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Weather and Climate early warning services in Ethiopia

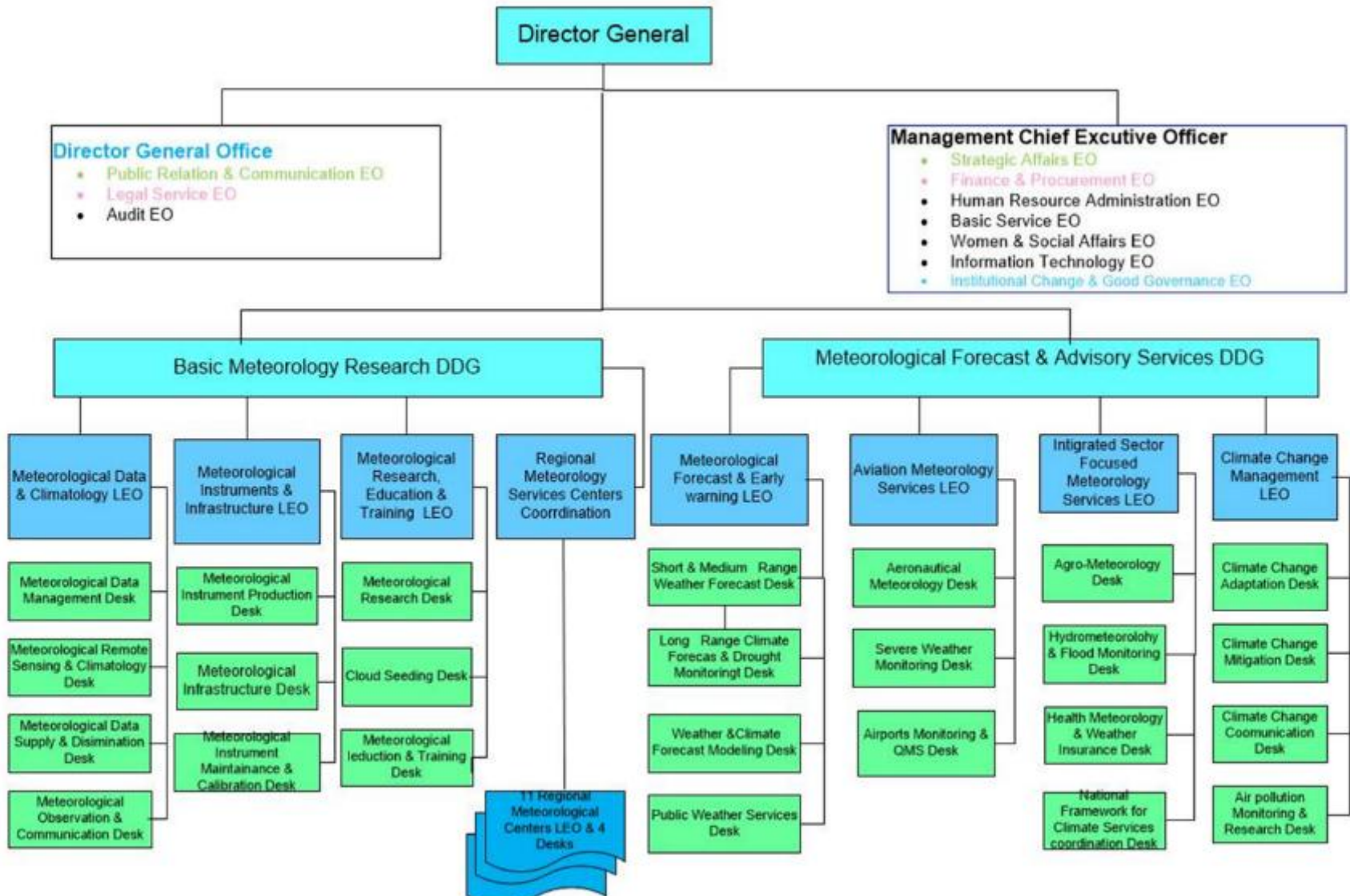
Kinfe Hailemariam, Ethiopian Meteorological Institute

Jameel Observatory drylands food security and resilience
early action research and evidence dialogue, Addis Ababa,
15-16 May 2025

Outline

- ✓ Introduction
 - ✓ Weather **Forecasting**, Climate Prediction and **Early Warning Service**
 - ✓ **Sectoral Meteorological Services**
 - ✓ Research on **Climate Change and Variability**
- ✓ **EW4ALL: Pillar 2**

Introduction



4 LEO's and 15 Desk's

Core Service 1: Weather Forecasting and Climate Prediction and Early Warnings

Short range Weather Forecast

- **Now casting to 72 hrs**
 - **Daily Forecast for 260 cities**
- Daily, two days and **three days** Weather Forecast
- Numerical Weather Prediction for **1hr to ten** days

Medium range Weather Forecast

- **Ten day** Weather Assessment and Forecast
- **Monthly** Weather Assessment and Forecast

Long Range Forecasts

- Climate Prediction for **three seasons**
- **Mid-seasons** www.ethiomet.gov.et

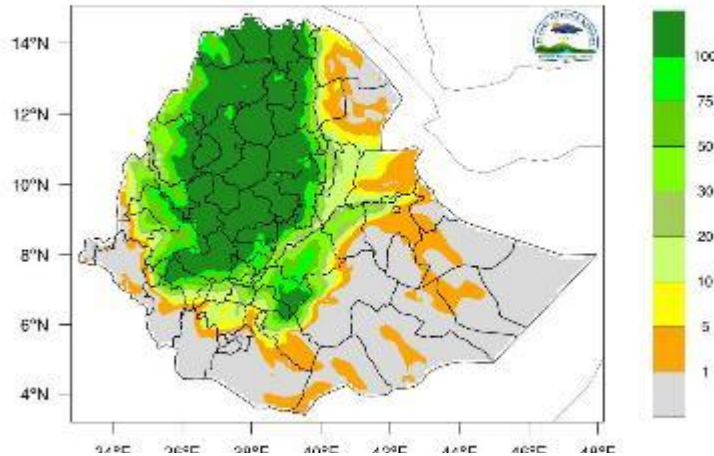
Numerical Weather Prediction

- Using **WRFv3.9** with east African domain.
- Initialized by **CFS** surface flux and different level pressure
- Up to **4km** resolution
- DA for **upper air** & **surface observation**.
- Run regularly from **daily** to **10 daily** ;
- Up to **seasonal** prediction.
- **High Performance Computing Facility (Cluster)**
 - **480 Processors**
 - **over 300 TB HDD**

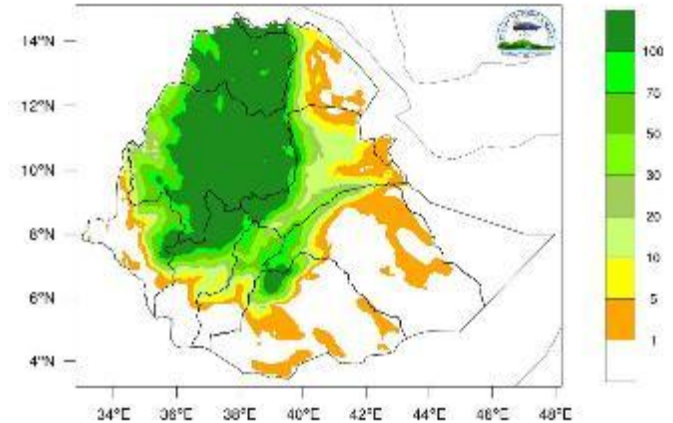


NWP-Products

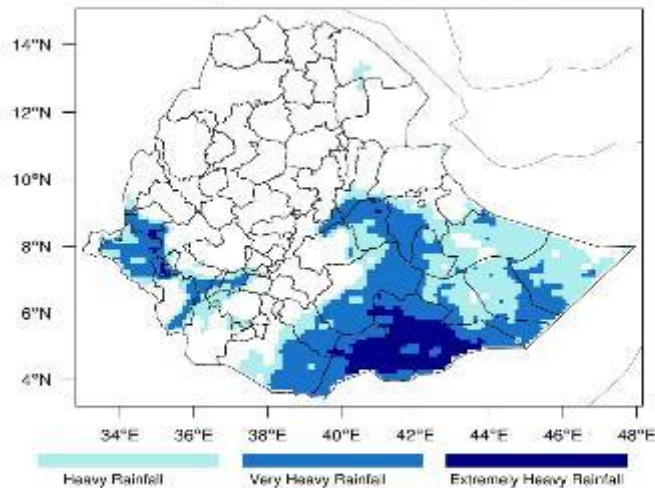
Total Rainfall (mm) for 01-11 Jul 2024



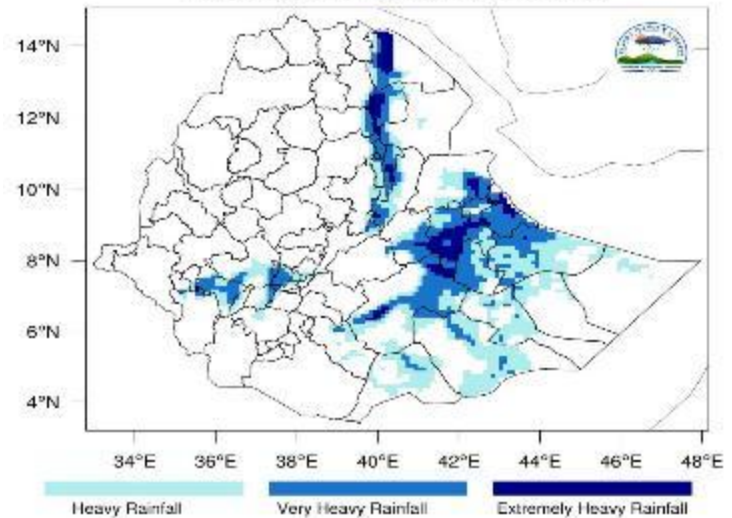
Ethiopia river Basin Rainfall (mm) forecast for 01-11 Jul 2024



Exceptional Rainfall for 15-20 Nov 2023



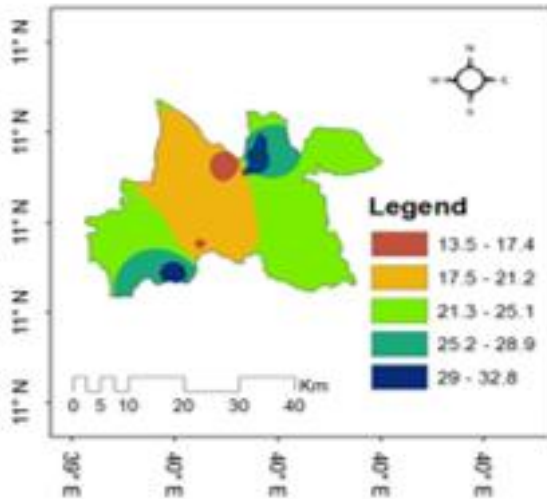
Exceptional Rainfall for 28-29 Mar 2024



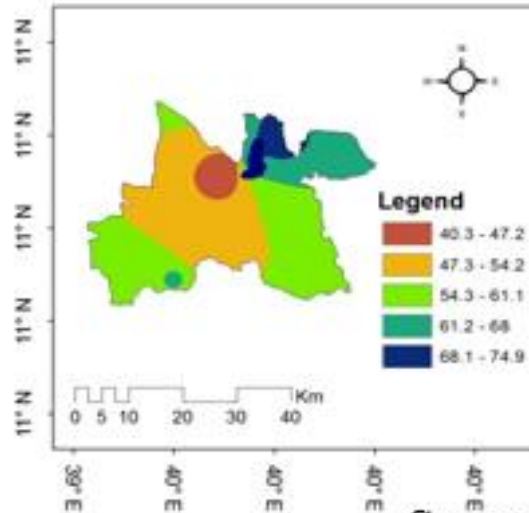
Downscaled services

Monthly and seasonal rainfall climatology

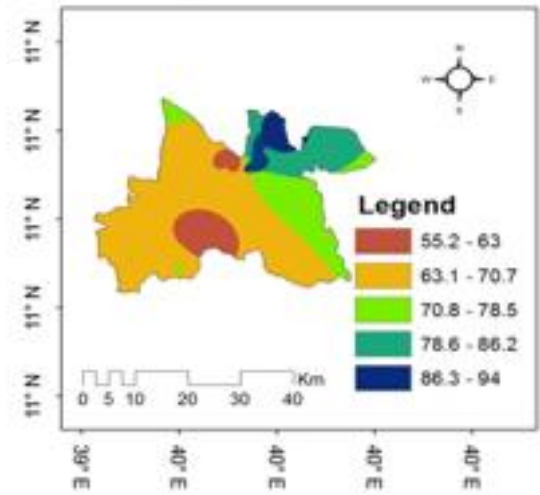
February



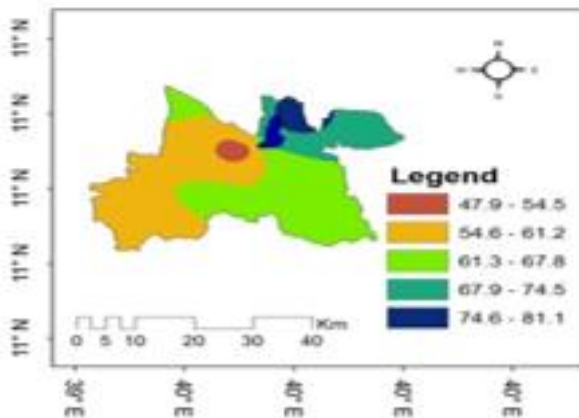
March



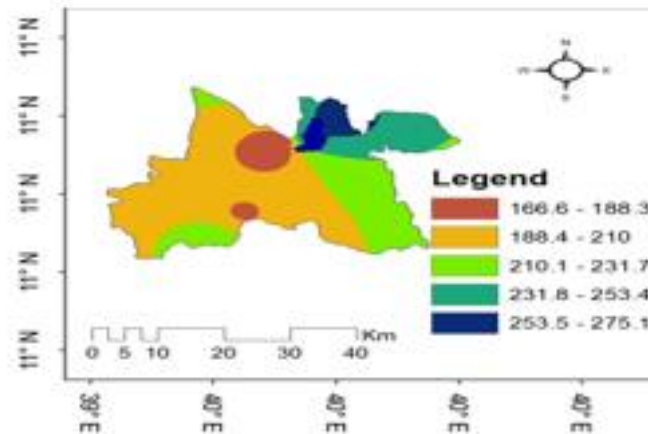
April



May



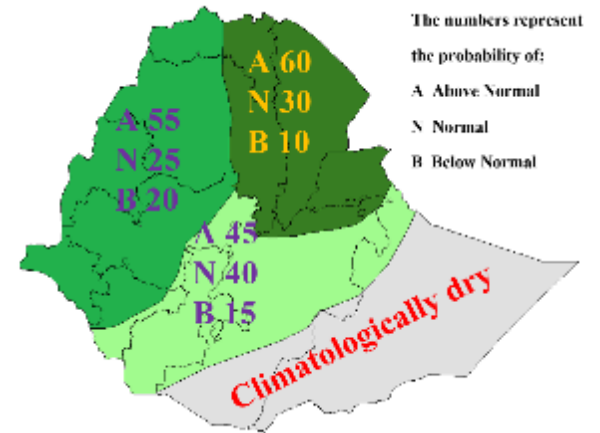
Seasonal



Seasonal Climate Prediction

Since 1987 for three seasons's

- ✓ (Belg) Feb-May
- ✓ (Kiremt) June-Sep
- ✓ (Bega) Oct-Jan
- ✓ In the presence of >300 participants



Core Service 2: Sectoral Meteorological Services

- **Agro meteorological** Advisory Services
 - ✓ 10 daily, monthly and seasonal agro-met bulletin
- **Hydro meteorological** Advisory Services
 - ✓ 10 daily, monthly and seasonal hydro-met bulletin
- Meteorological Advisory service for **health**
 - Monthly Malaria and Comfort Index Bulletin
- Meteorological Advisory service for **insurance**
 - Special service for Weather based index insurance
- Coordinating of **NFCS**
 - ✓ Promoting and implementing **co-production**

Different indices for the advisory services

• Agro-meteorology

- Assessment of moisture status
- LEAP
- Water Requirement Satisfaction Indices (WRSI) for crops
- WSRI for Rangelands

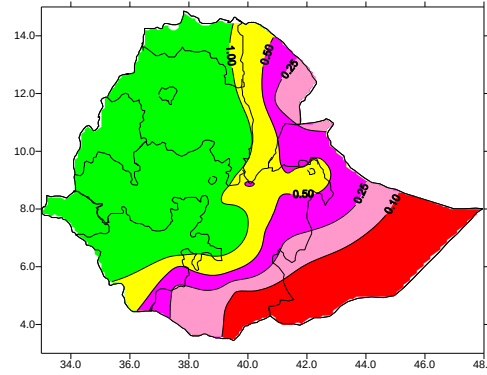
• Hydro-meteorology

- Aridity index
- Dam level assessment
- Frequency of heavy falls
- Flood forecast over Awash

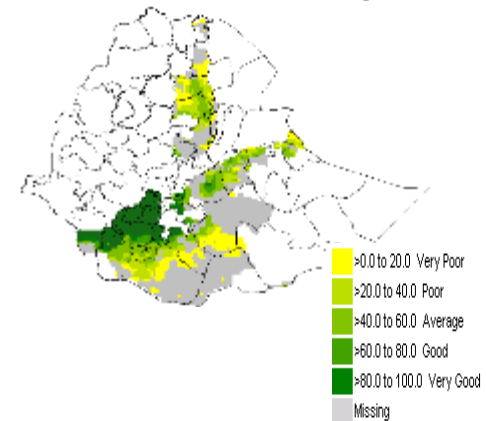
• Bio-meteorology

- Malaria Prevalence
- Comfort Index analysis

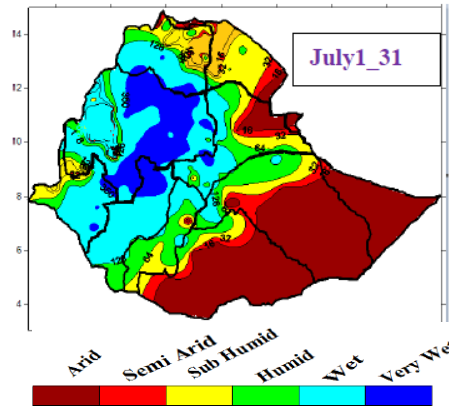
Mean Moisture status for Kiremt



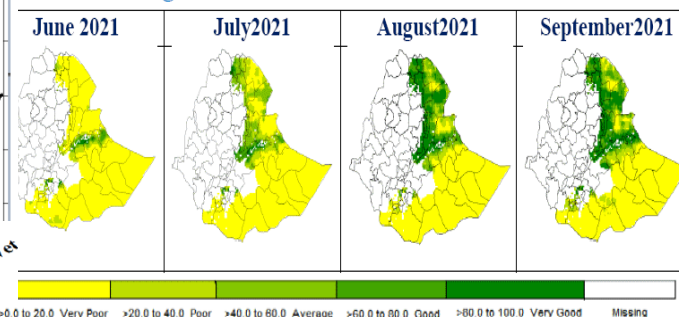
WRSI Maize Belg 2019



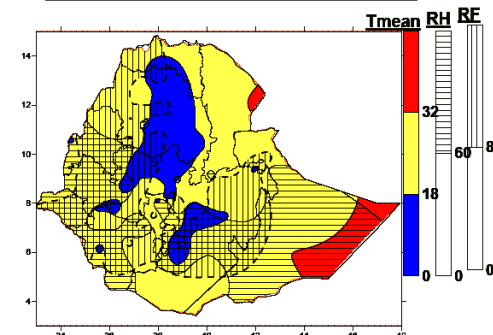
Aridity Index July 2021



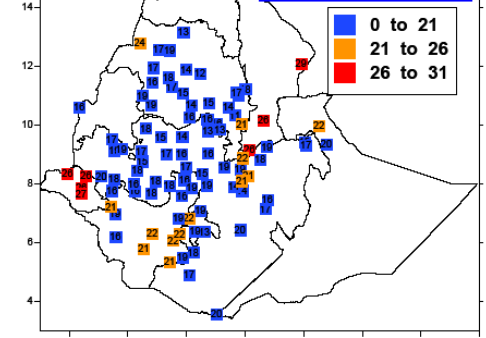
Rangeland WRSI in % - Kiremt 2021



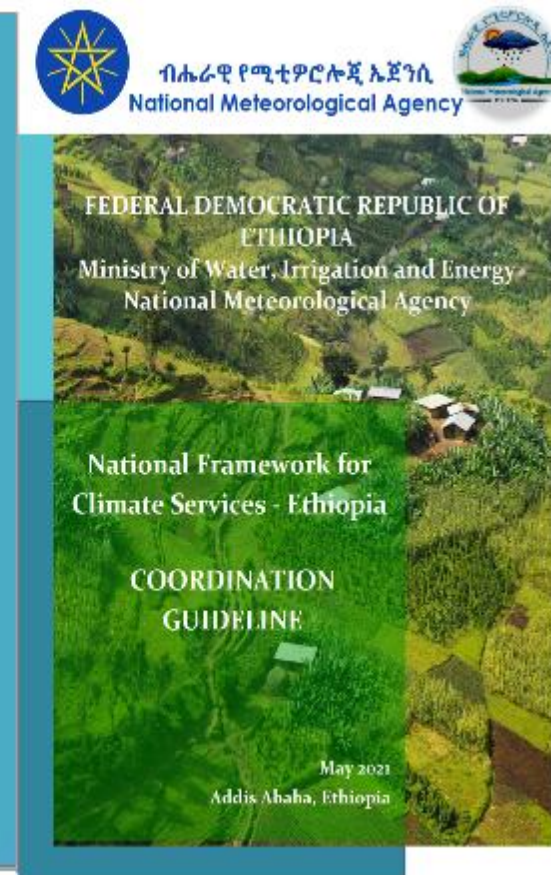
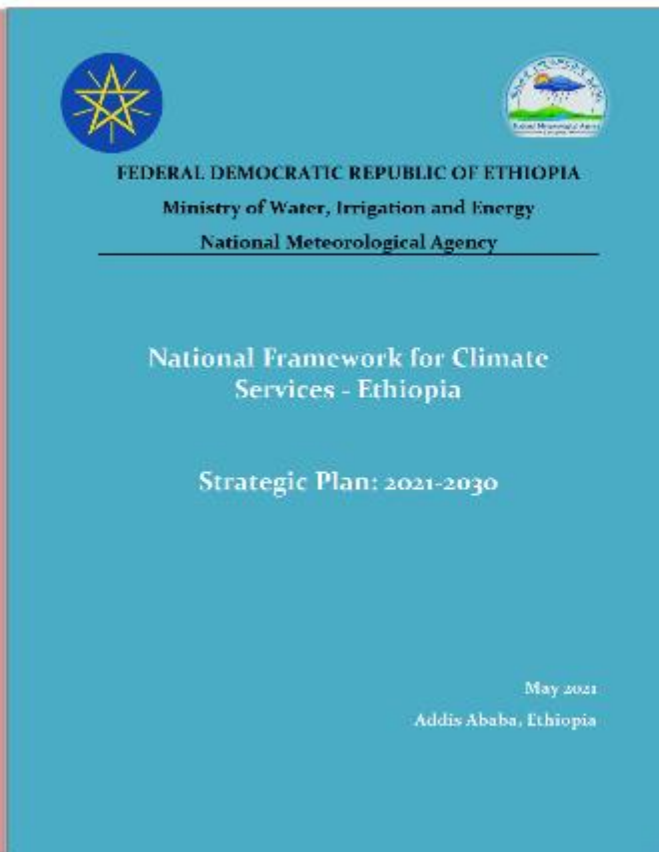
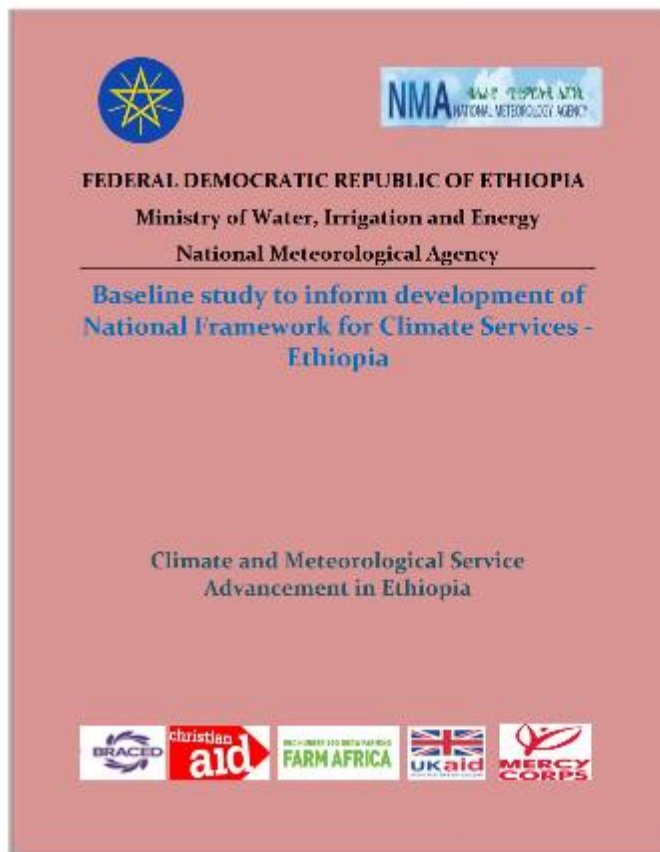
1.3 Malaria prone areas during the month of October 2021.



Oct 2021 THI for Human



Update in EMI climate services



Core Services 4: Research on climate change and variability

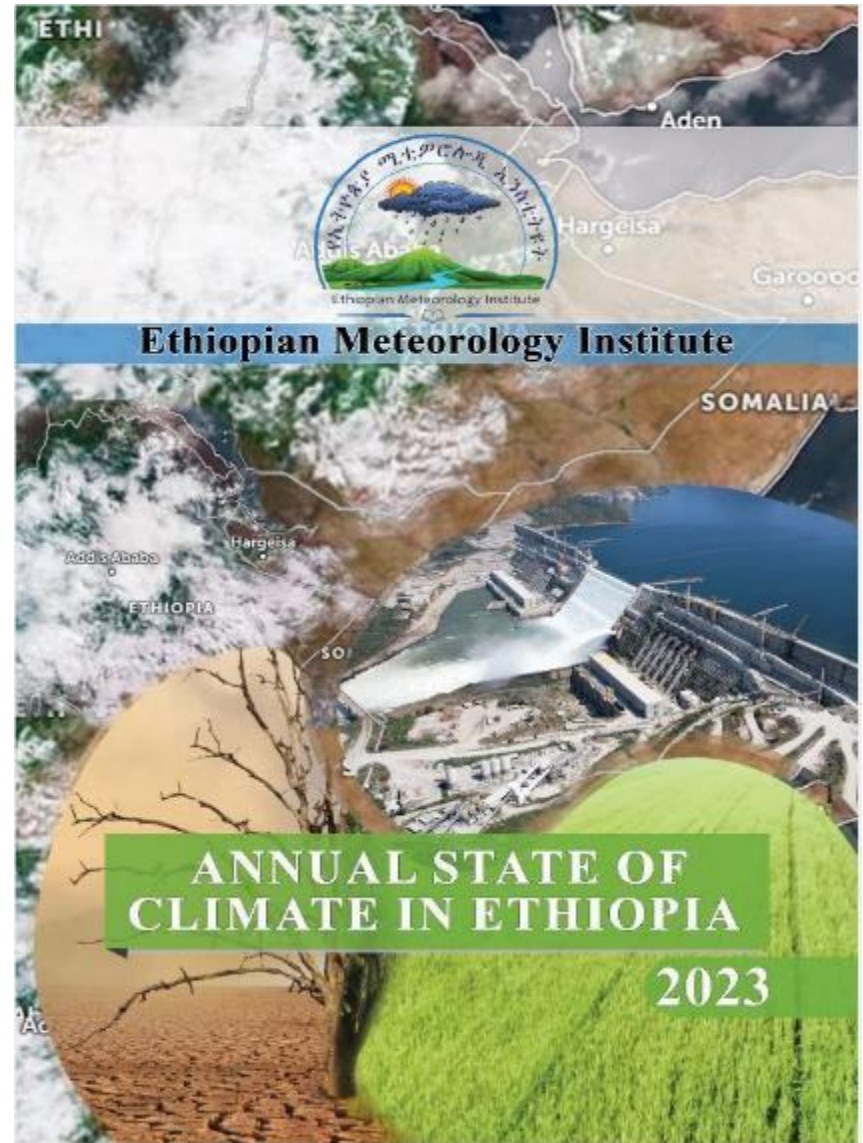


THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
MINISTRY OF WATER RESOURCES
NATIONAL METEOROLOGICAL AGENCY

CLIMATE CHANGE NATIONAL ADAPTATION PROGRAMME OF ACTION (NAPA) OF ETHIOPIA



JUNE 2007
ADDIS ABABA
ETHIOPIA



Meteorological information dissemination

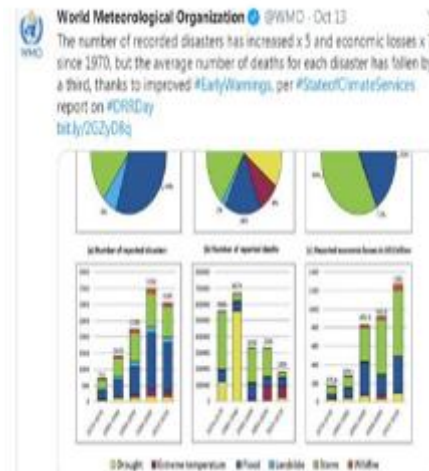


Radio stations
using different
languages

Website, mobile app, social media
like FB/Telegram and WhatsApp

- **Pillar 2: Observation, Detection and Forecasting**

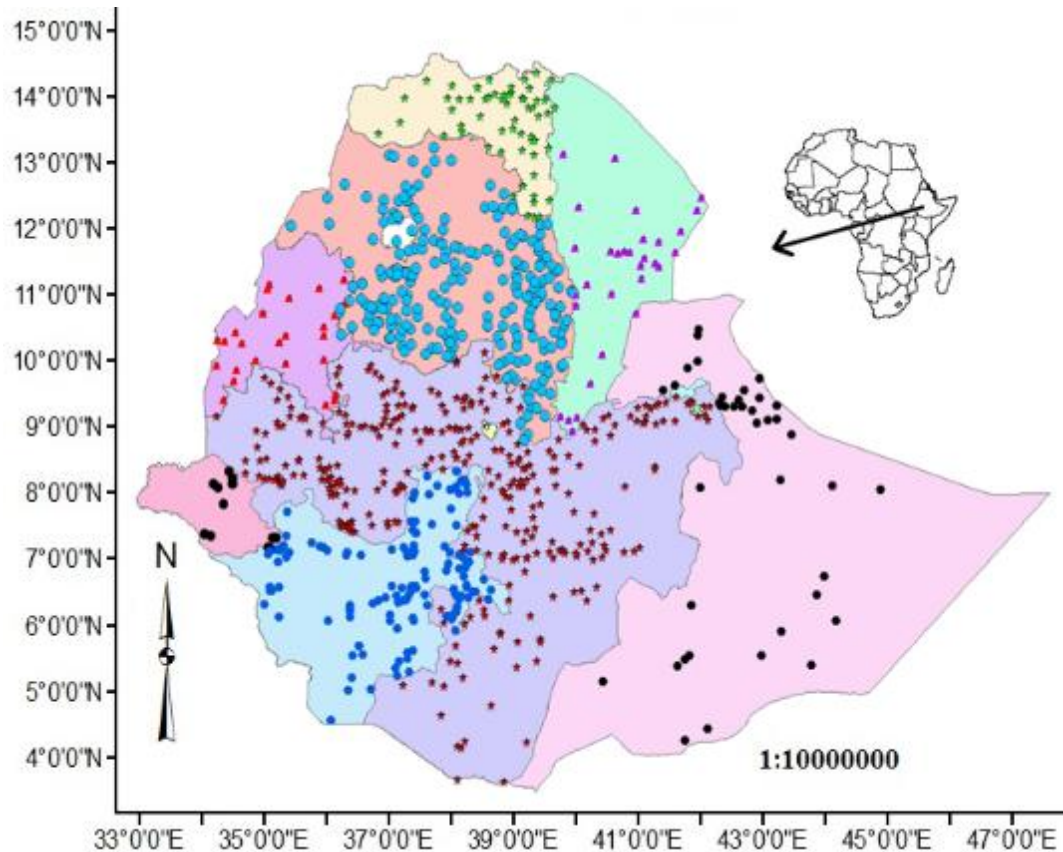
Extreme events



António Guterres @antonioguterres · 42s
Extreme weather and climate events have increased in recent years.
The latest State of Climate Services report shows how governments can invest in effective early warning systems that strengthen resilience in the face of the climate crisis. bit.ly/2GZyD8q

- Drought
- Flood
- Land slide

Monitoring , Observation



- **Significant lack of monitoring stations compared to the domain of Ethiopia.**
- **Lack of modern infrastructures.**

Pillar 2: Coordination mechanism

- Ethiopian Meteorological Institute
- Ministry of Water and Energy
- Ethiopian Disaster Risk Commission
- Ministry of Agriculture
- Environmental Protection Authority
- Research and academic Institute
- FEWSNET
- Artificial Intelligence Institute
- Ministry of health

NFCS

2. Declaration of Partnership

We member organizations of the NFCS partnership hereby officially declare that the contents of this coordination guideline are valid and accepted to work in partnership and we confirm to be guided by the provisions therein.

1. Ministry of Water, Irrigation and Energy

Name Abraham Adugna
Signature Abraham Adugna
Date 25/05/2021
State Minister

2. Ministry of Agriculture

Name Sami Redi
Signature Sami Redi
Date 25/05/2021

3. Ministry of Health

Name Dereje Dagnachew
Signature Dereje Dagnachew
Date 25/05/2021
State Minister

4. National meteorological Agency

Name Fetene Teshome
Signature Fetene Teshome
Date 25/05/2021
Director General

5. National Disaster Risk Management Commission

Name Mitiku Kassa
Signature Mitiku Kassa
Date 25/05/2021
Commissioner

6. Environment, Forest, and Climate Change Commission

Name Prof. Getachew Bejane
Signature Prof. Getachew Bejane
Date 25/05/2021
Chairman



Activities of Pillar Two identified

- Activity 1. Modernization and Expansion of Ethiopia Hydro-met **observing stations**
- Activity 2. Development of **woreda's climate profile** and Generation of **digital advisory services**
- Activity 3. **Improving** data availability quality, archiving, and sharing protocols among entities
- Activity 4. Integrating **Geo-hazard** information into EWS

Activity 1. Modernization and Expansion of Ethiopia Hydro-met observing stations

- Climate change has accelerated the frequency occurrence and vulnerability in Ethiopia.
- There are very **limited stations in Ethiopia**
- **Increasing the coverage of modernized** observing stations are cornerstone for accurate and reliable weather forecasts.
- Installation of Meteorological and hydrological stations.
- Enhancing institutional capacity building.

Target areas



- ✓ An estimated population of 2,000,000 of which 1,000,000 men and 1,000,000 females will benefit from the EW4ALL.
- ✓ Time frame: 2025-2028

Activity 2. Development of woreda's climate profile and Generation of digital advisory services

- **Rationale:** Localized weather/climate information and early warning systems are essential at district basis.
- **Infrastructure needed:** Integrated Local Community Knowledge Center, ICT equipment enhanced local community communication channels.

Activity 3. Improving data availability quality, archiving, and sharing protocols among entities

- Rationale: Improving the existing observation, monitoring and archiving of weather/climate data is very important.
- Improve the interoperability of databases and systems to minimize data fragmentation and ensure **timely sharing of data.**

Activity 4. Integrating Geo-hazard information into EWS

- **Rationale:** Ethiopia's land surface is characterized by wide **elevation contrast** that varies from about 125 m below sea level to 4550m.
- It has been found that soil is being normally removed annually due to various reasons.
- In recent years, as part of environment and land degradation **assessment** policy for sustainable agriculture and development, soil erosion is increasingly being recognized as a hazard
- Therefore, it's very important to incorporate the **Geo-hazard mapping** is crucial in early warning system

Target areas

- Rift systems and adjoining areas

