2025

A Comprehensive Inventory of Temperature Data in the ICPAC Database

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Executive Summary

This inventory aimed to identify stations with data inconsistencies and gaps within the ICPAC regional database for daily minimum and maximum temperature records. Consistent and quality-controlled station records are crucial for both regional and national climate institutions to produce reliable climate products for end users. Encouraging NMHSs to share standardized, high-quality data with ICPAC is essential for improving climate services.

The findings reveal significant temporal inconsistencies in both minimum and maximum temperature records within the ICPAC database. While NMHSs consistently shared daily temperature records between 1981 and 2002, many transitioned to sharing dekadal records from 2002 onward. Additionally, data availability varies between temperature elements and across stations, posing challenges for climate institutions like ICPAC, which rely on external observational networks.

This report underscores the critical state of the regional climate database and highlights the urgent need for collaboration between ICPAC and its member states. Strengthening climate data services is vital for enhancing early warning systems and improving climate resilience across the Greate Horn of Africa (GHA) region.

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List of Acronyms

CDT	Climate Data Tools
ClimSA	Intra-ACP Climate Services and Related Applications
CSV	Comma-Separated Values
DMCH	Drought Monitoring Centre Harare
DMCN	Drought Monitoring Centre Nairobi
GUI	Graphical User Interface
ICPAC	IGAD Climate Prediction and Applications Centre
IGAD	Inter-Governmental Authority on Development
GHA	The Greate Horn of Africa
IRI	International Research Institute for Climate and Society
MOU	Memorandum of Understanding
NMHSs	National Meteorological and Hydrological Services
RCC	Regional Climate Centre
WMO	World Meteorological Organization

1 Background

In 1989, in response to the devastating droughts that severely impacted livelihoods across the Eastern Africa region, 24 countries from Southern and Eastern Africa came together to establish the Drought Monitoring Centre. The center's headquarters, known as the Drought Monitoring Centre Nairobi (DMCN), was set up in Nairobi, while a sub-center, the Drought Monitoring Centre Harare (DMCH), was established in Harare.

At the time of its formation, the World Meteorological Organization (WMO) Permanent Representatives from the National Meteorological and Hydrological Services (NMHSs) affiliated with the center formed the steering committee. These representatives demonstrated a strong commitment to the initiative by agreeing to share climate observation data, primarily from synoptic weather station networks. This collaboration marked a significant step towards enhancing regional climate monitoring and drought mitigation efforts.

In 2003, during the 10th Summit of the IGAD Heads of State and Governments in Kampala, Uganda, DMCN was formally adopted as a specialized IGAD institution and renamed the IGAD Climate Prediction and Applications Centre (ICPAC). Eleven years later, ICPAC became a World Meteorological Organization (WMO) Regional Climate Centre (RCC) of excellence tasked with the provision of climate services to national and regional users across Eastern Africa.

Under its expanded mandate, ICPAC was tasked with providing operational climate monitoring services across the region. This critical service relied heavily on access to high-quality, up-to-date climate observations. However, National Meteorological and Hydrological Services (NMHSs) were grappling with several challenges that hindered effective data management and sharing.

Key issues included a declining number of climate observing stations, high staff turnover, and a shortage of skilled personnel required for tasks such as digitizing climate data from hardcopy formats and managing climate data records. Furthermore, both national and regional levels faced inadequate infrastructure for maintaining and processing climate data. These challenges led to discontinuities and inconsistencies in the climate records shared by NMHSs with ICPAC, affecting the quality and reliability of the region's climate services including climate monitoring.

Data sharing within the region was previously conducted on an ad hoc basis and lacked formalization until on the 25th August 2022, when a regional Data Sharing Memorandum of Understanding (MOU) was signed in Mombasa, Kenya. This milestone was achieved with support from the Intra-ACP Climate Services and Related Applications (ClimSA) project.

Despite this progress, ensuring the consistent sharing of high-quality, controlled data required ICPAC to provide additional support to National Meteorological and Hydrological Services (NMHSs), many of which continued to face challenges in climate data management.

To address these challenges, ICPAC, in collaboration with partners such as the UK Met Office and with support from the ClimSA project, has implemented various initiatives to enhance the capacity of NMHSs. These efforts focus on providing training and skill development to improve climate data management practices and ensure the credibility and reliability of shared data.

Recognizing the importance of data quality, ICPAC has also prioritized the development of an inventory of climate data available within its database. This inventory aims to identify stations with data inconsistencies and gaps, encouraging NMHSs to share standardized and high-quality data with ICPAC. This will enable ICPAC to provide regional climate services that meet high-quality standards and ensure reliability for the users.

1.1 Objectives

The main objective of this exercise is to assess availability of the temperature data in the ICPAC database in order to prepare a comprehensive inventory of the data available in the database. The specific objectives are to:

i. Evaluate the current status of stations actively sharing data with ICPAC.
ii. Determine the annual number of stations contributing data to ICPAC.
iii. Identify stations within the ICPAC region with inconsistent temperature data.

1.2 Methodology

The assessment employed Climsoft Climate Data Management Software (version 4.1.4) to extract data from the database in comma-separated values (CSV) format, compatible with Climate Data Tools (CDT). CDT is an open-source, R-based software package featuring a user-friendly graphical user interface (GUI). CDT was developed by the International Research Institute for Climate and Society (IRI), to support data managers at National Meteorological and Hydrological Services (NMHSs) across Africa, Asia, and Latin America. CDT provides a suite of tools for data quality control, bias correction, data merging, and visualization, enabling more effective management and analysis of large volumes of climate data.

CDT was utilized to perform various analyses, including:

- Assessing data Availability with non-missing records.
- Generating graphs showing the annual count of non-missing data for each station over time.
- Mapping the percentage of available data for all stations.
- Filtering the data to identify stations with specific percentages of non-missing values.

These analyses provided valuable insights into data quality and coverage across the ICPAC region.

2 Results and Discussion

2.1 Current Status of Stations Actively Sharing Data with ICPAC

This section highlights the results of the assessment of the status of stations actively sharing data with ICPAC for maximum and minimum temperature datasets. The section presents these results separately; firstly, for maximum temperature followed by minimum temperature records.

2.1.1 Maximum Temperature

Daily observed data from approximately 113 stations out of 183 were used to assess availability of the maximum temperature datasets in the ICPAC database. Seventy stations lacked enough records of the available data. Only 49 stations were found to have 50% of non-missing values in 43 years (1981-2024). Whereas, 35 stations were found to have 60% non-missing values in the same period. These results were achieved by filtering the data using Climate Data Tool (CDT).

The spatial distribution of the stations as well as the percentage of available data (non-missing) for the period 1981-2024 for daily maximum temperatures and current stations that are sending maximum temperature data to ICPAC are as shown in Figure 1(a) & (b).

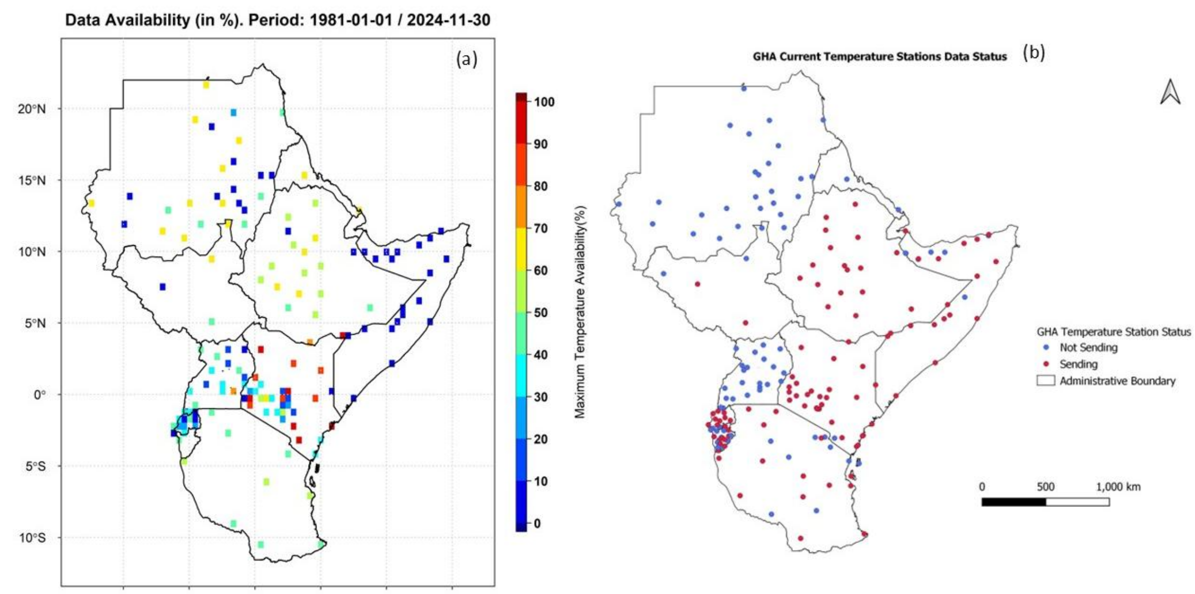

Figure 1: Percentage of available daily maximum temperature data in the ICPAC database and the status of stations actively sharing maximum temperature data with ICPAC (a and b respectively).

2.1.2 Minimum Temperature

Daily observed data from 125 stations out of 146 were used to assess the availability of the minimum temperature datasets in the ICPAC database. Twenty-one stations were excluded from the process for not having enough records. Twenty-Eight stations were found to have equal to or greater than 50% of non-missing values whereas 20 stations were found to have equal or greater than 70% of non-missing values in the period of 43 years (1981-2024).

The spatial distribution of the stations as well as the percentage of available data (non-missing) for the period 1981-2024 for daily minimum temperatures and current stations that are sending minimum temperature data are as shown in Figure 2(a) & (b).

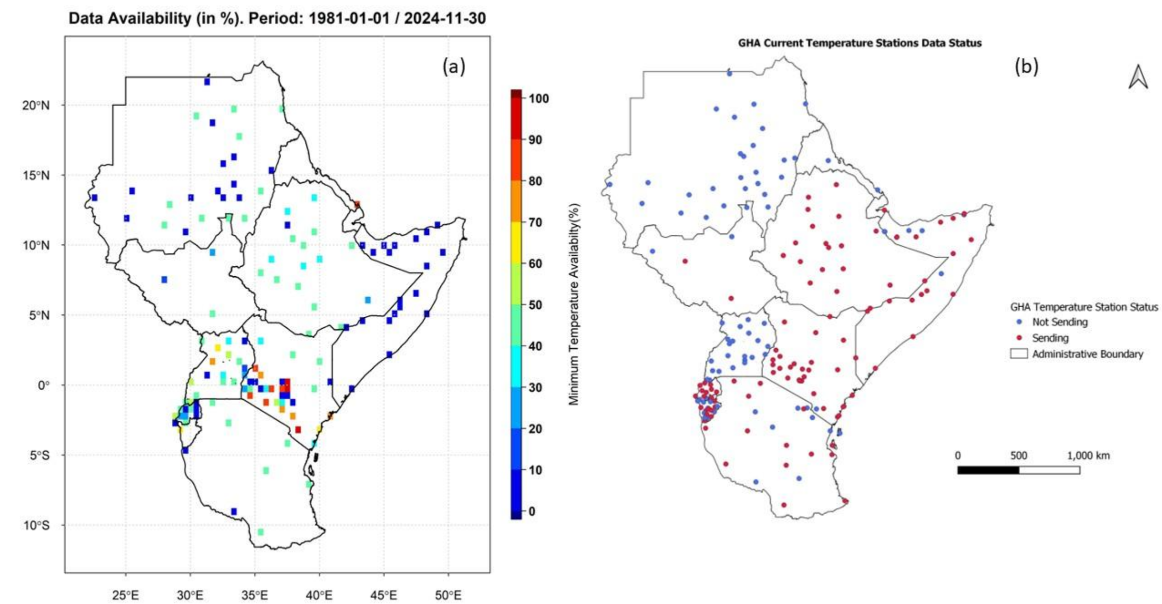

Figure 2: Percentage of available daily minimum temperature data in the ICPAC database and the status of stations actively sharing minimum temperature data with ICPAC (a and b respectively).

2.2 Annual Number of Stations Contributing Data to ICPAC

This section highlights the results of the assessment of the number of stations contributing data to ICPAC for maximum and minimum temperature datasets. The section will present these results separately; firstly, for maximum temperature followed by minimum temperature.

2.2.1 Maximum temperature

Figure 3 shows the average number of stations reported annually. It was observed that during the early years from 1981 to 2009, the daily maximum temperature observation station records available in the database are attributed to approximately 55 stations reporting per year whereas about 90 stations reporting per year account for available data from 2010 to 2024. This implies that there are more stations with observation records in the period from 2010 to 2024 than it is from 1981 to 2009. It is also worthy noting that in this period, the data records are mainly dekadal data.

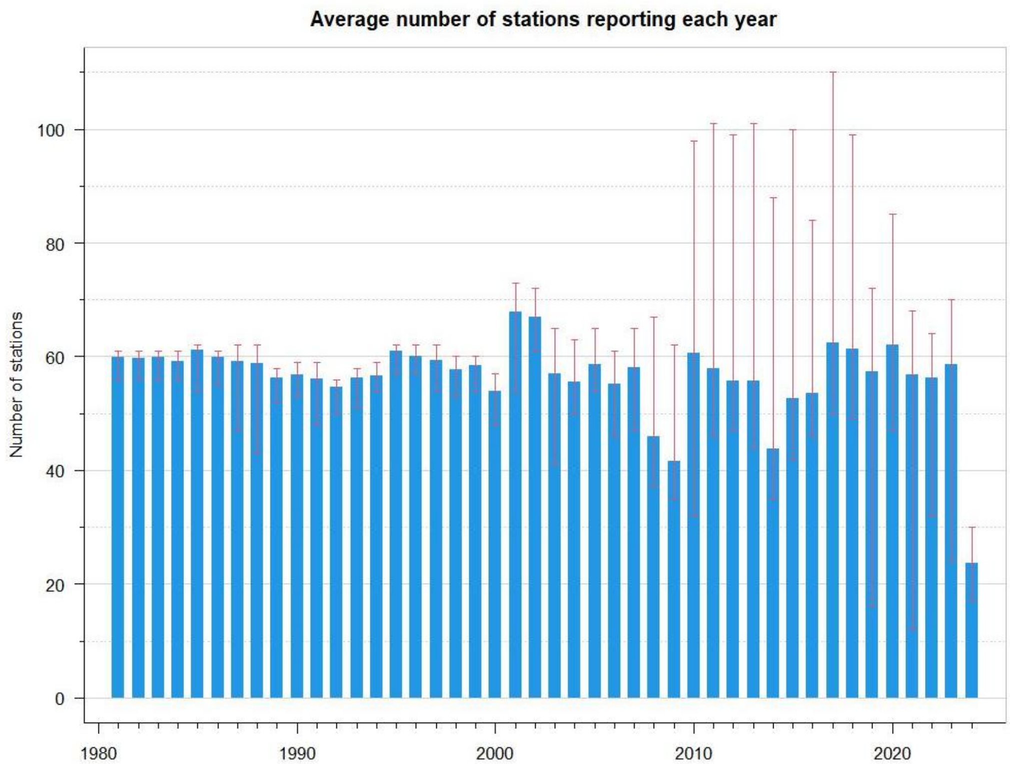

Figure 3: Average number of stations reporting daily maximum temperature observations per year.

2.2.2 Minimum Temperature

Figure 4 shows the average number of stations reporting annually. It was observed that during the early years from 1981 to 2009, the daily minimum temperature observation station records available in the database are attributed to approximately 55 stations reporting per year whereas 35 stations reporting per year account for available data from 2010 to 2024. This implies that there are few stations with observation records in the period from 2010 to 2024 than it was from 1981 to 2009.

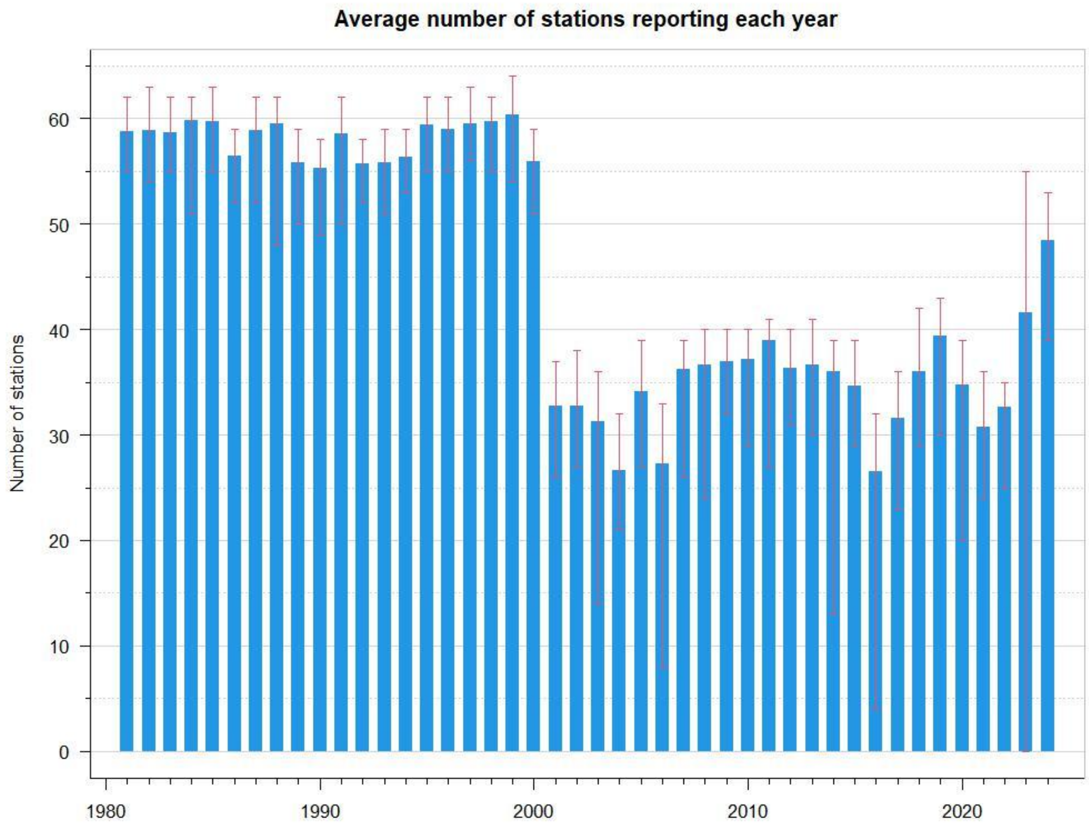

Figure 4: Average number of stations reporting daily minimum temperature observations per year.

2.3 Stations with Inconsistent Temperature Data within ICPAC Region

2.3.1 Maximum Temperature

In this analysis, a station with an average of 36 records per year indicates that the maximum temperature data is available on a 10-day (dekadal) time scale. Conversely, a station with an average of 365 records per year signifies that the data is available on a daily time scale within the database. It was observed that some stations reported daily maximum temperatures during different historical periods. For example, Kampala (Uganda), as shown in Figure 5a, provided data from 2001 to 2024, while Metehara (Ethiopia), depicted in Figure 5b, reported data from 1984 to 2001. Starting in 2008, some of the stations (such as Metehara) transitioned to reporting decadal (10-day aggregated) records of maximum temperature to ICPAC.

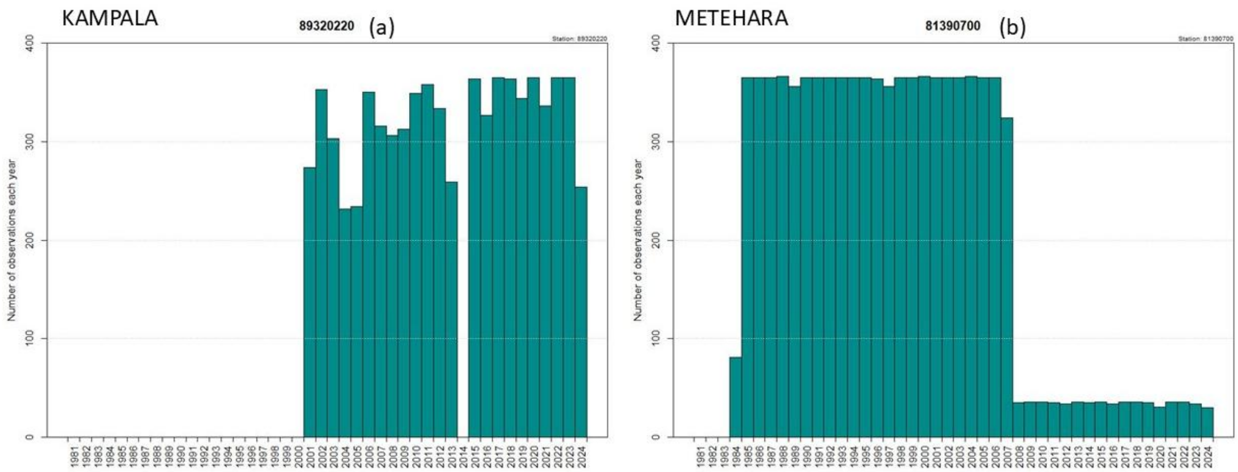

*Figure 5: Number of daily maximum temperature observations for Kampala (Uganda) and Metehara (Ethiopia) stations (a and b respectively). **Note:** There are a maximum of 365 data records per station per year for daily data and a maximum of 36 data records per station per year for dekadal (10 day) records.*

The stations in Ethiopia—Addis Ababa, Debre Markos, Awassa, and Combocha—are shown in Figure 4a, b, c, and d. The full dataset should include daily maximum temperature records for each station representing a total of 365 records per year. From 1981 to 1999, there are approximately 365 records (daily) per station per year for most of the stations. From 1981 to 2006, there are approximately 365 records (daily) per station per year. However, from 2007 to 2024, the records are reduced to 36 per station per year, representing 10-day aggregated intervals. This indicates that while daily maximum temperature records are available for these stations from 1981 to 2006, only 36 records (10-day aggregated) per year are available in the database from 2007 to 2024.

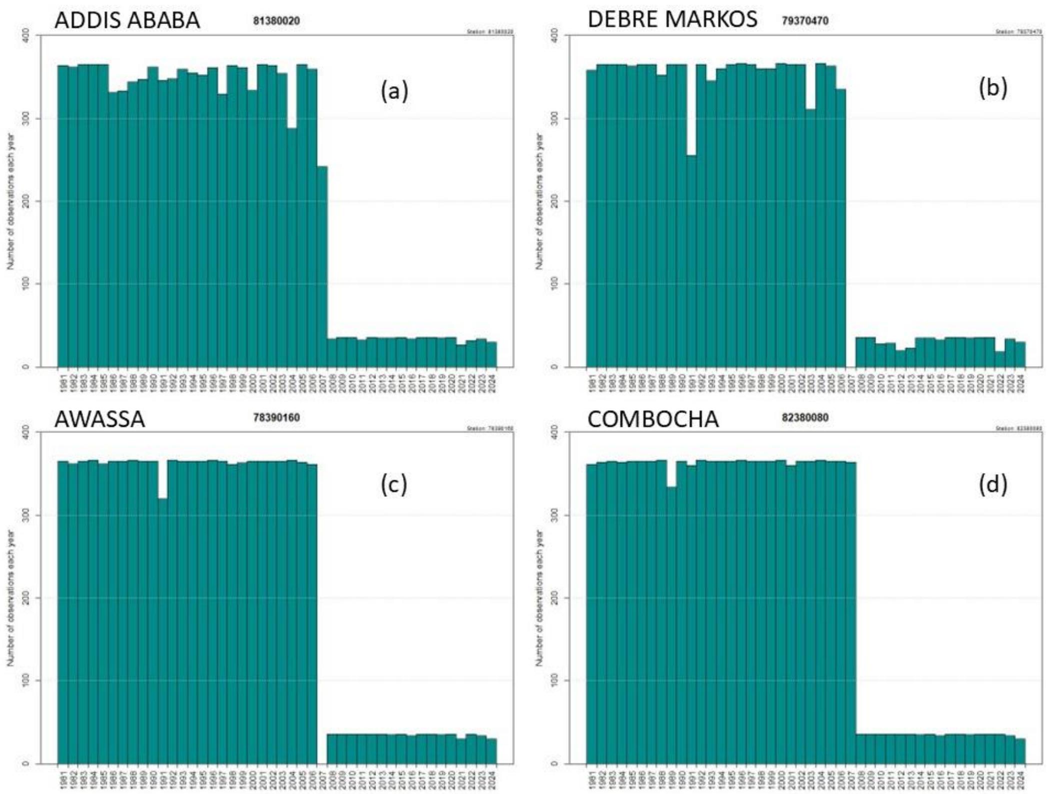

Figure 6: Number of daily maximum observations each year for Adiss-Ababa, Debre-Markos, Awassa & Combocha (Ethiopia) stations respectively. ***Note:*** *There are a maximum of 365 data records per station per year for daily data and a maximum of 36 data records per station per year for deakal (10 day) records.*

The stations in Sudan—EL Gedref, Port Sudan, EN Nahud, and Khartoum—are depicted in Figure 75a, b, c, and d. The full dataset should include daily maximum temperature records for each station representing a total of 365 records per year. From 1981 to 1999, there are approximately 365 records (daily) per station per year for most stations in Sudan. However, from 2000 to 2023, the records are reduced to 36 per station per year (representing 10-day intervals). An exception is observed for Khartoum, where the dataset contains approximately 365 daily records per year from 1981 to 2009. From 2010 to 2023, the records for Khartoum are also limited to 36 per year (10-day intervals).

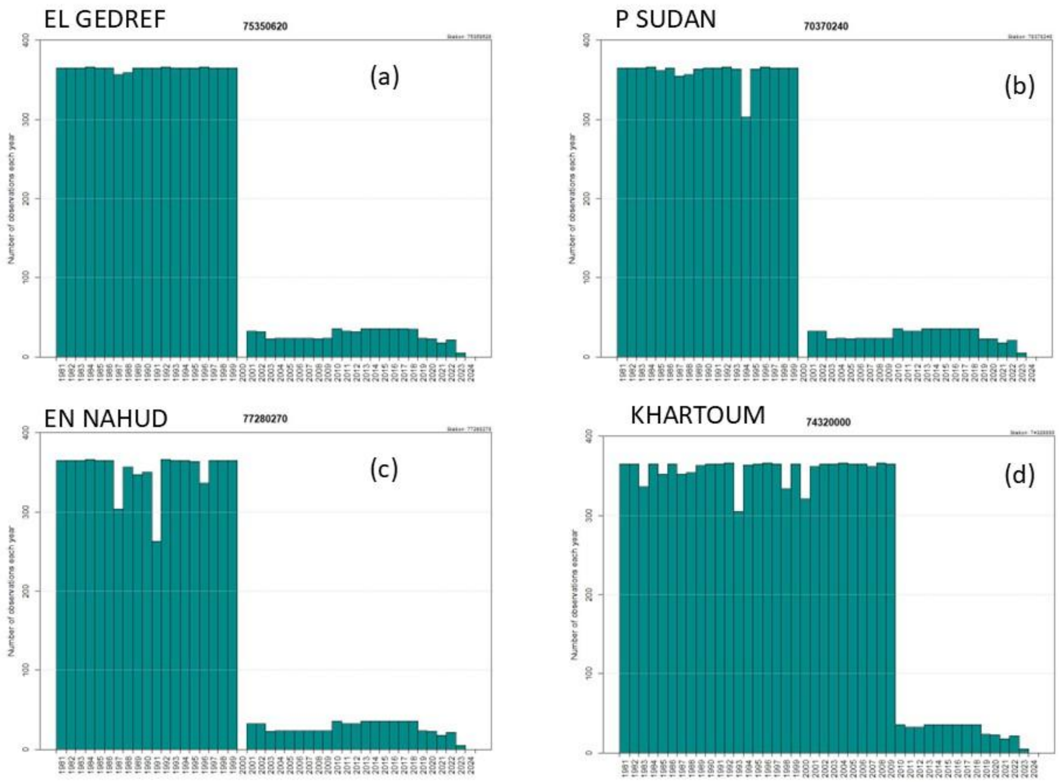

Figure 7: Number of daily maximum observations each year for El-Gedref, P Sudan, En Nahud & Khartum (Sudan) stations respectively. ***Note:*** *There are a maximum of 365 data records per station per year for daily data and a maximum of 36 data records per station per year for dekadal (10 day) records.*

The temperature data for the Tanzanian stations (Dar Es Salaam, Mwanza, Dodoma, and Kigoma) are presented in Figure 8a, b, c, and d. For Mwanza, Dodoma, and Kigoma, the dataset includes 365 daily maximum temperature records per year from 1981 to 2002, followed by 36 dekadal (10-day) temperature records per year from 2003 to 2024. In the case of Dar Es Salaam, the dataset comprises 365 daily maximum temperature records per year from 1981 to 2009, and 36 dekadal records per year from 2010 to 2024.

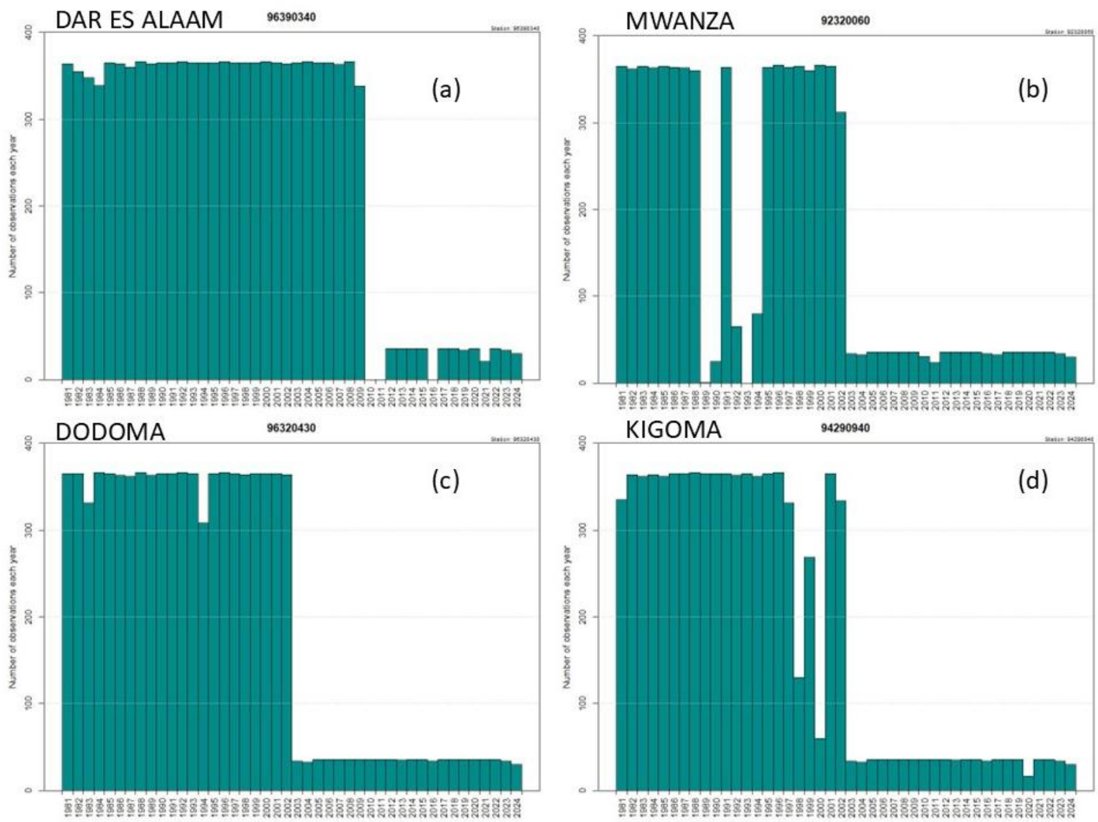

Figure 8: Number of daily maximum observations each year for Dar Es Salaam, Mwanza, Dodoma & Kigoma (Tanzania) stations respectively. ***Note:*** *There are a maximum of 365 data records per station per year for daily data and a maximum of 36 data records per station per year for dekadal (10 day) records.*

The stations in Rwanda (Kigali), Burundi (Bujumbura), Uganda (Jinja), and Kenya (Lodwar), as shown in Figure 9a, b, c, and d, have an average of 365 daily temperature records per station per year. This indicates that maximum temperature data is available on a daily time scale for these stations, except for Bujumbura, which has missing daily maximum temperature records from 2000 to 2022. In general, Uganda, Rwanda, Burundi, Kenya, South Sudan, and Djibouti are member states that submit daily rainfall and daily temperature records to ICPAC every 10 days.

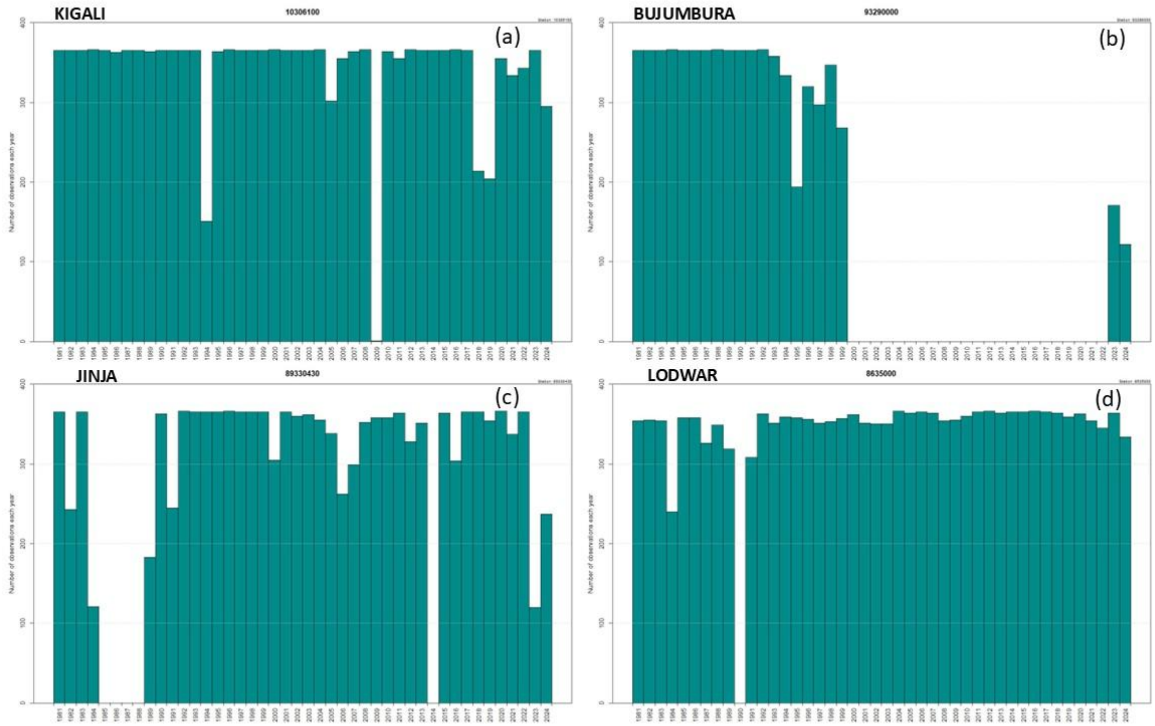

*Figure 9: Number of daily maximum observations each year for Kigali (Rwanda), Bujumbura (Burundi), Jinja (Uganda) & Lodwar (Kenya) stations respectively. **Note:** There are a maximum of 365 data records per station per year for daily data and a maximum of 36 data records per station per year for dekadal (10 day) records.*

Table 1 provides a summary of the inventory of sampled stations that transmit data to ICPAC. The table indicates that most stations in the sample sent daily records from 1981 to 2007, while the majority began sharing dekadal data between 2001 and 2024. This variation has resulted in inconsistencies within the ICPAC database, limiting the ability to generate products that rely on continuous daily records.

Table1: Summary of the list of stations with daily and dekadal maximum temperature records as shown from Figures 1 to 9.

Station Id	Station Name	Period of Tmax Daily available record	Period of Tmax Daily missing record	Period of Tmax Dekadal available record	Period of Tmax Dekadal missing record
89320220	Kampala	2001 - 2013,2015-2024	1981 – 2000, 2014		
81390700	Metehara	1981 - 2007	2008 - 2024	2008 - 2024	
81380020	Addis Ababa	1981 - 2007	2008 - 2024	2008 - 2024	
79370470	Debre Markos	1981 - 2006	2007 - 2024	2008 - 2024	2007
82380080	Awassa	1981 - 2007	2008 - 2024	2008 - 2024	
78390160	Combocha	1981 - 2006	2007 - 2024	2008 - 2024	2007
75350620	Elgedref	1981 - 1999	2000 - 2024	2001 - 2023	2000, 2024
70370240	P Sudan	1981 - 1999	2000 - 2024	2001 - 2023	2000, 2024
77280270	EN Nahud	1981 - 1999	2000 - 2024	2001 - 2023	2000, 2024
74320000	Khartoum	1981 - 2009	2010 - 2024	2010 - 2024	
96390340	Dar es Salaam	1981 - 2009	2010 - 2024	2012 – 2015,2017-2024	2010 – 2011, 2016
92320060	Mwanza	1981 – 1988,1994-2002	1989, 1993	2003 - 2024	
96320430	Dodoma	1981 - 2002	2003 - 2024	2003 - 2024	
10306100	Kigali	1981 – 2008,2010-2024	2009		
93290000	Bujumbura	1981 – 1999,2023-2024	2000 - 2022		
89330430	Jinja	1981 – 1984,1989-2013,2015-2024	1985 – 1988,2014		
8635000	Lodwar	1981 – 1989,1991-2024	1990		

2.3.2 Minimum Temperature

It was observed that some stations reported daily minimum temperature data during specific historical periods. For example, Kampala (Uganda), as shown in Figure 10a, provided data from 2001 to 2024, while Metehara (Ethiopia), depicted in Figure 10b, reported data from 1984 to 2024.

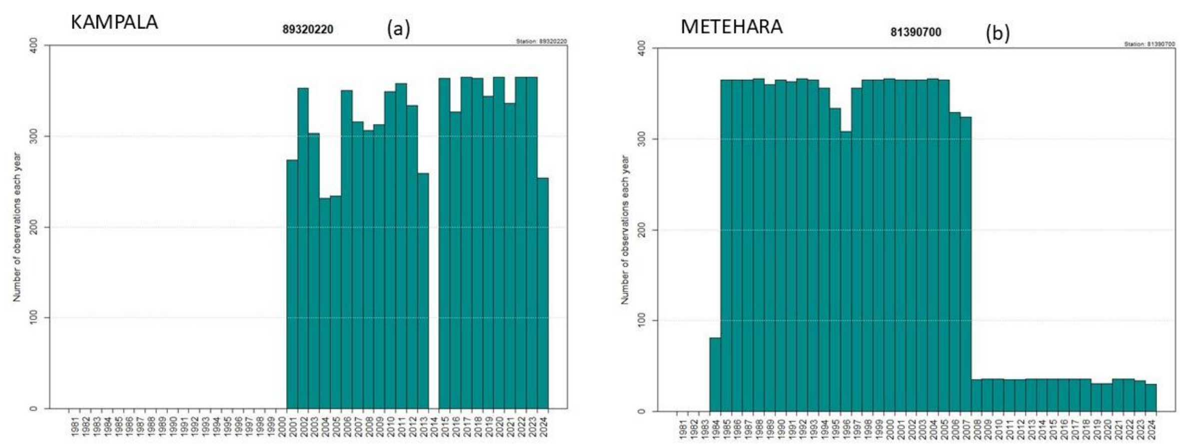

Figure 10: Number of daily minimum observations each year for Kampala (Uganda) and Metehara (Ethiopia) stations respectively

The Ethiopian stations (Addis Ababa, Debre Markos, Awassa, and Combolcha), as shown in Figure 11a, b, c, and d, have 365 records of minimum daily temperature per station per year from 1981 to 2007. From 2008 to 2024, these stations have 36 records per station per year, indicating a shift to 10-day aggregated data. This implies that daily minimum temperature records are available for these stations from 1981 to 2007, while only 36 dekadal (10-day aggregated) records are available for the remaining years up to 2024 in the database.

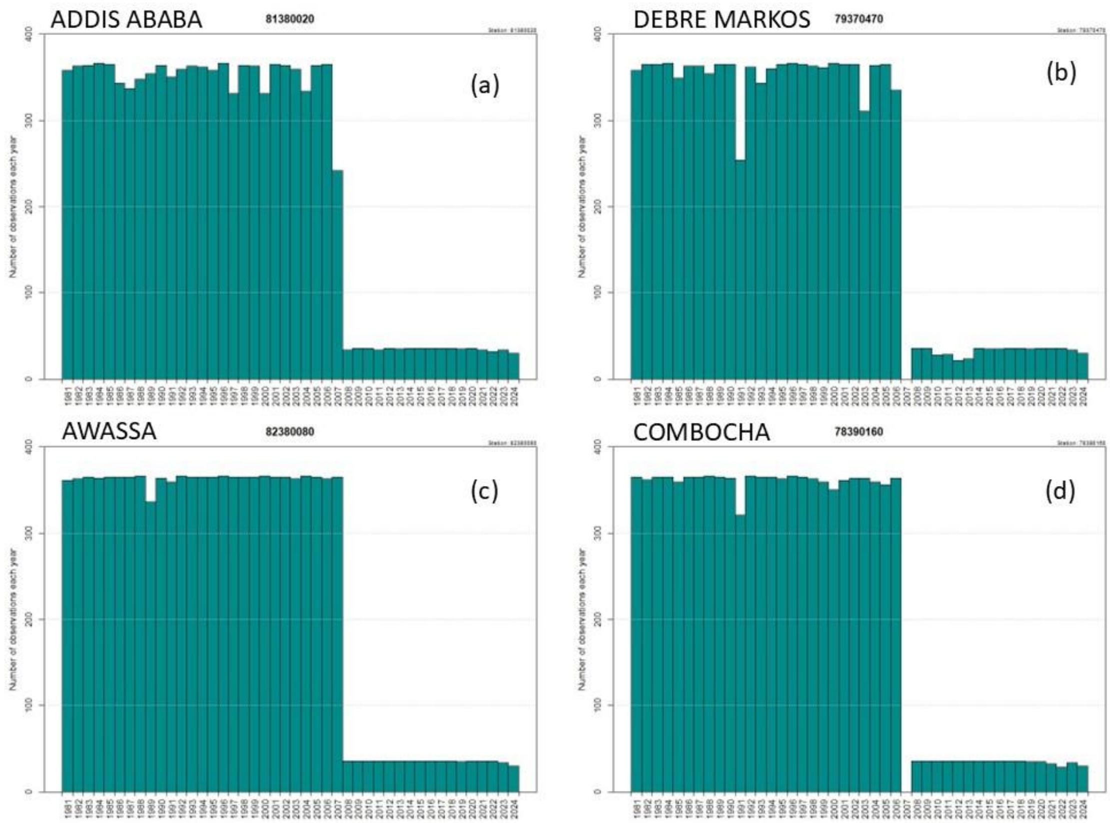

Figure 11: Number of daily minimum observations each year for Adiss-Ababa, Debre-Markos, Awassa & Combolcha (Ethiopia) stations respectively.

The Sudan stations (El Gedaref, Port Sudan, En Nahud, and Khartoum), as shown in Figure 12a, b, c, and d, have 365 records of minimum daily temperature per station per year from 1981 to 1999. From 2000 to 2023, these stations have 36 records per station per year, reflecting a shift to 10-day aggregated data. However, the Khartoum station is an exception, with approximately 365 daily maximum temperature records per year from 1981 to 2009 and 36 dekadal (10-day) records from 2010 to 2023, as illustrated in Figure 12(d).

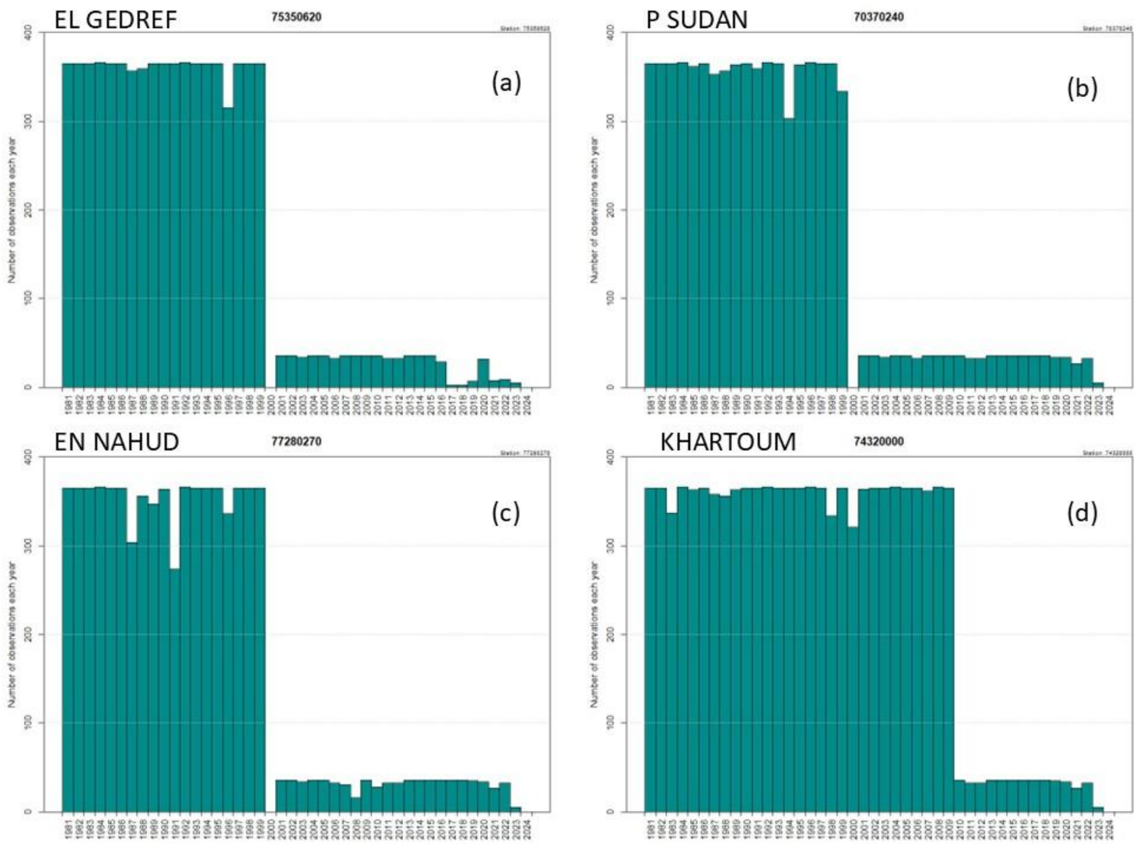

Figure 12: Number of daily minimum observations each year for El-Gedref, P Sudan, En Nahud & Khartoum (Sudan) stations respectively.

The Tanzania stations (Dar Es Salaam, Mwanza, Dodoma, and Kigoma), as shown in Figure 13a, b, c, and d, have varying records of minimum daily temperature. For Mwanza and Dodoma, there are 365 daily minimum temperature records per station per year from 1981 to 2002, followed by 36 dekadal (10-day) records from 2003 to 2024. Dar Es Salaam, on the other hand, has an average of 350 daily minimum temperature records per year from 1981 to 2009. Kigoma has two years of daily minimum temperature records (1981–1982), with missing data from 1983 to 2002, and 36 dekadal records from 2003 to 2024, as illustrated in Figure 13d.

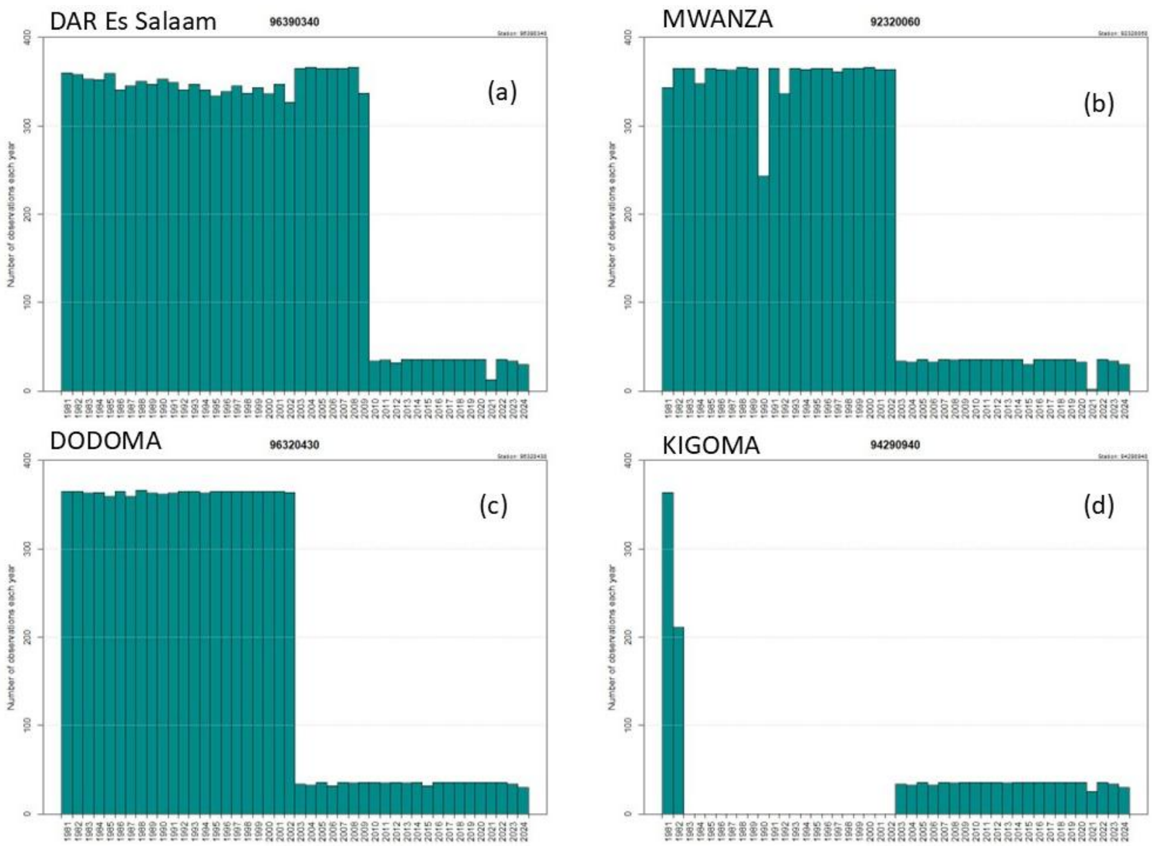

Figure 13: Number of daily minimum observations each year for Dar Salaam, Mwanza, Dodoma & Kigoma (Tanzania) stations respectively.

The stations in Kigali (Rwanda), Bujumbura (Burundi), Jinja (Uganda), and Lodwar (Kenya), as shown in Figure 14a, b, c, and d, have an average of 365 daily temperature records per station per year, indicating the availability of minimum temperature data on a daily time scale.

- **Kigali** has complete daily temperature records from 1981 to 2024.
- **Lodwar** has records from 1984 to 2024, with missing data for the years 1986 and 1990.
- **Bujumbura** has daily temperature records from 1981 to 1999, missing data from 2000 to 2019, and resumed daily minimum temperature records from 2020 to 2024.
- **Jinja** has missing records from 1981 to 2000, available data from 2001 to 2021, and missing records again in 2021.

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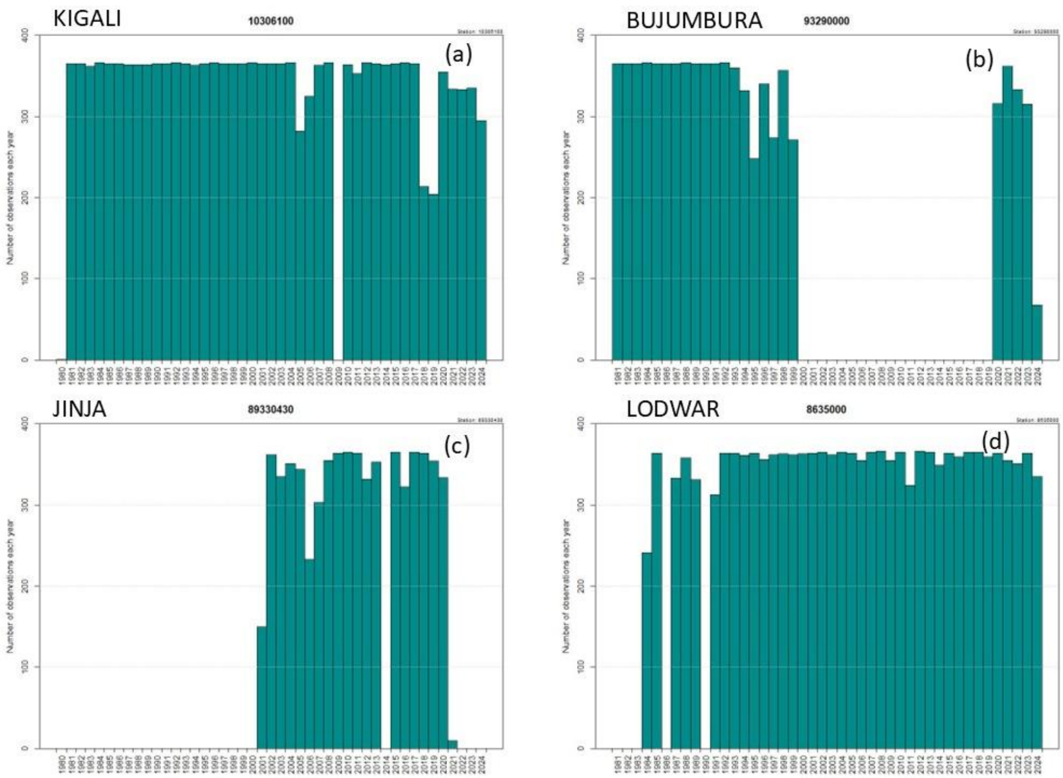


Figure 14: Number of daily minimum observations each year for Kigali (Rwanda), Bujumbura (Burundi), Jinja (Uganda) & Lodwar (Kenya) stations respectively.

Table 2 presents a summary of sampled stations that share minimum temperature data with ICPAC. Similar to the assessment of maximum temperature, most stations provided daily minimum temperature data between 1981 and 1999. However, some stations transitioned to sharing dekadal data, thereafter, continuing to the present. This shift has significantly impacted on climate products that rely on daily records, such as those used for monitoring extreme climate events.

Table 2: Summary of the list of stations with daily and dekadal minimum temperature records as shown from Figures 10 to 14.

Station Id	Station Name	Period of Tmin Daily available record	Period of Tmin Daily missing record	Period of Tmin Dekadal available record	Period of Tmin Dekadal missing record
89320220	Kampala	2001 - 2013,2015-2024	1981 – 2000, 2014		
81390700	Metehara	1984 - 2007	1981 -1983,2008 - 2024	2008 - 2024	
81380020	Addis Ababa	1981 - 2007	2008 - 2024	2008 - 2024	
79370470	Debre Markos	1981 - 2006	2007 - 2024	2008 - 2024	2007
82380080	Awassa	1981 - 2007	2008 - 2024	2008 - 2024	
78390160	Combocha	1981 - 2006	2007 - 2024	2008 - 2024	2007
75350620	Elgedref	1981 - 1999	2000 - 2024	2001 - 2023	2000, 2024
70370240	P Sudan	1981 - 1999	2000 - 2024	2001 - 2023	2000, 2024
77280270	EN Nahud	1981 - 1999	2000 - 2024	2001 - 2023	2000, 2024
74320000	Khartoum	1981 - 2009	2010 - 2024	2010 - 2024	
96390340	Dar es Salaam	1981 - 2009	2010 - 2024	2010 - 2024	
92320060	Mwanza	1981 -2002	2003 - 2024	2003 - 2024	
96320430	Dodoma	1981 - 2002	2003 - 2024	2003 - 2024	
10306100	Kigali	1981 – 2008,2010-2024	2009		
93290000	Bujumbura	1981 – 1999,2020-2024	2000 - 2019		
89330430	Jinja	2001-2013,2015 - 2021	1981 – 2000,2014,2022-2024		
8635000	Lodwar	1984 – 1985, 1987-1999,1991-2024	1981-1983,1996,1990		

2.4 Total Available Records per Station per Element per Country for the GHA

The available maximum and minimum temperature records for Kenya ranges between 40% to 80% for majority of the stations that share data with ICPAC. It is also evident that minimum temperature records are lacking for some stations compared to maximum temperature, see Figure 15.

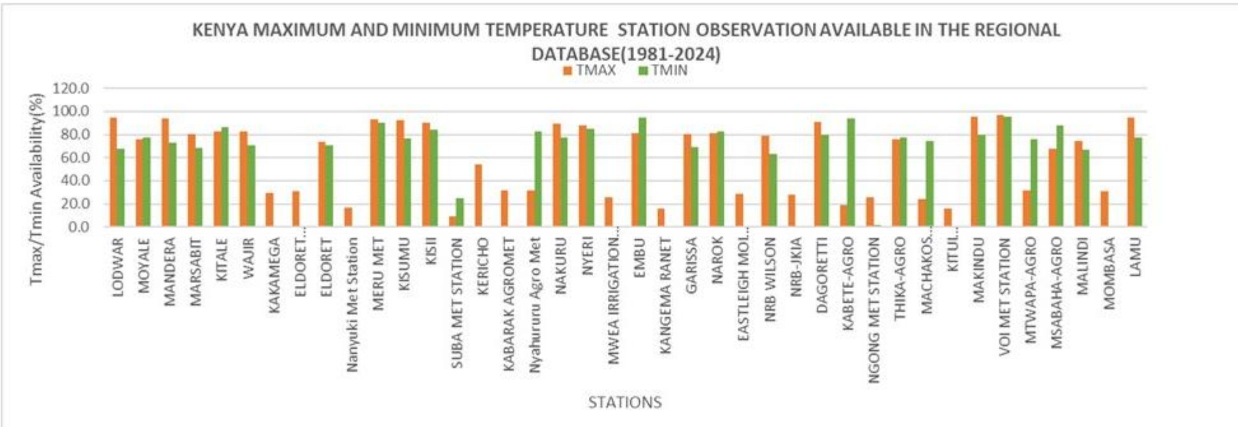


Figure 15: Total available records per station per element for the Kenya stations sharing data with ICPAC

In Uganda, the availability of maximum and minimum temperature records in the regional database varies, with most stations sharing between 20% and 40% of their data with ICPAC (see Figure 16). However, data availability differs across stations. For instance, Jinja has more daily maximum temperature records in ICPAC's database compared to daily minimum temperature records, while stations like Masindi have a higher number of daily minimum temperature records than daily maximum temperature records.

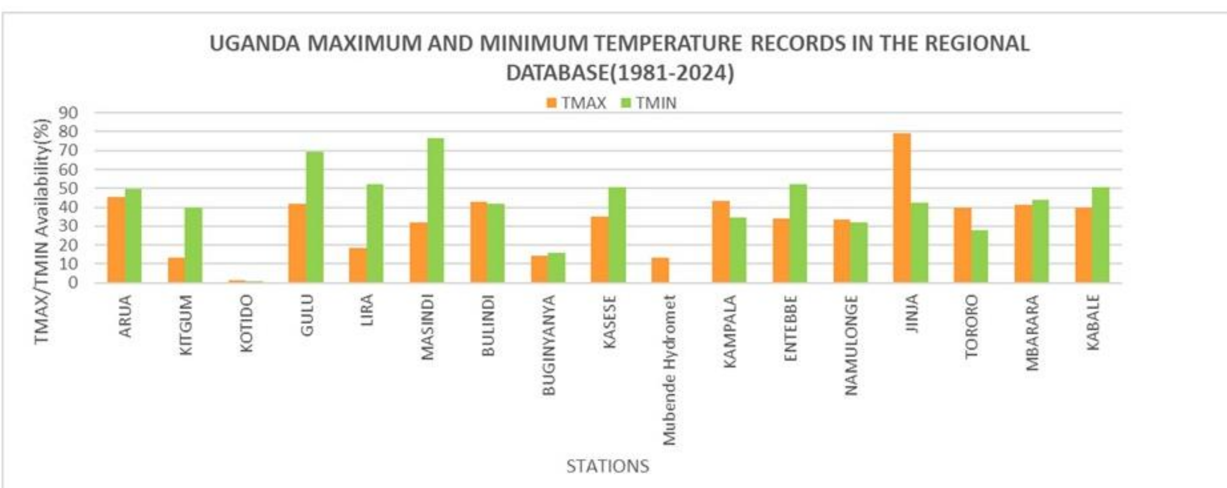


Figure 16: Total Available records per station per element for Uganda stations

Ethiopia's records of daily maximum and minimum temperature ranges between 30% to 50% (Figure 17). The records for maximum temperature are more than the minimum temperature records across all the stations except Dire-Dawa.

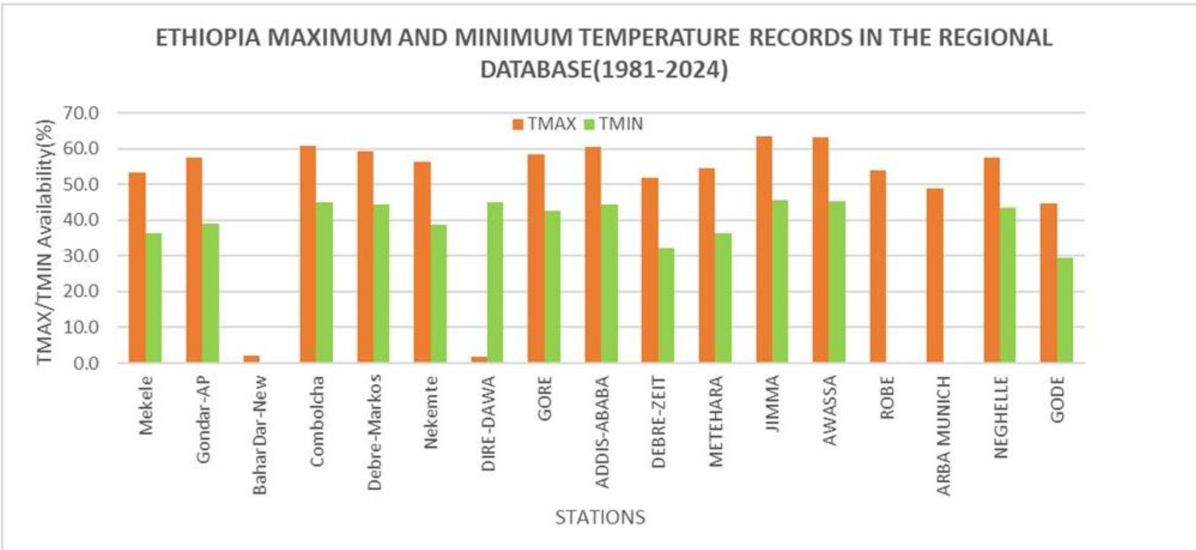


Figure 17: Total Available records per station per element for Ethiopia stations

Sudan's data records range between 20% to 50% for most of the stations with a few below 5% (Figure 18). In most stations, except Abu-Hamad, Karima, Seninar, and Nyala, daily maximum temperature records are more compared to daily minimum temperature records.

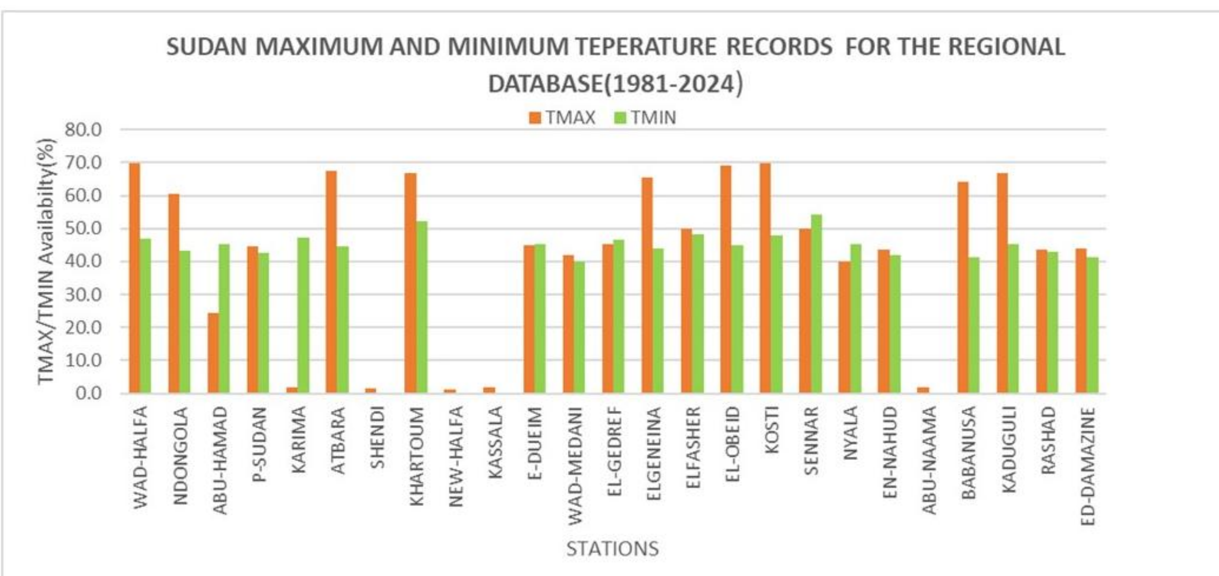


Figure 18: Total Available records per station per element for Sudan stations

South Sudan shares data from only five stations with ICPAC: El-Renk, Malakal, Wau, Juba, and Raga. Among these, three stations have a higher number of daily maximum temperature records. In contrast, Wau has the most daily minimum temperature records; however, the overall data availability at this station is the second lowest among the five, Figure 19.

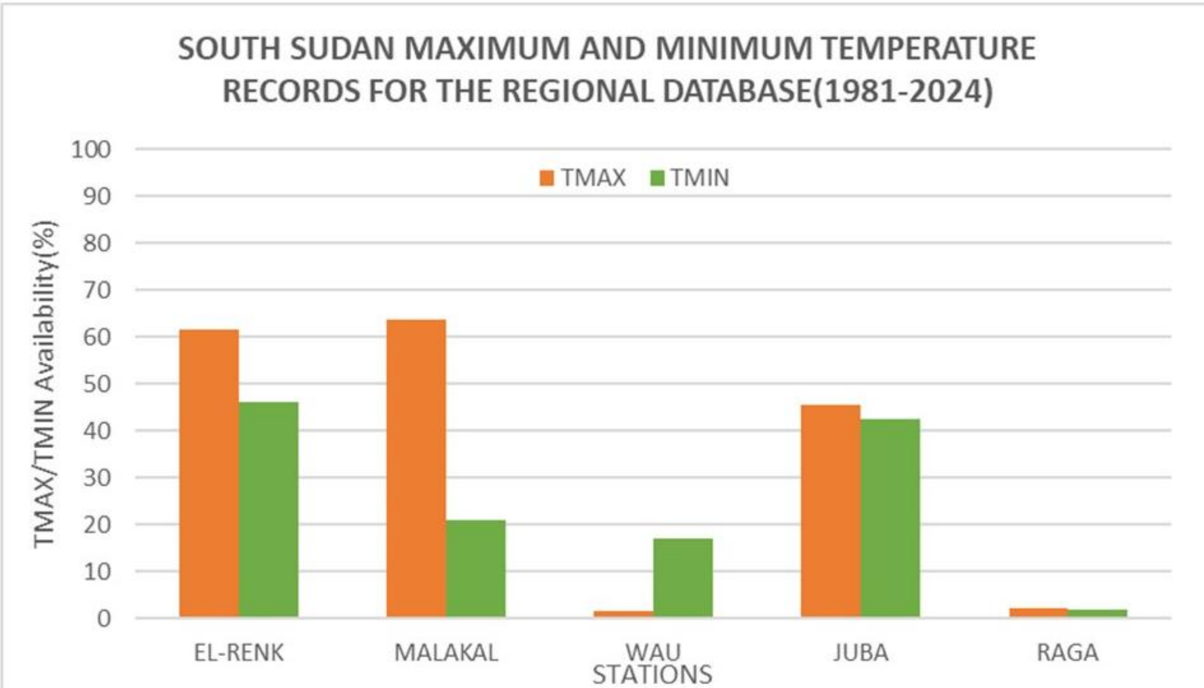


Figure 19: Total Available records per station per element for South Sudan stations

In the regional database, Tanzania's records for both maximum and minimum temperature are below 50%. Similarly, Rwanda's records are also below 50%, except for Kigali station, which has over 90% data availability. Somalia's records primarily consist of AWS data from 2019 to 2024, with overall availability below 10%.

For Eritrea and Djibouti, Asmara has approximately 60% data coverage, while Assab has less than 10%. Djibouti's only station has 65% data coverage for maximum temperature and 83% for minimum temperature. In Burundi, most station records are below 10%, except for Bujumbura, which has over 40% data availability.

2.5 Total Missing Records per Station per Element for selected stations in GHA

The results highlight significant gaps in the regional database for daily temperature records. For instance, Port Sudan has over 8,000 missing records for this variable, representing approximately 45% of the total records from 1981 to 2024. In contrast, Dagoretti station, in Nairobi has the fewest missing records among the two temperature variables analyzed. See Figure 20 for further details.

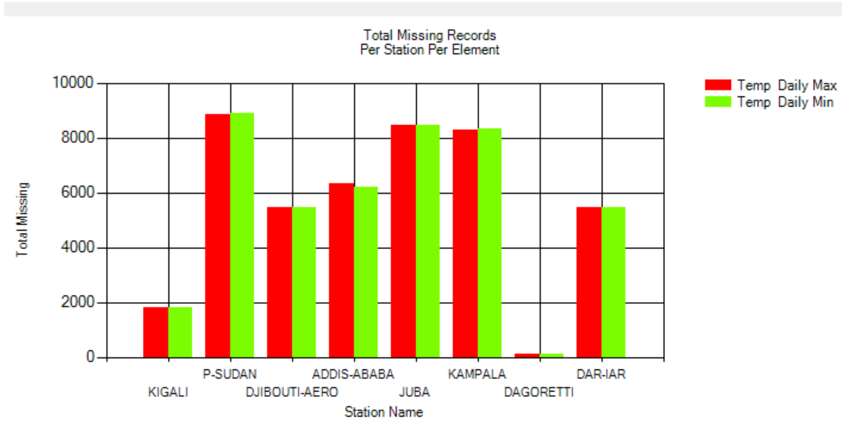


Figure 20: Total missing records per station per element for sample Gha stations

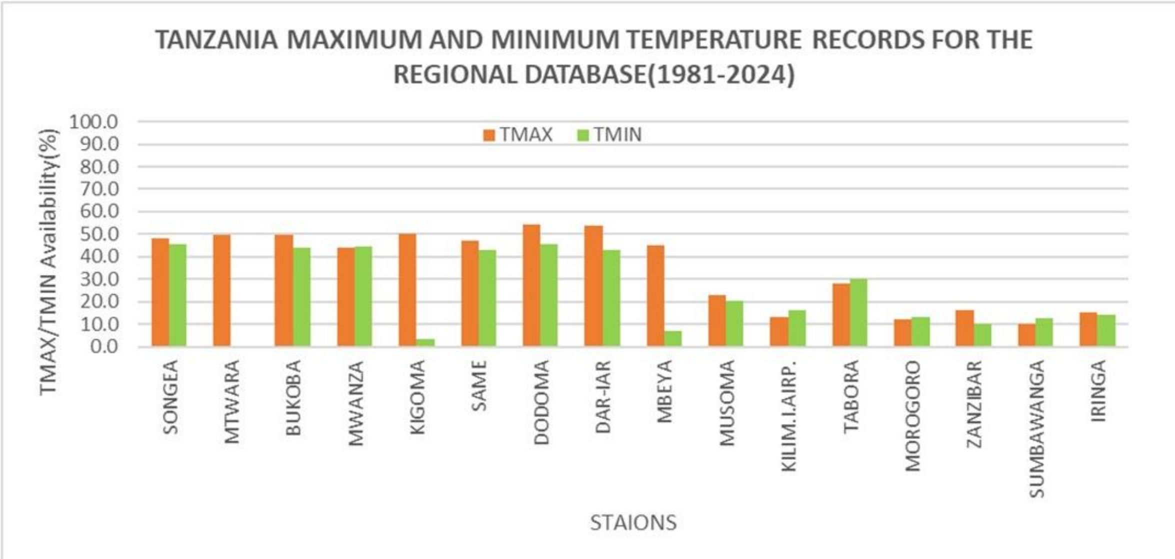
3 Conclusion

This inventory aimed to identify stations with data inconsistencies and gaps within the ICPAC regional database for daily minimum and maximum temperature records. Consistent and quality-controlled station records are crucial for both regional and national climate institutions to produce reliable climate products for end users. Encouraging NMHSs to share standardized, high-quality data with ICPAC is essential for improving climate services.

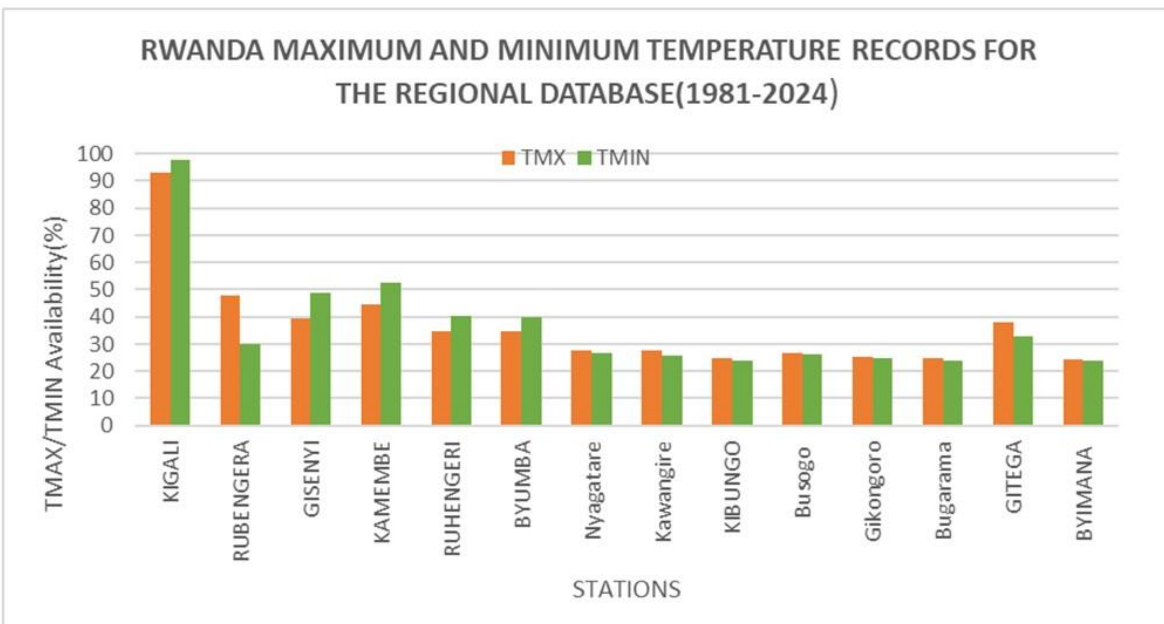
The findings reveal significant temporal inconsistencies in both minimum and maximum temperature records within the ICPAC database. While NMHSs consistently shared daily temperature records between 1981 and 2002, many transitioned to sharing dekadal records from 2002 onward. The countries that share daily data to ICPAC consistently include Uganda, Kenya Rwanda, and Djibouti which shares only one station. Ethiopia, Sudan and Tanzania only share dekadal data. Additionally, data availability varies between temperature elements and across stations, posing challenges for climate institutions like ICPAC, which rely on the NMHSs' observational networks. The daily temperature records available in the ICPAC database revealed both temporal and spatial inconsistences and may not be suited to generate a regional daily merged dataset. Therefore, the dekadal station data would be ideal for use in the merging.

This report underscores the critical state of the regional climate database and highlights the urgent need for collaboration between ICPAC and its member states. Strengthening climate data services is vital for enhancing early warning systems and improving climate resilience across the region.

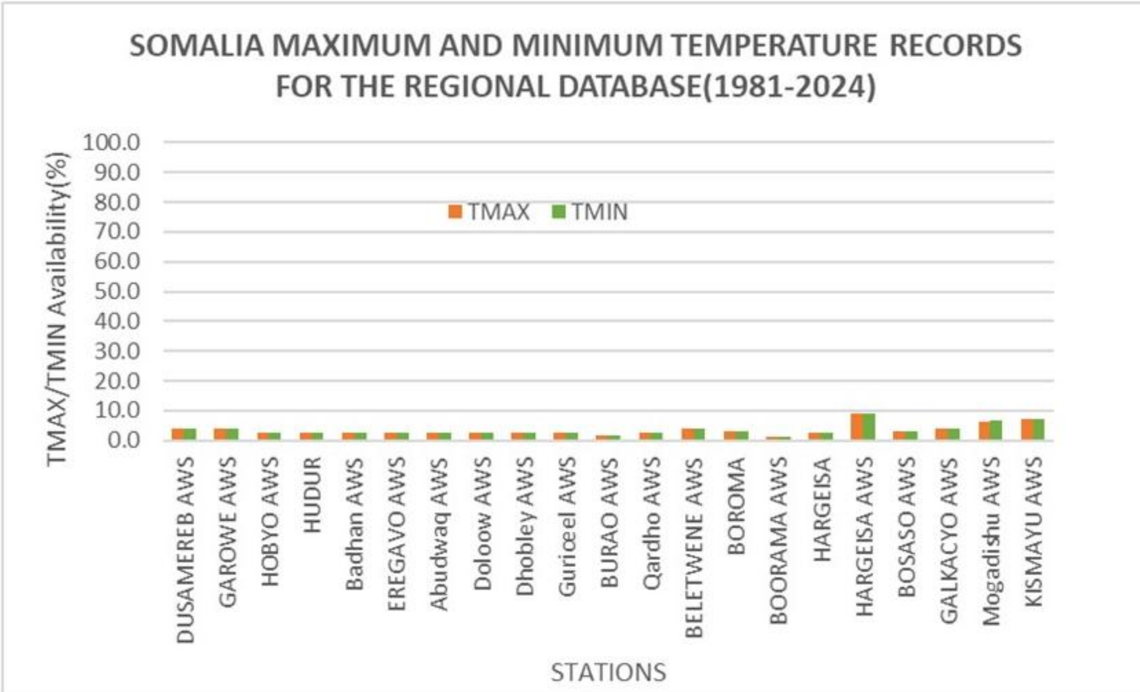
Appendix



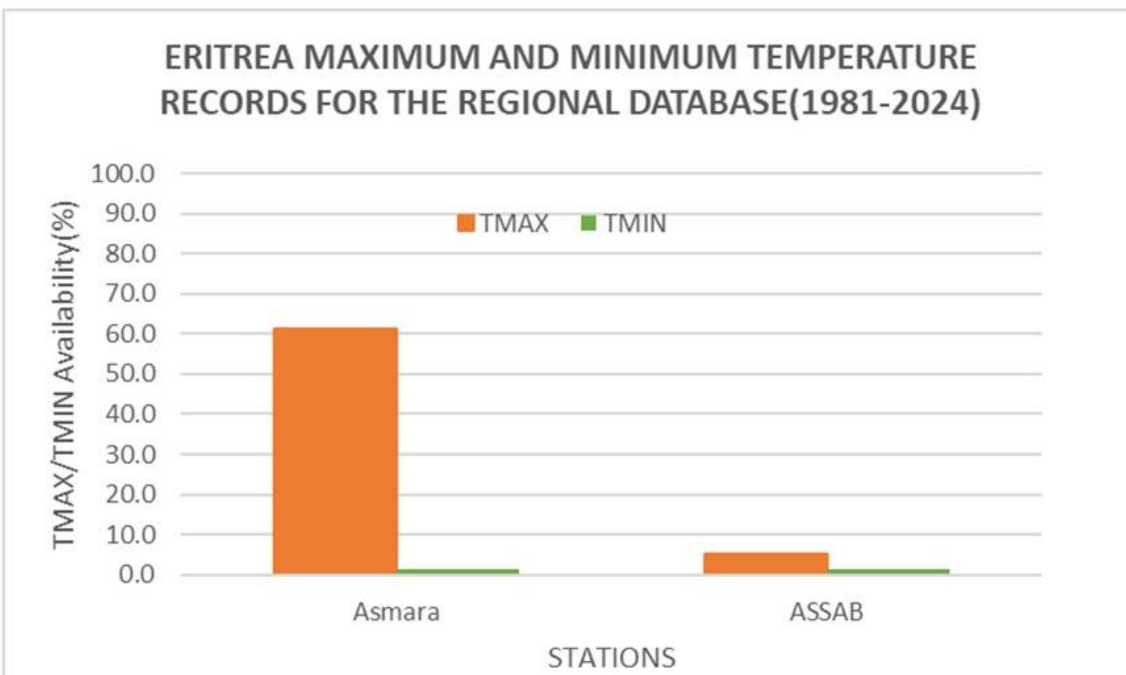
Total Available records per station per element for Tanzania stations



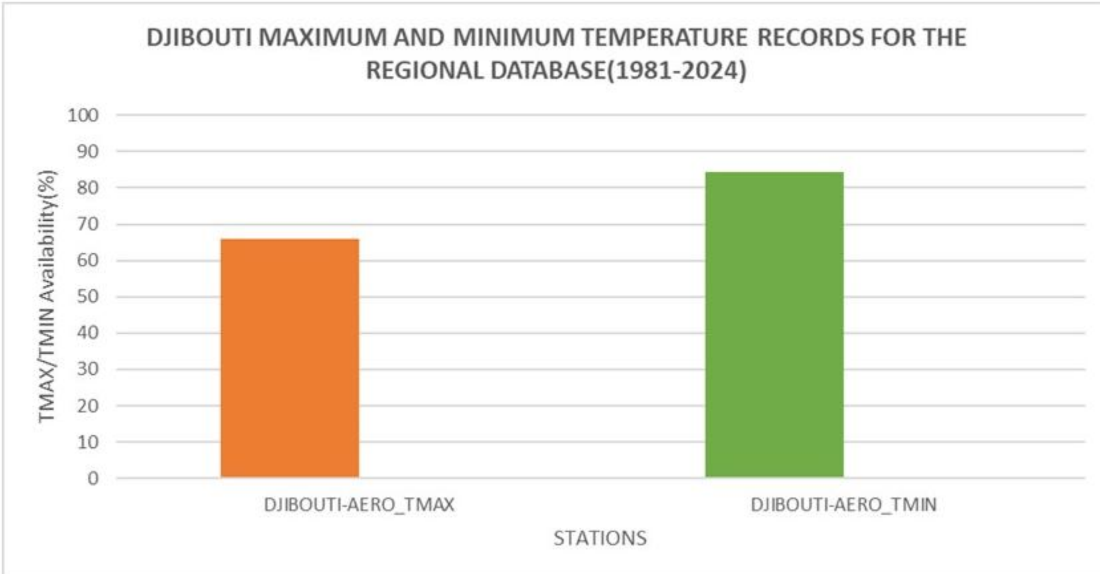
Total Available records per station per element for Rwanda stations



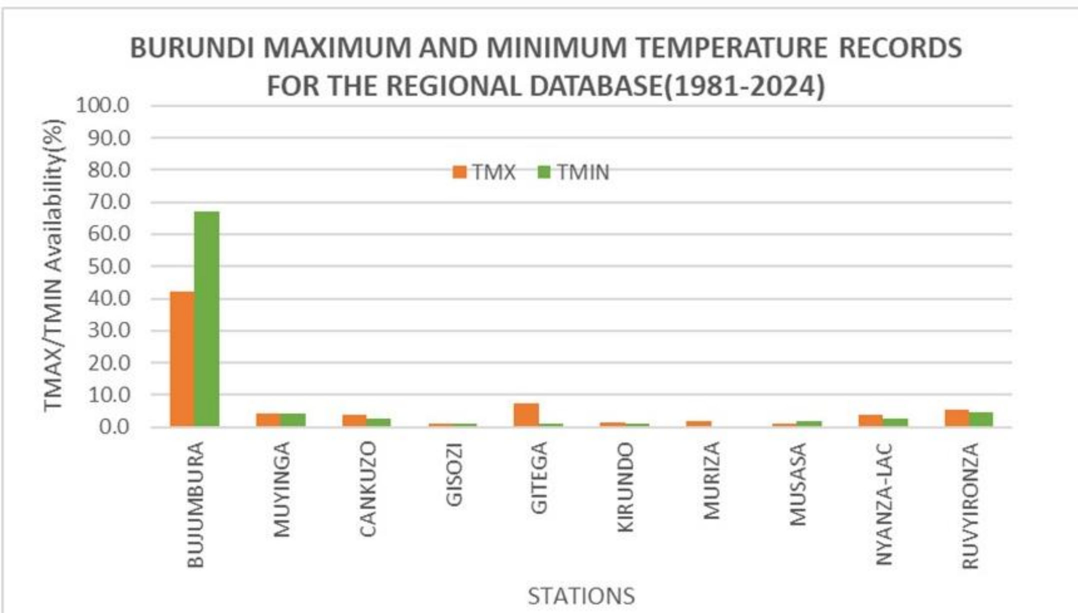
Total Available records per station per element for Somalia stations



Total Available records per station per element for Eritrea stations



Total Available records per station per element for Djibouti stations



Total Available records per station per element for Burundi stations