs.

- Discussions focused on **evaluation strategies**, particularly the need for **systematic verification of nowcasting performance**, including analysis of **hits, missed events, and false alarms**.
- Community observers provided **feedback on nowcasting formats, warning communication, and operational procedures**, helping refine forecasting products.

### Community Engagement & User Feedback

- **Community observers (SDMCs)**, actively spreading nowcasting information and integrating disaster risk reduction practices within their communities.
- **Feedback on nowcasting templates included:**
  - Need for **greater consistency in warning levels** (color-coded rather than numbered).
  - **Clearer maps and impact symbols** to assist community mobilizers in conveying warnings.
  - **Use of local languages (Nyanja & English)** for better accessibility.
  - **Voice notes in multiple languages** for enhanced engagement.
  - **Expanded SMS-based alerts** for users without smartphones.

### Research & Innovation

- PhD students and researchers presented their research on **AI-driven nowcasting**.
- WP2 gathered feedback on forecasting tools, warning communication, and operating procedures, contributing to refinements in the **King-size Testbed** and broader forecasting strategies.

### Looking Ahead

- The feedback gathered during T2-Z will be instrumental in refining the **King-Size Testbed**. Insights from forecasters, community observers, and researchers will be applied to **enhance Standard Operating Procedures (SOPs), refine nowcasting templates, and improve communication guidelines**. These improvements aim to streamline processes, ensure consistency across participating meteorological services, and strengthen the overall effectiveness of nowcasting operations for the future.
- **Expansion of community engagement**, adding more participants to WhatsApp groups and ZMD's SMS list for wider dissemination of nowcasting information. **Daily reporting on the Google Form** will continue, ensuring consistent data collection from community observers.
- **ZMD will maintain regular updates in multiple languages and formats**, strengthening trust in meteorological services.
- **ZMD's forecasters will continue engaging communities**, explaining meteorological products to improve understanding of weather alerts and advisories.

We will **resume our daily briefings on Monday, February 17th**. We encourage forecasters from **ZMD, INAM, and SAWS** to continue filling in the **Outlook Forecast Table daily**, as this remains crucial for supporting the evaluation of nowcasting operations.

Thank you for your continued collaboration and contributions to the T2-Z Intensive Testbed! Your dedication has created a valuable environment for learning, knowledge exchange, and international collaboration, making this intensive testbed a meaningful success.

