Training on Climate Data Management, Data Merging and Generation of Climate Products 24-28, March 2025

Training Workshop Report

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Introduction

1.0 Background

Long-term, high-quality, and reliable climate data are essential for conducting consistent assessments to better understand, detect, predict, and respond to climate-related risks. In promoting climate service for the region, IGAD Climate Prediction and Applications Centre (ICPAC) and the National Meteorological and Hydrological Services (NHMS) require consistent climate data of good quality.

Under the mandatory function of the Regional Climate Center (RCC), ICPAC is working with the member states to strengthen the capacities in developing and promoting climate services and these include climate and data services such as:

- Perform climate diagnostics: This function includes analyzing climate variability and extremes at regional and sub-regional scales.
- Establish a historical reference climatology: This involves creating a historical reference climatology for the region or sub-regions, including normal of monthly mean temperature and precipitation.
- Implement a regional climate watch: This function requires monitoring the regional climate and providing timely information to users.
- Develop quality-controlled regional climate datasets: This involves creating and maintaining quality-controlled regional climate datasets, which may be gridded where applicable.
- Provide climate database and archiving services: This function includes maintaining a climate database and archiving services to ensure the long-term availability of climate data.

ICPAC receives station observation datasets from the Member States. Climate data management within ICPAC and member states face challenges which include availability, access, and use of climate data for climate information generation. The generation of blended observation and gridded precipitation data has largely been achieved and is in use within the region. This has largely helped improve some of these data challenges. However, the available station temperature datasets are not well established in ICPAC, and the blended grided data sets are not available.

The World Meteorological Organization (WMO), under the ClimSA project, evaluated the operational status of the ICPAC Regional Climate Centre. This evaluation proposed the need to have and improve the RCC mandatory functions and these included the climate and data services to enable effective provision of Climate Services.

Recognizing these challenges, in partnership with the WMO (World Meteorological Organization) ICPAC recently received vital support under the CREWS-Horn of Africa project, to further reinforce national and regional climate data management and analysis capabilities. This has led to this training which is going to fulfill the CREW-Horn of Africa project Objective 3.0, Building capacity to deliver operational data services to support operational LRF and climate monitoring. This involves developing quality controlled regional gridded climate data (merged station observation with satellite data); generating monthly and ten-day gridded data & products; and training NMHSs on climate data management (Climsoft), data merging and generation of relevant climate products (e.g., monitoring products using CDT)

1.2 Objectives of the Workshop

The objective of the workshop is to train the staff of NMHSs on data merging and generation of gridded temperature datasets and climate products. Specifically, the training objectives are to:

a. Create an understanding of the state of the regional and national grided temperature dataset.
b. Train on the staff of NHMS on generation of gridded temperature dataset and generate the relevant temperature products and information using Climate Data Tool (CDT).
c. Validate the blended gridded temperature data at regional and national level.
d. Share experience, strength and challenges on climate data management within the region and the member states

1.3 Expected Outcome

At the end of the workshop, the participants are expected to have:

i. Generated and validated the regional and national station blended gridded temperature dataset.
ii. Enhanced the skill of the participants on using Climate Data Tool for climate data management and analysis.
iii. Improved the capacity of the participants to generate relevant temperature information and products for their users using the CDT.
iv. Have insight on the challenges facing climate data management in the national and regional scale.

1.4 Methodology

This workshop was conducted through, lecture presentation, hands-on exercises and discussions. The Training will use the Climate Data Tool (CDT) for merging and analysis of data. The participants are expected to bring to the training the long-term daily maximum and minimum temperature timeseries datasets from their operational stations. The working language for the workshop was English.

1.5 Venue and Date of Meeting

The meeting took place at ICPAC Office located in Nairobi, between 24th – 28th of March 2025.

1.6 Participants

The participants for the meeting were drawn from the Data Managers of the National Meteorological and Hydrological Services (NMHSs) of IGAD member states. Relevant IGAD/ICPAC staff and Climsoft developers. Table 1 provides the list of attendees for the meeting.

Training Content and Sessions

2.0 Day 1: Topics covered, key discussions, hands-on exercises

The first day of the training focused on introducing participants to the workshop and outlining its objectives. The session officially commenced with an opening address by Dr. Abdi Fidar, the Officer in Charge of ICPAC.

The day featured three key presentations:

1. Status of temperature data availability at ICPAC.
2. Climate data management tools and updates from the Climsoft development team.
3. An overview of the CDT software.
4. Introduction to data manipulation using CDT

The day concluded with a hands-on practical session, where participants were guided through the installation of CDT on their local machines.

2.1 Day 2: Topics covered, key discussions, hands-on exercises

The second day of the training focused on data preparation and manipulation. Participants were introduced to the data formats supported by the Climate Data Tools (CDT) and the procedures for importing datasets into the system. They learned how to ingest various data types, including reanalysis datasets, national boundary shapefiles, and digital elevation models (DEMs) for altitude information.

A key part of the day involved training on quality control procedures for temperature datasets. Participants were shown how to identify and correct data issues, such as inaccurate station coordinates and outliers in temperature observations.

Additionally, participants were guided on how to organize their observational data into the CDT-compatible format in readiness for performing quality control tests. They also learned how to extract gridded data corresponding to station locations for the purpose of validation.

2.2 Day 3: Topics covered, key discussions, hands-on exercises

The third day focused on data validation and the initial steps of data merging. Participants were introduced to the concept of data validation and guided through the process using CDT. The objective of the validation exercise was to assess the consistency between observed station data and corresponding reanalysis datasets.

Following the validation session, the training progressed to data merging. Participants were finally introduced to the methods and procedures for merging data and were given a hands-on demonstration on how to perform data merging using CDT.

2.3 Day 4: Topics covered, key discussions, hands-on exercises

The fourth day continued with data merging activities, alongside support for participants who had not yet completed the data validation assignment. A dedicated session was held on verifying and validating the merged datasets by comparing them against station observations, ensuring the accuracy and reliability of the merged output.

2.4 Day 5: Topics covered, key discussions, hands-on exercises

On the fifth day, participants were guided through a demonstration on how to conduct climatological analysis using the merged datasets. The core focus of the day, however, was participant presentations highlighting the status of climate data management in their respective countries.

Key discussion points included:

- The current state of the station network
- Status and management of Automatic Weather Stations (AWS)
- The structure and functioning of their national Climate Data Management Systems (CDMS)
- Existing data sharing mechanisms (e.g., GTS, GWIS, national data sharing frameworks)
- Progress and challenges related to data rescue and archiving
- Identified needs, ongoing plans, and advancements in climate data management

2.5 Discussion Summary

The discussions revealed that member countries have varying levels of observational network coverage, with some stations functioning optimally while others are non-operational. Key challenges cited include security concerns, vandalism, and limited technical capacity for effective climate data management.

All participating countries reported the presence of Automatic Weather Stations (AWS). However, a common issue is the inconsistency in data formats generated by different AWS models, compounded by maintenance challenges that often lead to data gaps or malfunctioning equipment. Participants recommended the development of a unified system to facilitate streamlined access and utilization of AWS data across the region.

Some countries have also installed weather radar systems to enhance forecasting capabilities. Nonetheless, they face challenges in archiving radar data for long-term historical use and research. There is also a pressing need for capacity building to enhance skills in utilizing radar data and incorporating it into gridded and merged datasets.

While the Climsoft Climate Data Management System (CDMS) is widely used across the region, there is still a need for further capacity strengthening. This includes improving technical infrastructure, user skills, and integration of AWS data into existing CDMS platforms.

On data rescue and archiving, countries expressed different levels of need. However, there was consensus on the importance of conducting inventory assessments as a prerequisite for any data rescue initiatives.

Finally, participants proposed that ICPAC should explore the establishment of an automated data exchange mechanism with member states. They also recommended that national meteorological agencies develop standard operating procedures (SOPs) to formalize data sharing and remittance protocols with ICPAC.

Outcomes and Recommendations

3.0 Key Outcomes of the Meeting

The meeting resulted in several important outcomes:

- **Increased Awareness of CDT**: Participants gained a clear understanding of the Climate Data Tool (CDT), including its installation, core features, and functionality.
- **Enhanced Technical Capacity**: Participants became proficient in conducting data quality control, validation, and merging processes for temperature datasets, including the integration of station and reanalysis data.
- **Contribution of National Data**: National daily temperature datasets were submitted by participants and used to generate gridded, merged temperature data. Countries also committed to continuing the regular remittance of daily temperature data to ICPAC.
- **Generation of Regional Datasets**: Blended and validated daily maximum and minimum temperature datasets were produced for the IGAD region, covering the period 1981 to 2024.
- **Assessment of Climate Data Management**: The status, strengths, and existing gaps in climate data management across member states were reviewed and discussed.

3.1 Key Recommendations from the Meeting

The following recommendations emerged from the discussions:

- **Automation of Climate Data Management**: There is a critical need to automate key processes such as data quality control, especially given the declining number of technical personnel within NMHSs.
- **Initiate Data Discovery Exercises**: Most NMHSs are encouraged to begin data discovery initiatives, particularly targeting datasets held by conservancies, research institutions, and other agencies within their countries.
- **Marine Data Integration**: The group recommended developing mechanisms to automate the ingestion of marine station data into the Climsoft database.
- **Standard Operating Procedures (SOPs)**: Draft SOPs for climate data sharing should be circulated and discussed during upcoming CSIS group meetings, with the goal of institutionalizing data sharing between member states and ICPAC.

- **Review of the ICPAC-Member State MoU**: Consider revising the current Memorandum of Understanding to ensure it reflects the evolving needs and expectations of all member states.

- **Support for SOFF Applications**: Encourage countries that have not yet applied for Systematic Observations Financing Facility (SOFF) support to learn from the experiences of member states that have already secured funding.

- **Climsoft Installation in Sudan**: Explore the possibility of installing Climsoft at Port Sudan and linking it with the central database currently hosted at ICPAC.

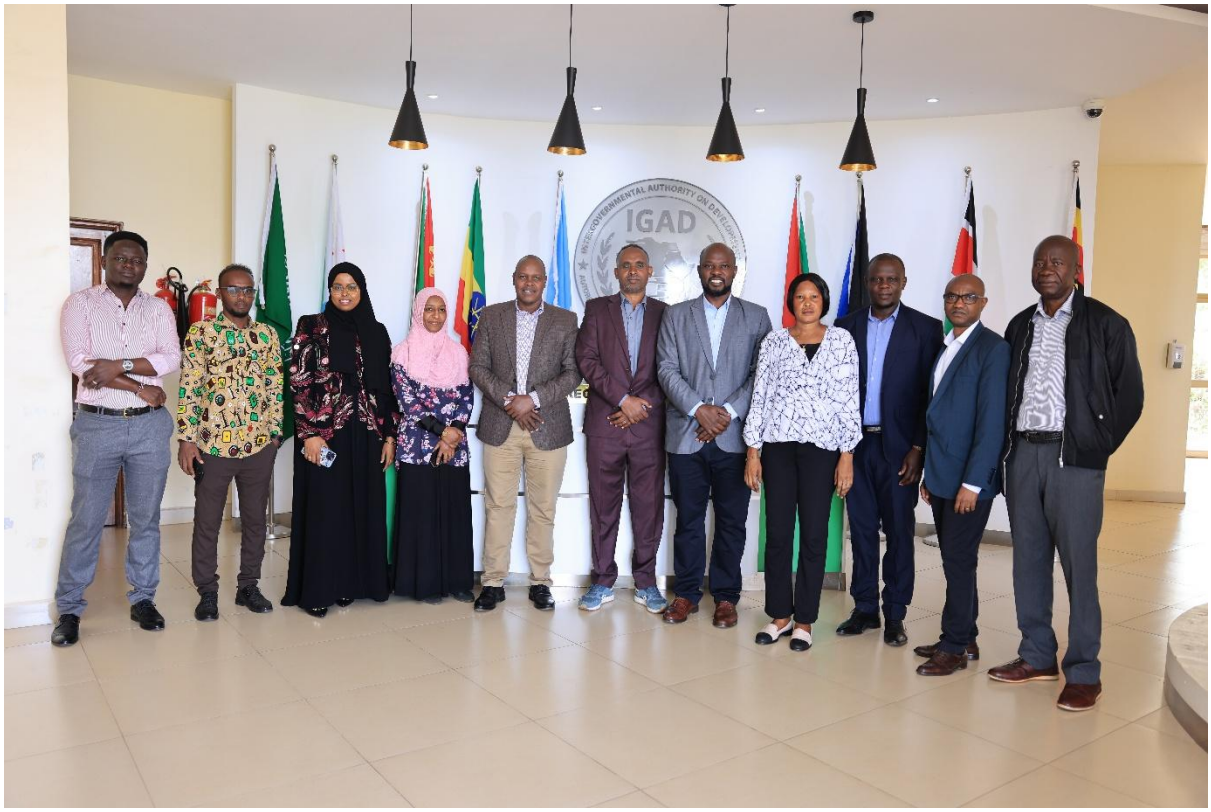
- **Radar Data Support for Uganda**: Provide technical assistance to Uganda in archiving and utilizing radar datasets for operational and research use.

- **Data Rescue Initiatives**: Offer support for rescuing climate data stored in obsolete formats, particularly in Uganda, Kenya, and Tanzania.

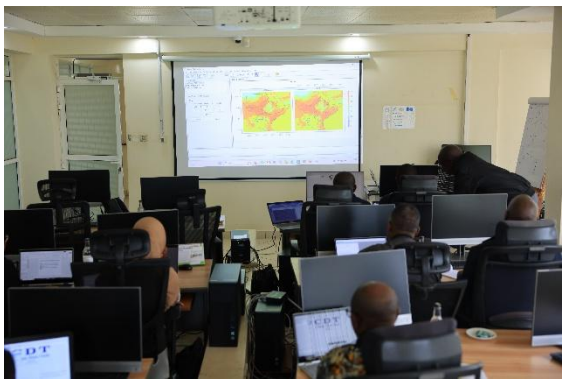
- **Ongoing Capacity Building**: Continue investing in capacity-building efforts across the region to strengthen climate data management skills and infrastructure.

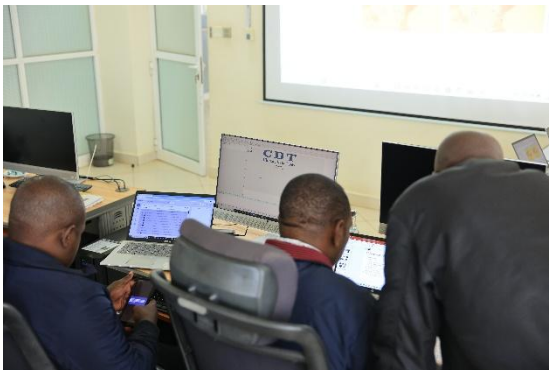
Appendix

Photos



Group photo of participants and facilitators.





Participants

Table 1: Participants of the meeting

No.	Name of Participant	Organization	Country	Email Address
1	Abdillahi H. Hersi	NMA	Djibouti	abdillahi.hassan.hersi@gmail.com
2	Dolly E. Faustino	SSMD	S. Sudan	elviegijoe@gmail.com
3	Melese Lema	NMA	Ethiopia	mellemma2001@gmail.com
4	Sara Abdelmahmoud	SMA	Sudan	sraralfangari@gmail.com
5	Godfrey R. Mujuni	UNMA	Uganda	grmujuni@gmail.com
6	Ms. Lul M. Osman	Somalia	Somalia	Lulmohamed026@gmail.com
7	Dr Philip Okelo	KMD	Kenya	koderaphillips@yahoo.com
8	Peterson Ngari	KMS	Kenya	pngari09@gmail.com
9	Ismael Mulama	IGAD-ICPAC	Kenya	Ismael.Lutta@igad.int
10	Herbert Misiani	IGAD-ICPAC	Kenya	Herbert.Misiani@igad.int
11	George Kabaka	IGAD-ICPAC	Kenya	Okoth.Kabaka@igad.int
12	Paulino Omay	IGAD-ICPAC	Kenya	Paulino.omay@igad.int

Workshop Agenda

Training on Climate Data Management System (Climsoft) and Climate Data Tool (CDT), Data Merging and Generation of Climate Products
24- 28, March 2025

Date	8:30 – 11:00		11:15 – 13:00		14:00 – 16:30
Day 1	• Registration • Opening • Introduction • Training objectives • Program of work **Presentation of Status of temperature data availability at ICPAC (Mulama)**	**B** **R** **E** **A**	climate data management tools and progress of development (Machua/Habimana) Discussion by Member countries on climate data management, availability, access and status of country station and gridded dataset • Djibouti • Eritrea • Ethiopia • Kenya • Sudan • Somalia • South Sudan • Uganda • **Participant presentation and discussion**	**L** **U** **N** **C**	• **Overview of CDT** (What is CDT, why CDT, components of CDT, CDT installation, CDT data formats) **Kabaka** • **Practical installation of CDT** (CDT configuration, CDT menu and short description of menu function) • **Herbert/Kabaka/ Mulama/**
Day 2	• Overview of Data preparation using CDT • CDT data preparations o Data formats requirement o Station coordinate file • Overview of reanalysis & satellite datasets	**K**	• Data arrangement and conversion to CDT format. • Data quality control using CDT o check station coordinates, false zero checks o Temperature outlier quality check **Mulama/**	**H**	**Data extraction** Data Extraction -Reanalysis 2-meter temperature data at stations using grid point location **Mulama/Kabaka**

	Herbert/Kabaka/ Paulino				
Day 3	• Review of data validation • Overview on data merging Validation of multiple datasets- Reanalysis 2-meter temperature data against station observations **(Mulama/Herbert/ kabaka)**		• **Data validation -continues**		**Data merging** Compute downcalling coefficient Downscalling data Compute bias coefficient Apply bias correction Merging Data **(Mulama/Kabaka)**
Day 4	**Merging-continues**		**Merging-continues**		**Verification** Evaluate and compare the performance of the different datasets
Day 5	**Product Generation** Sample analysis of temperature products (**Mulama/Kabaka)**		Discussion – on way forward		Meeting closure

Attendance List

TRAINING ON CLIMATE DATA MANAGEMENT, DATA MERGING AND GENERATION OF CLIMATE PRODUCTS

24 – 28 MARCH 2025

ATTENDANCE SHEET

NO	NAME	F/M	COUNTRY	E-MAIL	24/03/2025	25/03/2025	26/03/2025	27/03/2025	28/03/2025
1	Godfrey Mujuni	M	Uganda	grmujuni@gmail.com					
2	Phillip Okello	M	KENYA	kodera phillips@yahoo.com					
3	Dolly Elviega Faustino	F	South Sudan	elviegifoe@gmail.com					
4	Lul Mohamed Osman	F	Somalia	lulmohamed026@gmail.com					
5	Sara Abdelmahmoud	F	Sudan	sararafangari@gmail.com					
6	Abdillahi Hersi	M	Djibouti	abdillahi.hassan.hersi@gmail.com					
7	Herbert Misiani	M	Kenya	Herbert.misiani@igad.int					
8	Ismael Lutta Mukasa	M	Kenya	ismael.lutta@igad.int					
9	MARCELLIN HABIMANA	M	KENYA	marcellin.habimana@igad.int					
10	George Kabaka	M	Kenya	okiir.kabaka@igad.int					
11	Anthony Mwanthi	M	Kenya	anthony.mwanthi@igad.int					
12	Eunice Koech	F	Kenya	eunice.koech@igad.int					
12	Melesse Lemma	M	Ethiopia	melelemma2004@gmail.com					
13	PETERSON NGARI	M	KENYA	pngari09@gmail.com					
14									

Links to Resources

CDT online training manual	*https://shammun.github.io/CDT_Book/introduction-to-cdt.html*
	https://iri.columbia.edu/~rijaf/CDTUserGuide/index.html
Training presentation	https://igadint-my.sharepoint.com/:f:/g/personal/okoth_kabaka_igad_int/EvxuBzf118xHqMbIEBNAUdcBFPdxLV10vi0D-aHbNK0hYw?e=oTRwlQ