WISER-EWSA Testbed 1 Operations Plan.

Version 2

Last updated: 21/12/2023

1. Summary details: WISER-EWSA Testbed 1

Dates: Monday 29th January to Friday 9th February 2024.

Venues:

Testbed Operational Centre: Zambia Meteorological Department (ZMD), Lusaka

South Africa Testbed Office: South African Weather Service (SAWS), Pretoria.

Mozambique Testbed Office, Instituto Nacional de Meteorologia (INAM), Maputo.

Contact details: WISER-EWSA Project Office: wiser-ewsa@ncas.ac.uk

This document provides an outline of the plans for the testbed in order to orient participants and partners to the overall aims and practicalities. All details will be refined in the intervening months through a series of planning meetings, workshops and co-production events between practitioners and users. A much more comprehensive Operations Plan will be released prior to the event.

2. Background; Outputs and Outcomes

WISER-EWSA Testbed 1 (T-1) will be a live severe weather forecasting event conducted in Southern Africa over a period of 2 weeks early in 2024. During the testbed, meteorologists, academics, economists, and user-engagement specialists will create real-time warnings of severe weather, deliver these to partnering user groups, and co-evaluate the effectiveness of those warnings. Learning from T-1 will be used to design and deliver a second testbed early in 2025.

The Testbed is being conducted as part of the WISER Early Warnings for Southern Africa (WISER-EWSA: 2023-2025) project. The WISER-EWSA team of meteorologists, academics, economists, and user-engagement specialists from South Africa, Zambia, Mozambique and the UK will work with disaster risk management agencies and non-governmental organisations, focusing on women and people with disabilities to reduce disaster risk through the co-production of new weather and climate information services and early warnings.

Testbed 1 will build on experience in the first African testbeds, conducted in the GCRF African SWIFT project (2017-2022) and documented by Fletcher *et al.* (2023)[1].

WISER-EWSA Testbed 1 contributes to the Theory of Change of the WISER-EWSA project, and the wider WISER programme. As such, the intended Outputs and Outcomes of Testbed 1 are as follows.

Outputs

The testbed will deliver the following:

a. Early Warning Systems (EWS) which have been co-produced between forecast providers (in a network of agencies and countries) and users, and tested and evaluated in the testbed.
b. Standard Operating Procedures (SOPs) of the EWS, which have been tested and evaluated.
c. Documentation of other good practice as part of Knowledge Management and Applied Learning.
d. Training and practical experience of forecasters and users in use of nowcasting as a part of EWS.
e. End-to-end evaluation of the value-chain associated with urban EWS.

The testbed contributes directly to WISER-EWSA Outputs:

B. Urban populations who know how to access, understand and use EWSs
C. Improved capacity to generate EWSs and co-produce alerts in 3 countries

The testbed will also be used to provide evidence to support the other WISER-EWSA outputs:

A. Business models for co-produced EWS sustainability
a. Regional awareness of nowcast potential for Disaster Risk Reduction (DRR)

In turn this contributes to four **WISER-Africa Outputs**

Output 1: Strengthened co-production between producers, intermediaries and users to improve the uptake and use of weather and climate information services across weather to climate timescales.

[1] Fletcher, J.K., C.A. Diop, E. Adefisan, M. Ahiataku, S.O. Ansah, C.E. Birch, H.L. Burns, S.J. Clarke, J. Gacheru, T.D. James, C.K. Ngetich Tuikong, D. Koros, V.S. Indasi, B.L. Lamptey, K.A. Lawal, D.J. Parker, A.J. Roberts, T.H.M. Stein, E. Visman, J. Warner, B.J. Woodhams, L.H. Youds, V.O. Ajayi, E.N. Bosire, C. Cafaro, C.A.T. Camara, B. Chanzu, C. Dione, W. Gitau, D. Groves, J. Groves, P.G. Hill, I. Ishiyaku, C.M. Klein, J.H. Marsham, B.K. Mutai, P.N. Ndiaye, M. Osei, T.I. Popoola, J. Talib, C.M. Taylor, and D. Walker. "Tropical Africa's first testbed for high-impact weather forecasting and nowcasting", Bulletin of the American Meteorological Society (published online ahead of print 2022), doi: https://doi.org/10.1175/BAMS-D-21-0156.1

Output 2: Strengthened networks, partnerships and regional and national coordination mechanisms that support the generation, uptake and use of enhanced weather and climate information services.

Output 3: Strengthened designated producers' capacity to deliver enhanced user-led weather and climate information services.

Output 5: Better evidence and learning, continually strengthening co-produced weather and climate information services and programme decision-making.

3. Locations

The testbed will create and share forecasts of severe and high-impact weather in the Southern African region. This will be conducted as a co-production and evaluation exercise in partnership with a selected group of forecast users. The activity will not replace or duplicate any mandated weather services and early warning systems.

The creation and delivery of forecasts will be conducted in three centres. Most of the scientific participants will come together at the **Testbed Operational Centre (TOC) at ZMD in Lusaka**. Smaller teams will remain in SAWS (Pretoria) and INAM (Maputo) to focus on engagement with their local user groups in the forecast delivery.

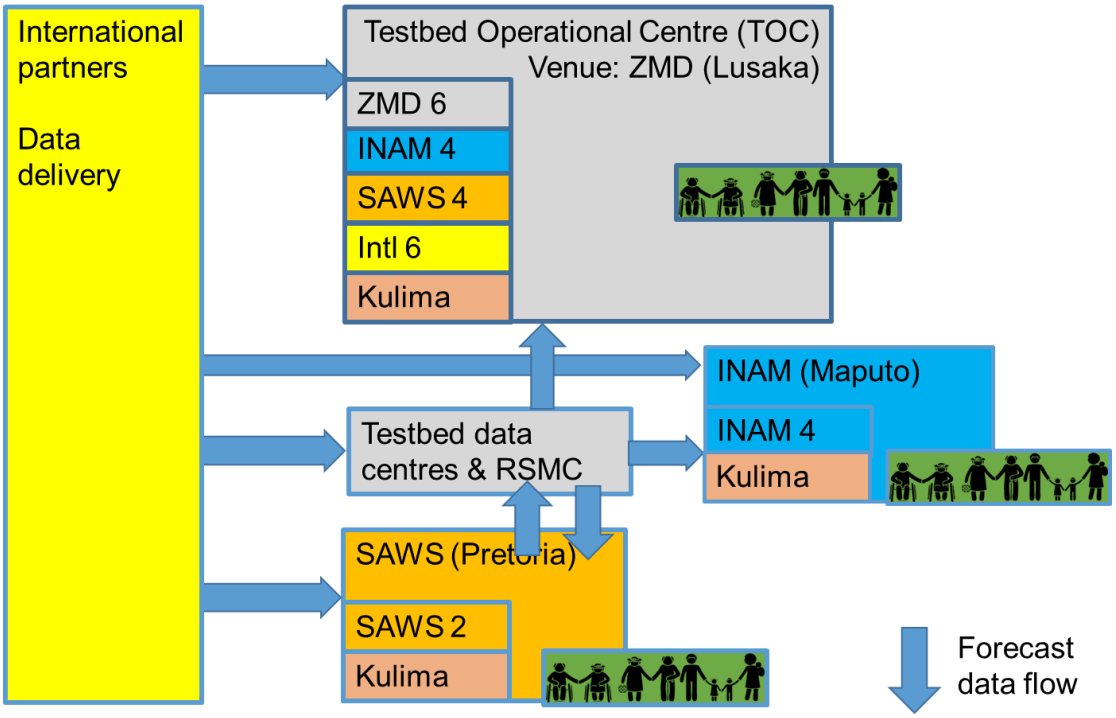

Figure A: Schematic diagram of testbed sites. The TOC will be hosted at ZMD, Lusaka. Numbers against the organisations are a guide to the likely number of staff from each organisation present in each centre. "Intl" indicates additional international contributors, from the UK, WMO and elsewhere. The green boxes indicate engagement with users in each centre.

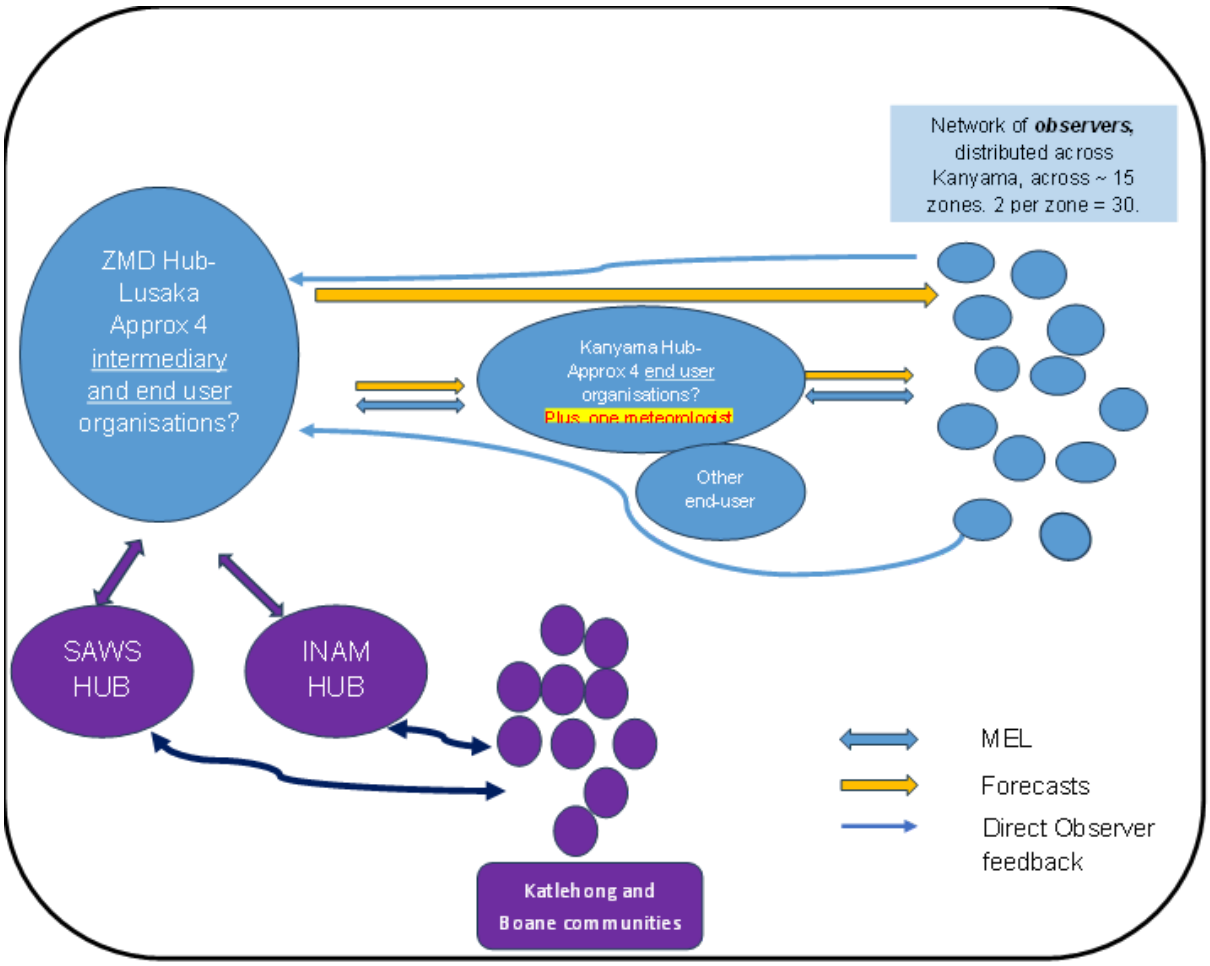

Figure B: Simplified multi-sited testbed schematic and information flow. The ZMD hub is where the TOC will be located, with most of the testbed activities happening. From the TOC, forecasts will be relayed to the Kanyama hub, and to the community. Additionally, the intermediary organisations and end-user representatives at the Kanyama hub can also relay the forecasts to the communities through their networks. Feedback from the community can be directly sent to the TOC or via the Kanyama hub. Similar activities to those happening in Zambia will be replicated in Mozambique and South Africa.

4. Personnel, operational teams

We envisage about 12-20 people working in the main Testbed Operational Centre, plus collaborating organisations and users. Groups of around 2-4 people will be working in the other centres.

Personnel will consist of

- Meteorologists (forecasters, academics etc);
- Impact specialists (DRR / DRM professionals);
- Social scientists;
- Representatives of user groups.

The link to the different roles on a daily basis has been drafted.

The participants will be organised into teams responsible for different aspects of the forecast creation, communication, decision-making, feedback and evaluation.

We are open to the opportunity to partner with relevant organisations, programmes and projects. Please get in touch if you would like to discuss your potential involvement.

All Testbed participants should be added to [this spreadsheet]

4.1. Short-range severe weather forecast team (meteorologists and impact specialists)

- Responsible for 12-48h forecast using an ensemble of NWP model forecasts.
- Creates a map of severe weather likelihood and some written forecasts and alerts. Creates risk maps and colour-coded alerts.
- Provides a synoptic summary of drivers relevant to the nowcasting.
- Follows the methodology of SWFP.
- ***Standard Operating Procedure (SOP)*** *has been created based on existing local practice*

4.2. Nowcasting team (meteorologists and impact specialists)

- Responsible for nowcasting of high-impact weather according to user needs, using all available observations and projections.
- Creates and updates maps and timelines. Delivers alerts through various communication channels.
- We will design the nowcasting methodology in co-production with users, making use of the existing protocols and Standard Operating Procedures of SAWS, INAM and ZMD, and learning from the SWIFT testbeds.
- ***Standard Operating Procedure (SOP)*** *has been created based on existing local practice*

4.3. Evaluation and Engagement team (meteorologists, impact specialists, social scientists, users)

- Performs validation of prior forecast and nowcast accuracy.
- Manages the user feedback regarding information supplied.
- Makes evaluation of EWS effectiveness day by day.
- The methodology for the Evaluation and Engagement team will be developed in co-production with all participants.
- *Standard Operating Procedure (SOP) has been created based on existing local practice*

4.4. Management and decision-making

We will define a management structure for day-to-day running of the testbed, including chairing of meetings, record-taking, decision-making, logistical management, Monitoring, Evaluation and Learning (MEL) and knowledge management. In particular:

The TOC leader and deputy are to be designated for each day of the testbed.

- Chair discussions and meetings.
- Ensure timekeeping and reporting.

Scientific Secretary will be designated for each day:

- Maintain notes from meetings and discussions.
- Ensure timekeeping and reporting.
- Coordinate documents; keep shared file spaces tidy.

These details are to be completed as part of the ensuing planning process. These details will be specified in the roster.

5. Schedules

5.1. Weekly including periodic reviews

12 days, including weekends.

Consider a "soft down day" for rest, reviews and so on (forecasting/nowcasting continues at reduced level).

Regular review meetings.

The ***full schedule*** has been drafted.

5.2. Daily

0800-1600 Local time: Synoptic team and Evaluation-engagement team.

1400-2200[2]: Nowcasting team.

1400-1445: Daily forecast review (including communication between centres).

Also schedule: regular times for issuing of forecasts.

A daily schedule of activities has been created.

5.3. Informal engagement and relationship-building

These details are to be completed as part of the ensuing planning process.

6. Forecast and nowcast products for specialists (NMS / DMM)

6.1. Model products

Model	**Detail**	**Platform**	Products	Notes
ECMWF	Latest products from ECMWF for the South African region	RSMC site; Puma / Synergie.	Maps, meteograms	
SAWS CP LAM				
UKMO Africa LAM				Only covers the northern part of Zambia.
NOAA				

[2] Extension beyond 2200 to overnight coverage will also be considered.

WRF	Latest WRF simulations for country and region-wide domains			
MeteoF				
GFS				

Table A: Model products and availability: *This table is to be completed as part of the ensuing planning process.*

6.2. Nowcasting products

Table B: NWCSAF, SAWS radars, flood risk product, NFLICS, WMO AI collaborations. *This table is to be completed as part of the ensuing planning process.*

Model	**Detail**	**Platform**	Products	Notes
NWCSAF	Various NWC-SAF output will be utilised from SAWS ; Leeds ; Eumetsat	WISER RSMC ; SWIFT Catalogue? ; Eumetview ; Adaguc	1. Rapidly Developing Thunderstorm (RDT) 2. Convective Rainfall Rate (CRR) 3. Instability Indices (PW, TT, KI, LI) 4. Convection Initiation (CI) 5. Precipitating Clouds 6. Cloud products (Cloud Phase, Cloud Type)	
SAWS radars	Operational SAWS radars covering high risk areas of South Africa.	WISER RSMC	Reflectivity maps	
Flood risk products	South African Regional Flash Flood Guidance System (SARFFG)	SARFFG portal linked to WISER RSMC	Flash Flood Guidance Maps	
Satellite channels; RGBs	12 single channels ; colour enhancements ; difference channels available ; RGB's available	Puma/Synergie ; Eumetview ; Adaguc	1. 12 single MSG channels 2. Colour enhancements (if available) 3. Satellite difference	

			channels (if available) 4. RGB combinations (if available)	
NFLICS				
WMO AI collaborations				
Severe Storm Indicator	New potential product based on NWC-SAF to be tested to identify severe weather producing storms	WISER RSMC	Maps	

6.3. Ground-based observations

Table C: Radars; AWS; Synergie (soundings); …

Observation source	**Detail**	**Platform**	Resolution	Notes
Radar	Where available, e.g., in south Africa	SAWS archive?		
AWS	ZMD has provided their network. Request to INAM and SAWS to also provide data	ZMD data sites	Sub-daily and daily	
Conventional weather stations	Daily rainfall data			

6.4. Satellite products

Table D: satellites, data platforms such as Synergie/PUMA and free sites. *This table is to be completed as part of the ensuing planning process - check the swift site*

Satellite observation	**Detail**	**Platform**	Resolution	Notes
EUMETSAT		Synergie/PUMA		

6.5. Platforms

Table E: RSMC page hosted by SAWS; Bespoke page for the Testbed, to communicate new products under trial; external/partner products. *This table is to be completed as part of the ensuing planning process.*

Platform	**Detail**	**Responsibility**	Notes
PUMA/Synergy			
RSMC			
Leeds??, NFLICS,			

7. Communications channels and products for users

An important aim of the project is to exploit a broad range of media for the communication of early warnings, and to evaluate how these are used. These include the following.

7.1. Written guidance documents and summaries.
7.2. WhatsApp
7.3. SMS
7.4. Web products
7.5. Apps: SAWS app and FASTA app.

These details are to be completed as part of the ensuing planning process.

8. Feedback protocols

How and when do users give feedback to us? We will design feedback protocols in co-production with users.

8.1. Meetings
8.2. Electronic feedback.

9. Logistics

Logistics coordinator: Mrs Denise Groves (NCAS, Leeds)

9.1. Data transfer
We are intending to use two methods of data transfer to ensure reliability - 5G and Starlink. The procurement procedure for a starlink system for ZMD is underway, but we have an NCAS system we can borrow for the testbed on standby in case the ZMD system is not in place in time.
9.2. Data access platforms
https://www.wiser-ewsa.org/testbed/portal/
Password = ZambiaTestbed
9.3. Shared spaces for reports, alerts etc. - Shared Google Drive
This has been shared with everyone on the current WISER-EWSA drive, any additional people requiring access should send their google ID to Denise Groves
9.4. Office and meeting space

9.5. Accommodation and transportation
This is being arranged by SAWS. Anyone intending to attend the testbed in person needs to ensure their arrival and departure dates and times are on the participants spreadsheet

These details are to be completed as part of the ensuing planning process.

10. Economic analysis

Analysis of the conduct of the testbed will contribute to the economic analysis of the delivery and use of EWS. This will be handled in the testbed

11. Knowledge Management and Applied Learning (KMAL)

Our KMAL planning will be used to design the following.

- Structured outputs bringing in learning from all participants, for instance ensuring that insight from across all partners is used to evaluate and refine our SOPs.
- Collection of unstructured learning and insights, for instance through discussion groups and through quick notes collated in a shared document.

These details are to be completed as part of the ensuing planning process.

12. Planning

Testbed 1 is planned in WP4 of WISER-EWSA.

Leaders: Doug Parker, NCAS, University of Leeds; Katharine Vincent, Kulima.

Testbed planning team:

1. Hellen Msemo (Testbed Lead)
   Denise Groves (Testbed coordinator)
2. Nico Kroese (SAWS lead)
3. Felix Imbwae (ZMD lead)
4. Goncalves Junior (INAM lead)

Additional specialist roles will be filled:
IT and data management
Lead on economic analysis

13. Value for Money

The Testbed planning process will work to deliver high value for money, in particular paying attention to the main cost-drivers and optimal budgeting for these. Value for money will include consideration of workloads associated with preparing, delivering and evaluating the event.

A. Appendix A: Schedule of pre-events.

Activity	Responsible partner	Venue
Co-production for testbed and user training	Kulima	SA
Co-production for testbed and user training	Kulima	Zambia
Co-production for testbed and user training	Kulima	Mozambique
Product Training (1 x Month before Testbed)	SAWS	RTC
Test Bed Training: (1 x Week before Testbed)	SAWS	NMSs
Testbed	NCAS-Leeds	NMSs
Review meetings	NCAS-Leeds	Zambia
Review meetings	NCAS-Leeds	Mozambique

B. Appendix B: WISER-EWSA project summary

WISER EWSA: Reducing risk from storm events in cities in southern Africa

Severe thunderstorms cause significant damage in southern Africa, threatening lives, damaging property, and destroying livelihoods. This is particularly the case in cities and urban areas.

Nowcasting techniques using satellite data enable weather forecasters to observe thunderstorms as they form, how intense they are and to provide **early warnings** of where they will move within the coming 2 hours. Working with urban populations, including disadvantaged groups (such as women and people with disabilities) we can help to ensure that people receive these early warnings in a timely manner (including through direct alerts to cell phones). It is vital that people know what actions to take to reduce the risk of negative impacts, once they have received a warning..

The WISER EWSA team of meteorologists, academics, economists, and user-engagement specialists from South Africa, Zambia, Mozambique and the UK will work with disaster risk management agencies and non-governmental organisations, focusing on women and people with disabilities to reduce disaster risk through the co-production of new weather forecast information services and early warnings.

Particular outputs include:

- Strengthening the capacity of national meteorological agencies in severe weather forecasting and nowcasting techniques, using current and new satellite data (Meteosat Third Generation) and working through the World Meteorological Organization's Regional Specialised Meteorological Centre in southern Africa (South African Weather Service);
- Building strong links between the people who generate nowcast early warnings (national meteorological agencies) and the people who can use them, to reduce their risk (or communicate warnings to others who can use it to reduce risk);

- Generating user-focused early warning alerts for severe thunderstorms that are understood and can be acted upon by urban communities, including women and people with disabilities;
- Investigating business models to finance and sustain the process, and analyse the cost-benefit of services;
- Demonstrating the potential to scale up such an approach to other countries in southern Africa, and to other sectors beyond cities and urban environments.

Our approach is one of co-production of knowledge by all partners working collaboratively. This will be enabled through an ongoing participatory process that culminates in annual **testbeds, to be held** at the beginning of 2024 and 2025. We also commit to regular reflection and iteration to improve the process, and active documentation and communication of what works.

C. Appendix C: Table of acronyms.

AI	Artificial Intelligence
AWS	Automatic Weather Station
DRR	Disaster Risk Reduction
EWS	Early Warning System
EWSA	Early Warnings for Southern Africa
FASTA	Forecasting African Storms Application
INAM	Instituto Nacional de Meteorologia, Mozambique
KMAL	Knowledge Management and Applied Learning
LAM	Limited Area Model
MEL	Monitoring, Evaluation and Learning
NCAS	UK National Centre for Atmospheric Science
NMS	National Meteorological Service
NWCSAF	Nowcasting Satellite Application Facility
NWP	Numerical Weather Prediction
RSMC	Regional Specialised Meteorological Centre
SAWS	South African Weather Service
SOP	Standard Operating Procedure
SWFP	Severe Weather Forecasting Programme
SWIFT	UK Global Challenge Research Fund African Science for Weather Information and Forecasting Techniques (GCRF African SWIFT)
T-1	Testbed 1
TOC	Testbed Operational Centre
WISER	Weather and Climate Information Services programme
WMO	World Meteorological Organisation
WWRP	World Weather Research Programme
ZMD	Zambia Meteorological Department