

RSMC & EW4AII

Advancing satellite based nowcasting - Regional Approach

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South African Weather Service

1. Introduction:

Breaking News:

- Paris Summer Olympics in 2024
17 x World records broken
- Weather and Climate also achieved a world record:
2023 is Officially the hottest year since weather and climate records were gathered.
-What about 2024 ???
- Within 8-years of the Paris Agreement being ratified the global average temperature rose above 1,5°C
- Despite >20 years warning of climate change impacts by the scientific community.

Why are the world's decisionmakers on a “**Business as usual**” pathway

Background: Regional Specialised Meteorological Centre (RSMC)

- **SAWS is a recognised WMO RSMC for Southern Africa**

Regional Specialised Meteorological Centres (RSMC) are responsible for the distribution of information, advisories and warnings for one or more specific weather types in a defined geographical area of responsibility.

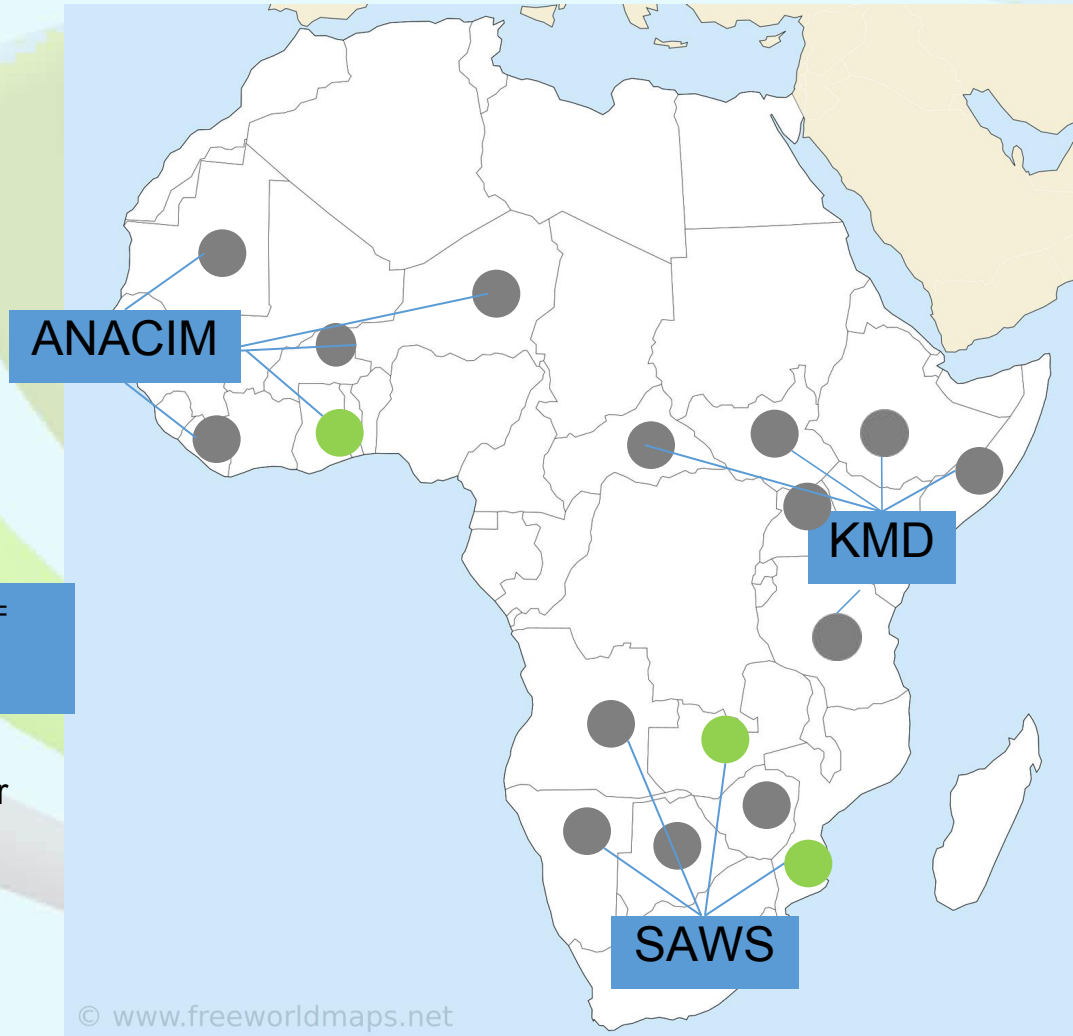
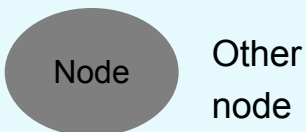
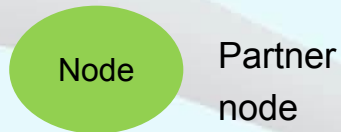
- Interpret information received from global centres, prepare daily guidance products up to 5-days ahead for distribution to National Meteorological Centres and maintain regional website.
- RSMC Pretoria provides weather products to meteorological services within the Southern African Development Community (SADC) region.
- Now with the advent of EW4All that responsibility also includes Nowcasting products.

Africa Context-WMO Regional Hubs

WMO coordination of severe weather forecasting in Sub-Saharan Africa.



Regional Hub = RSMC



WISER EWSA – does not start from fresh.

WISER EWSA builds on: Existing networks, previous experience, lessons from the past. [WISER-SWIFT, SWFP, CREWS etc.]

WISER EWSA involves international role players (EUMETSAT, ECMWF, UK Met Office etc.)

WISER EWSA integrates with Regional (SADC) initiatives
Southern Africa Regional Anticipatory Action Roadmap.

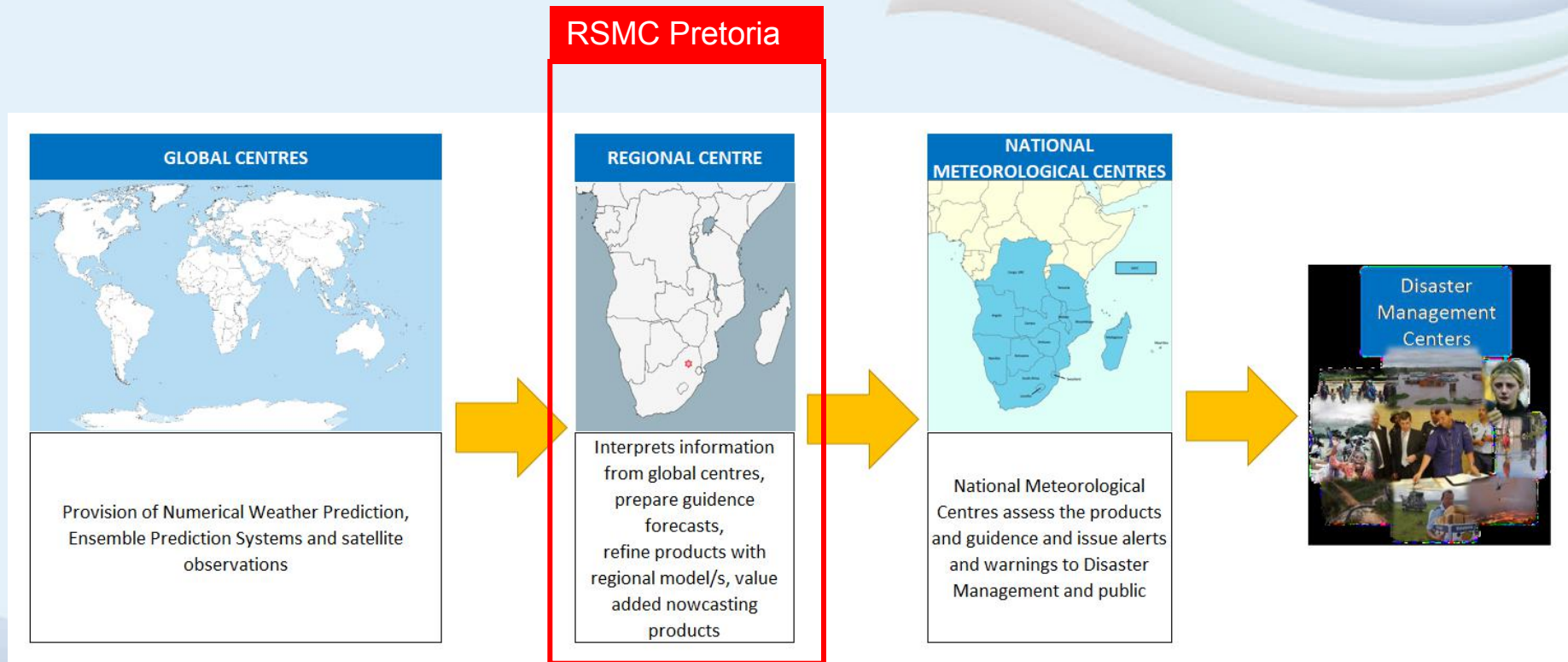
WISER EWSA is scalable to Include more products & services in more countries



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Severe Weather Forecasting Programmes

- The various SADC programmes (SWFP, CREWS, WISER and EW4All) makes efficient use of the “Cascading Forecasting Process” (from global to regional to national to local level) with contributions from the global centres.



Nowcasting service

- SAWS role as RSMC:
 1. Receive and make information from global centers available to the region
 2. Interpret information from global centers and SAWS to produce guidance forecasts
 3. Refine products with regional models/observations
 4. Production of value-added **nowcasting products**
 5. Make products available on RSMC webpage.
- **A nowcasting service typically consist of the following activities:**
 - Step 1.** Overview of large-scale synoptic situation where high-impact weather might develop.
 - Step 2.** Production of a nowcast outlook for the 6 hours (likely risks on national scale).
 - Step 3.** Production of nowcast risk maps for the next 2 hours (using nowcasting products).
 - Step 4.** Provision of near real-time nowcasts for specific locations/users.
- **Nowcasting activities above remain the responsibility of NMHS's**

EW4All & WISER-EWSA Project

WISER-EWSA will transform the access of socially disadvantaged urban groups in Southern Africa to short-range early-warning systems (EWS) **on the 0-48h timescale** and **innovate around nowcasting information for the 0-6h timescale**, which is transformational for the region.

WISER-EWSA Objectives:

- To strengthen capacity for co-producing nowcasts and short-range forecast EWS's across the Southern African regional network;
- To stimulate regional demand for nowcasts as part of a suite of weather and climate information across the full range of timescales for risk reduction.

Alignment with:

UN call for EW4All to reach the most vulnerable countries and give access to early warnings using satellite-based nowcasting in Africa



WISER-EWSA & EW4All:



UNDRR


WMO



Disaster risk knowledge
Systematically collect data and undertake risk assessments

- Are the hazards and the vulnerabilities well known by the communities?
- What are the patterns and trends in these factors?
- Are risk maps and data widely available?

Pillar 1



Detection, observations, monitoring, analysis and forecasting of hazards
Develop hazard monitoring and early warning services

- Are the right parameters being monitored?
- Is there a sound scientific basis for making forecasts?
- Can accurate and timely warnings be generated?

Pillar 2



Preparedness and response capabilities
Build national and community response capabilities

- Are response plans up to date and tested?
- Are local capacities and knowledge made use of?
- Are people prepared and ready to react to warnings?

Pillar 4



Warning dissemination and communication
Communicate risk information and early warnings

- Do warnings reach all of those at risk?
- Are the risks and warnings understood?
- Is the warning information clear and usable?

Pillar 3

IFRC

ITU



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WISER-EWSA –”Attempts” to address the 4 pillars of EW4All

The need for satellite-based nowcasting (0-6h)

Economical challenges make the African continent a **priority for the development of nowcasting services.**



- **Radars are the best solution for nowcasting**
BUT

Radars systems are resource intensive (complex, expensive to acquire and maintain)

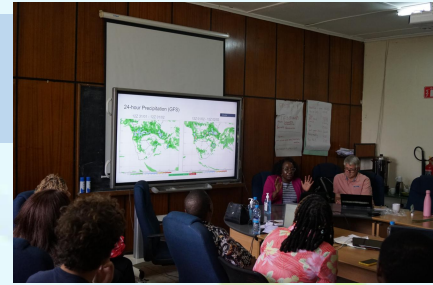
- **Satellite based nowcasting** can also be used for timely early warnings. MSG has proven to be very useful for this purpose, and **MTG offers massive new opportunities (resolution, frequency, lightning)**

- MSG/MTG Satellite services = efficient, reliable and free
- Uncomplicated and minimum maintenance required.

Satellite based products (MSG)

- Many **NWC-SAF** products were available via the ADAGUC viewer (<https://adaguc.nwcsaf.eumetsat.eu/cloud.host/>) and the SAWS RSMC website
- The **Forecasting African Storms Application (FASTA)** a publicly available mobile and web app (<https://fastaweather.com/web/zm/>) developed by NCAS at the University of Leeds (Google Play store)
- **Single and multichannel (RGB) satellite imagery**
- Hydrology - Satellite Application Facility (**HSAF**) - rainfall rates
- **NEW**: the nowcasting method developed by UKCEH to **view convective cores, land surface temperature anomalies** and the statistically (**ML**) generated probability of convection in the near future
- **NEW**: the **Rain over Africa product**. This rainfall retrieval was developed at the Department of Space, Earth and Environment, Chalmers University of Technology, Sweden and makes use of an **ML** approach to indicate regions that are likely to be receiving rain.
- **NEW**: Thunderstorms product from DWD which attempts to identify convective storm intensity using **MSG and lightning data (Vaisala GLD360)** and make **short term predictions of storm position with AI/ML**

NWP and observations



The SAWS "Upgraded" RSMC website:


- **4 km grid resolution Unified Model** simulations (initialised twice a day),
- **Arome** simulations for coastal Southern Africa, Madagascar and the surrounding Indian Ocean.
- short and medium range **guidance** forecasts including impact based forecasting **risk tables**.
- The Leeds University- NCAS data catalogue:
 - daily simulations performed using the **Weather Research and Forecasting model (WRF)**, 2 model domains at 20 km and 4 km grid spacings
 - Alongside maps plots, **cross sections**, and **skew-T LogP plots** were also available for sites across all three participant countries.
- **ECMWF, GFS, and ICON** model data available over the region on the **Windy.com** web application,
- **UM simulations available on the UK Met Office African Web Viewer**
- **Observations and retrievals** were used by forecasters to inform and verify their forecasts



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Impact based forecasts (IBF)





EWSA (Early Warnings for Southern Africa)
Nowcasting information sheet - Zambia

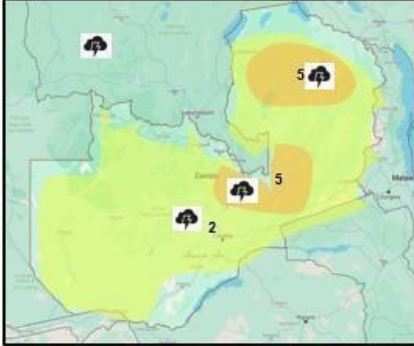
Date: 07.02.2024 Data time: 12:30 UTC Issue time: 13:00 UTC



6 hr Outlook

Region	Zambia
Date	07.02.2024
Time	13:00Z to 21:00Z
Data	NCEP, Adaguc viewer (RDT), Precipitation likelihood, Windy weather, Eumetview, OGIMET


Level 5: warning for scattered thunderstorms over Copperbelt Province, Mkushi, Serenje, Kasama, Mporokoso, Luwingu and Chitambo districts including surrounding areas.
 Level 2: warning for isolated thunderstorms over Lusaka, Northwestern, Luapula, Northern, Copperbelt, Muchinga, Central and Eastern provinces including the northern parts of southern province.



2 hr Nowcast Risk

Region	Zambia
Date	07-02-24
Time	13:00Z to 15:00Z
Data	NCEP, Adaguc viewer (RDT), Precipitation likelihood, Windy weather, Eumetview, IR10.8, Nowcasting model, Ogimet, Africa Web Viewer.

Level 2 warning for isolated thunderstorms over western Province, Serenje, Mulobezi, Mwinilunga, Solwezi, Kasama and Mporokoso including surrounding areas.



Local timelines

Province	Valid time	1+1hr	1+2hr	1+3hr	Outlook (1+4 to 1+6)
Serenje	1	2	2	2	2
Southaka	1	2	2	2	2
Mwinilunga	1	2	2	2	2
Mulobezi	1	2	2	2	2
Kazungula	1	2	2	2	2

Likelihood	High	2	6	10	
	Medium	1	5	9	
	Low	1	4	8	
	Very Low	1	3	7	
		Minimal	Minor	Significant	Severe
Impact					

Level 2 warning

- Localised flooding of susceptible roads, low-lying areas and bridges
- Flooding of roads, settlements and low-lying areas,
- resulting in closure of some bridges and roads

Dissemination and Communication of early warnings

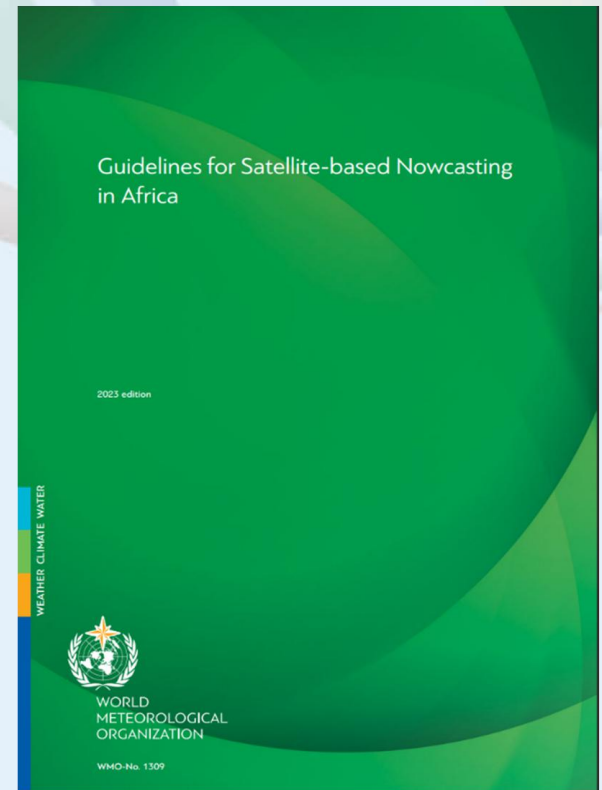
Feedback from community observers during a Testbed conducted in February 2024, Lusaka, Zambia:

*“I have learned a lot especially on the weather because I am able to warn my fellow community people when I receive the [forecast], and it has helped me plan for my daily activities”
(female community observer, Kanyama)”*

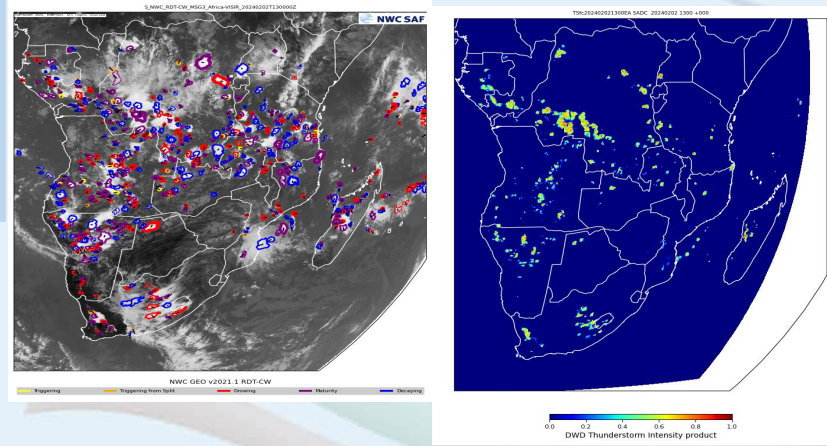
*“I have learnt to give weather feedback, helping people with disability and engaging other departments like the ZMD”
(male community observer, Kanyama)”*

Ongoing capacity development and training (critical role of the RTC's)

- WMO Guidelines for satellite based nowcasting in Africa
- Monthly online lectures on related material.
- Linking to training for EW4All
- SAWS (WMO RTC) will increase links to VLAB and RAIDEG and EUMETSAT trainers/training events as well as ASMET modules.
- WISER In person training in Maputo in October 2024



Next Steps



Images courtesy of: National Centre for Atmospheric Science (NCAS), University of Leeds 2
School of Earth
and Environment, University of Leeds

- Include MTG data
- *“New Testbed Concept” will span 7 months (October 2024 to April 2025) NMS’s to work together (remotely) including an intense in-person two-week period early in 2025 in Mozambique.*
- Further intercomparisons with AI products, DWD and Google AI-based methods, Rain over Africa AI-based rainfall shown here (Chalmers University, Sweden).
- Determine and understand user requirement (co-development)
- Upgrades to RSMC Web-portal with Nowcasting products be operationalized.

Conclusion

- Programmes such as the WMO initiated SWFP, CREWS, EW4All and WISER in southern Africa successfully demonstrates how regional centres can assist countries with guidance, modelling and nowcasting products.
- **Serve as a motivation for the establishment of regional nowcasting hubs across Africa.**
- Should work towards providing next level warning services such as multi-hazard early warning systems to support multiple sectors of society.
- The WISER Project has **improved the nowcasting skills** of forecasters in the countries involved
- It has **built confidence among forecasters** as the nowcasting tools helped in getting to more accurate/detailed forecasts than before.
- It has also **built confidence in the user community** and expanded the numbers of receivers of weather alerts on the ZMD platforms.



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- *The Director of the Zambian Meteorological Department, Mr Edson Nkonde, said his office would be looking at ways to maintain the outcomes from the project*

"All the data shows ... that when people get a warning and they take [it] seriously, they can rescue themselves ... They need 1 hour, not more."

Bruno Merz, Helmholtz Centre Potsdam, quoted in *Science*, 2021

Thank you!

(No one organisation can address the challenges posed by weather and climate change.)