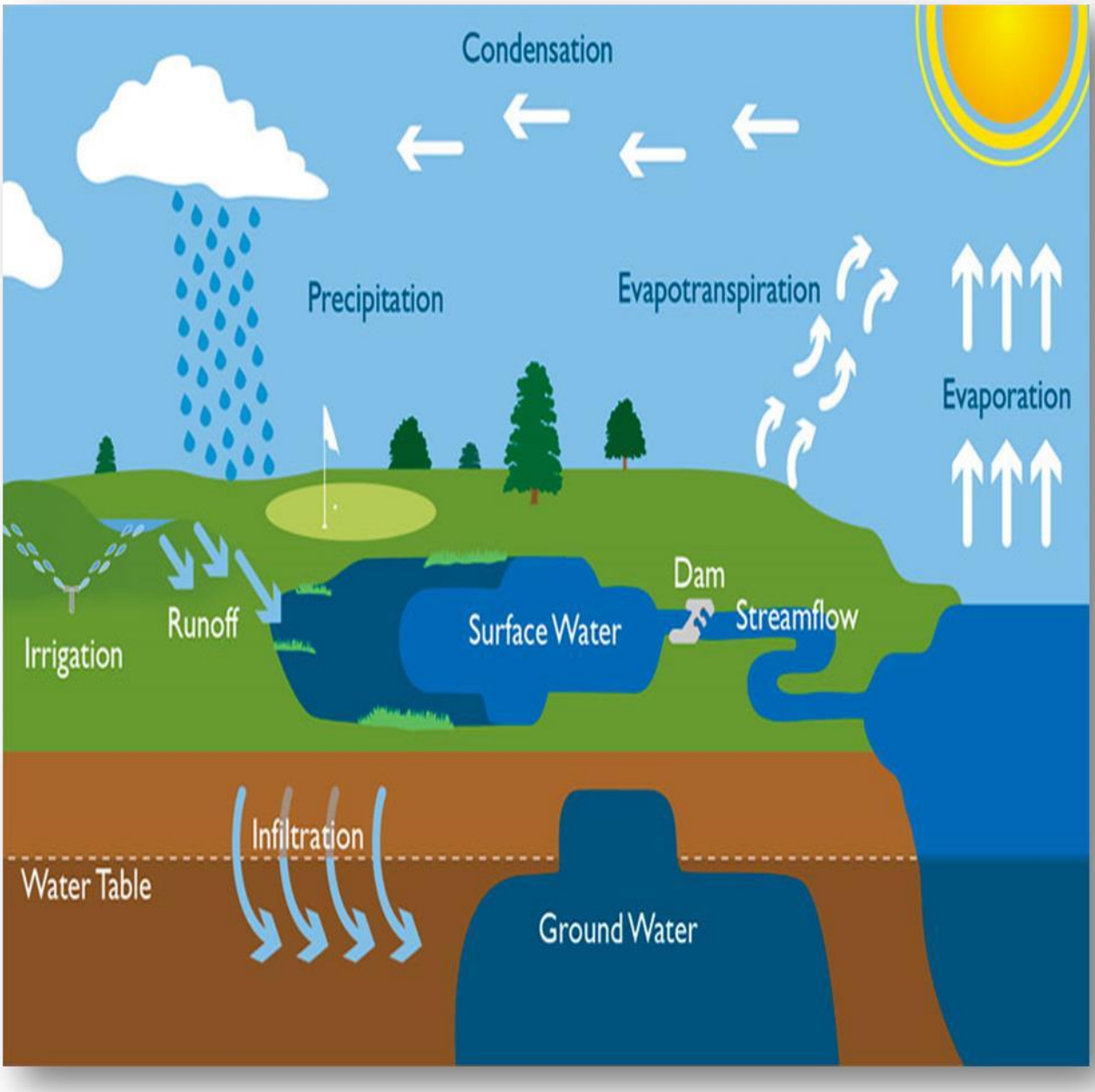
Ethiopia Meteorology Institute



Hydro Meteorological and flood monitoring Bulletin for Kiremt, 2024 impact assessment and Hydro meteorological impact outlook for Bega, 2024/25

Foreword

This seasonal hydro meteorological bulletin is prepared and disseminated by the Ethiopia Meteorological institution (EMI) of Ethiopia, for the purpose of providing hydro meteorological information to different sectors of the community involved in water related activities.

In general, Hydrometeorology is concerned with the study of the atmosphere and land phases of the hydrologic cycle, particularly, on the interrelationships involved. In this bulletin, more emphasis is given to presenting the results of analyses done on the extreme rainfall events as well as the moisture status prevailed over river catchments.

Accordingly, the data used in producing this bulletin are collected from selected indicative meteorological stations, which are believed to represent each of the main river catchments (hydrological regimes) of the country and the results of the hydro meteorological analyses are presented in maps format. Analysis presented in the forms of maps indicates comparisons of the total and extreme monthly rainfall events, monthly mean temperature and aridity index conditions for each basin.

Thus, the information contained in this bulletin is believed to be helpful in monitoring the performances of many hydraulic structures such as culverts, bridges, reservoir spillways, road embankments, dikes, flood prone areas as well as in planning and designing such new structures over the respective basins. It also gives the user an insight into the value as well as the contributions of the hydro-meteorological information towards the accomplishment of water resources assessment and management with respect to sustainable development of the country. Meanwhile, your comments and constructive suggestions are highly appreciated to make the objectives of this bulletin a success.

Director General
EMI
P.O.Box 1090
Tel: 011661-57-79
FAX 00251-11-6625292
Addis Ababa

Web site: - http://www.ethiomet.gov.et
http://www.Ethiopia.ranet.net

I. Introduction

Ethiopia is located between latitudes of 3.8°N to 14.5°N and longitudes of 33°E to 48°E with an area of about 1.12 million km^2. The varied topography of the country shows extreme changes in altitude with its lowest point at about 120meters below sea level (Kobat Sink Afar depression) and its highest point about 4620 meters above sea level (Ras dashen.).These physographic variations create a large difference in meteorological and hydrological condition both by time and space.

From meteorological point of view, there are three seasons in Ethiopia; Belg, Kiremt and Bega.

Belg (February-May) is the small rainy season in Ethiopia. Much of the northeastern, central, southern, southwestern, eastern and southeastern parts of the country receive considerable amount of rainfall during this season.

Kiremt (June-September) is the main rainfall season for most parts of the country except for the lowlands of southern and southeastern Ethiopia.

Bega (October-January) is mostly a dry season for most parts of the country except for southwestern as well as the lowlands of south and southeast Ethiopia.

In general the mean annual rainfall amount ranges from 2400mm (over south western) to 500 and below over the northeastern and southeastern lowlands. Hydro meteorologically a rainy day is considered as the one with 2.5 mm of rain or more but in this publication a rainy day is one regardless of the amount.

In Ethiopia, water resources availability in terms of space shows a marked discrepancy when one goes from east to west. The eastern part of the region compromise 7 catchments with only 11 percent of the water resource and while the west compromise 5 catchments with 89 percent of water resources.

II. Catchments profile

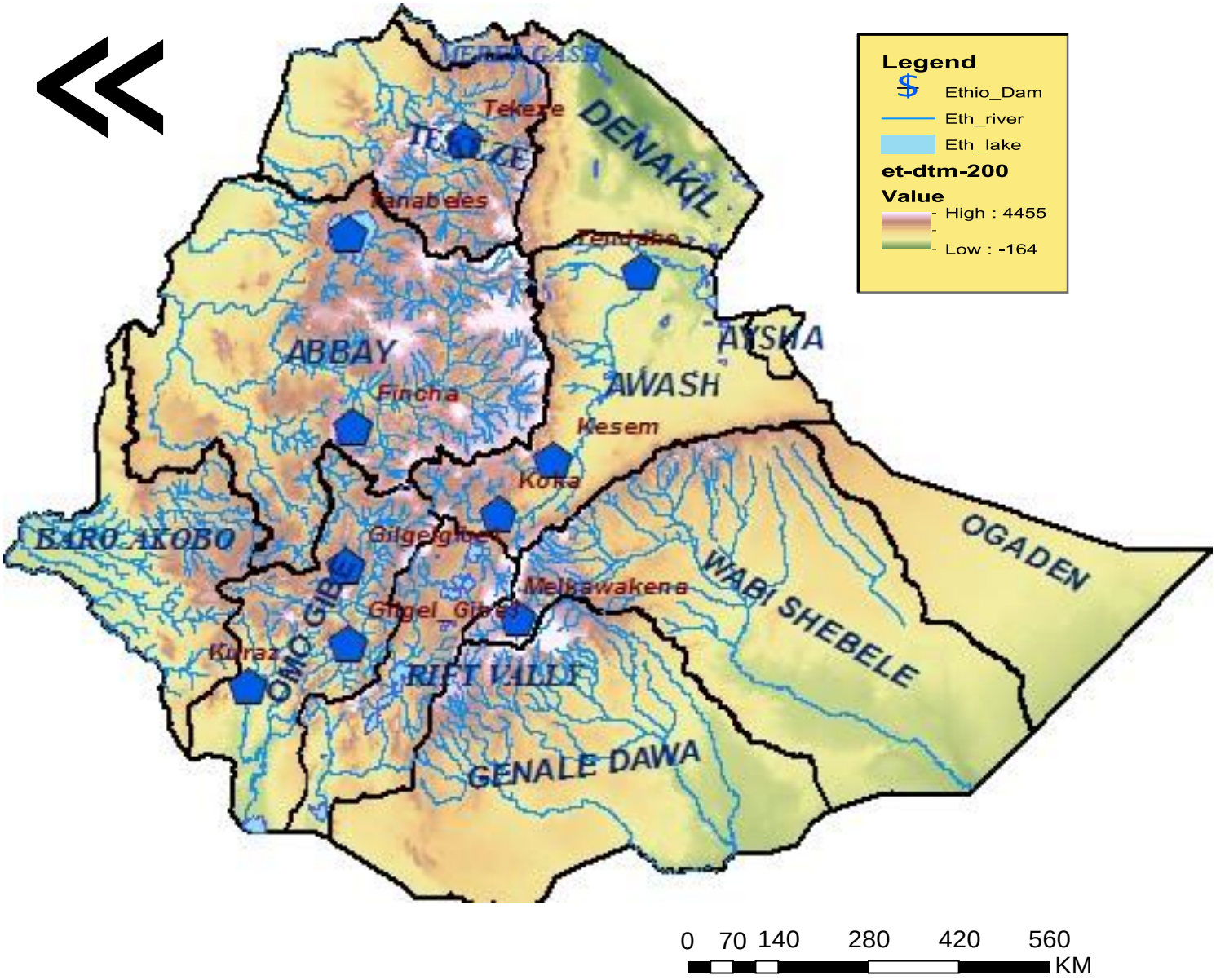
Catchment	**Location**
Mereb – Gash Catchment: -	Northwestern tip of Tigray.
Atbara-Tekeze Catchment: -	The Tekeze River basin is situated in the northwest of Ethiopia between 11 040` and 15 012` N, and 36 0 30` and 390 50` E. It is bordered by the Mereb River basin and by Eritrea in the north, the Atbara River plains in Sudan in the west, the Abay River basin in the south and Danakil basin in the east.
Blue Nile/ Abbay Catchment: -	Roughly 130 N South of Gondar to 110 30'N, and west of 390 45'E of Wello, northwestern parts of Shoa; Gojam except the South Western and Western narrow area, Wellega and extreme Eastern tip of Illubabor together with a narrow northeastern strip of Keffa. It is the largest catchment that covers about 16 percent of the total area of Ethiopia. The Catchment that includes the Lake Tana, Upper Abbay(to Guder confluence),Middle Abbay (to didessa confluence), Didessa, Dabus ,Lower Abbay,Dinder and Rahad Sub-basin.
Baro –Akobo Catchment: -	The south western and western narrow strip of Wellega, except the eastern tip, the whole of Illubabor and southwestern tip of Keffa. The Catchment has upper and lower sub-basins along Baro River. The Catchment It is the wettest catchment because of the highest rainfall over the area.
Danikil – Afar Catchment: -	East of 40^0 E of Tigray, North of 11^0N of Wollo, narrow coastal strip south of $14^0$30'N of Eritrea. The basin is the lowest region in the country where the kobar sink; with an elevation of about 120 meters b.s.l is found.
Awash Catchment: -	North of Garamuleta mountains, south of 11^0 $40^{'}$ N of Wollo, south of 9^0 N of Shoa, Northern tip of Bale and North part of Arsi. The catchment has upper, middle and lower sub-catchments. In general the catchment is narrow at the upper part marked by

	numerous volcanic mountains and wider at the lower part joining major tributaries from northwestern highlands and a number of seasonal wadies from the southeast highlands.
	Gulf of Aden – Aysha Catchment): - Eastern narrow strip of Hararghe. It is a very dry area with no stream flow representative meteorological station. Thus, no assessment is done for this catchment in this publication**.**
Omo-Ghibe Catchment: -	Southwestern narrow strip of Shoa, the whole of Keffa except the southwestern tip, southwestern tip of Wellega, Western half of northern Omo and northwestern tip of Sidamo. The upper part of the catchment starts from the plateaus in north part of Ghibe and extends southward to the lower part of it (known as Omo River).
Central Lakes-Rift Valley Catchment: -	The whole of North and South Omo, west and southwestern narrow strip of Sidamo, southwestern portions of Shoa and western narrow tip of Bale and western part of Arsi. The catchment is found in the Great Rift Valley system and typically known by its lakes and streams. Lakes which adjoin the awash catchment are found in its upper part, while Lake Awassa and Bilate in its central part and end to chamo bahr in its lower part**.**
Genale Dawa Catchment: -	The western half of Bale (South of Goba) and southeast, southwestern and northeastern parts of Sidamo. The catchment constitute three river systems namely Dawa ,Genalle and Wabi Gestaro that meet each other before they cross the Ethio-Somalia border.

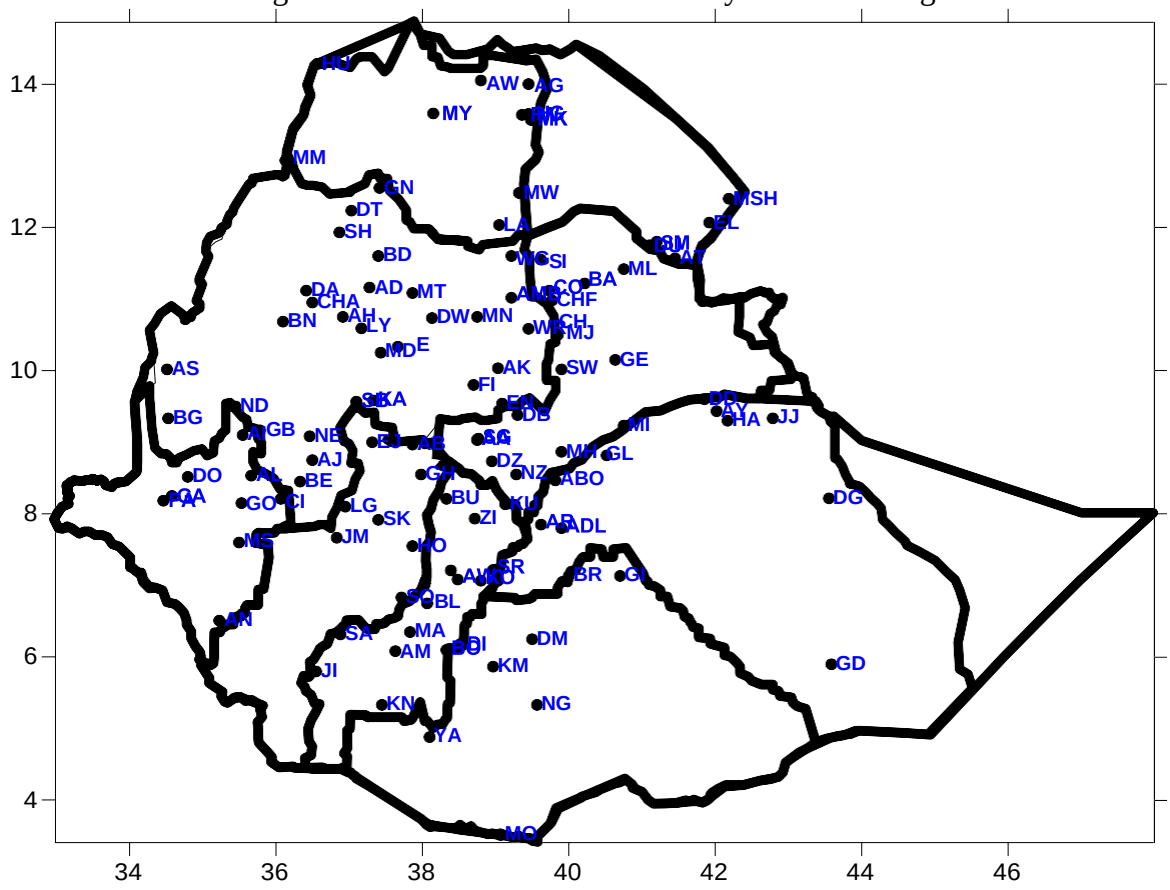
III. Major River Catchments in Ethiopia, Location and Spatial Status

No.	Catchement Name	Area ($km^{2)}$	Length in Kilo meter			Volume of water bm^3/Annum	Altitude (meter)
			Within Eth.	Outside Eth.	*Total*		***Peaks*** **(Highest & Lowest)**
01	Mereb-Gash	5,700	440	160	600	0.15	North tip of Tigray
02	Tekaze – Atbar	90,001	608	560	1168	8.13	4620 Ras Dashen 125 Tikil -Dengay
03	Blue Nile(Abbay)	204,100	800	650	1450	52.62	4231 Guna 200 Horekelife
04	Baro - Akobo	75,912	227	280	557	23.55	3700 Masha 410 Jikawo
05	Afar (Denakil)	62,882	-	-	-	0.86	
06	Awash	112,696	1200	-	1200	4.6	4000 N.Shewa 4001 NW mt. 4002 of A.A 250 L.Abe
07	Aysha	2223				0.86	
08	Omo-Ghibe	78,213	760	-	760	17.96	4203Guge/Gurage Mt. 195 Chiri
09	Rift valley	54,900	-	-	-	5.63	
10	Genale - Dawa	171,042	480	570	1050	5.88	4310 Bale mt./Batu 500 Dolo Odo
11	Wabi - Shebele	205,697	1340	660	2000	3.16	3626 Mt.Gololcha 200 Somalia Desert
12	Ogaden	77,121	-	-	-	-	1500 Turkile 350 Gelad

IV. Basin map of Ethiopia



V. Meteorological Station distribution used for hydro meteorological Bulletin.



STATION	CODE	STATION	CODE	STATION	CODE	STATION	CODE
A.A (Bole)	**AA**	Cheffa	**CHF**	Gonder	**GN**	Mille	**ML**
Abomsa	**ABO**	Chercher	**CH**	Gore	**GO**	Mira Abaya	**MR**
Adet	**AD**	Chira	**CI**	Hageremariam	**HG**	Motta	**MT**
Adigrat	**AG**	Combolcha	**CO**	Harer	**HA**	Moyalle	**MO**
Adwa	**AW**	Dangla	**DA**	Hossana	**HO**	Mytsebery	**MY**
Aira	**AI**	Debrebrhan	**DB**	Humera	**HU**	Nazaret	**NZ**
Alem ketema	**AK**	Degehabur	**DG**	Jijiga	**JJ**	Nedjo	**ND**
Alemaya	**AY**	Debremarkose	**DE**	Jimma	**JM**	Negele	**NG**
Alge	**AL**	Debre Tabore	**DT**	Jinka	**JI**	Nekemt	**NE**
Ambamariam	**AMB**	Debre Zeit	**DZ**	Kachise	**KA**	Pawe	**PA**
Ambo	**AB**	DembiDolo	**DO**	Kibremengist	**KM**	Sawla	**SA**
Arbaminch	**AM**	Dilla	**DI**	Konso	**KN**	Sekoru	**SK**
Arjo	**AJ**	DireDawa	**DD**	Kulumsa	**KU**	Semera	**SM**
ArsiRobe	**AR**	Dolomena	**DM**	Koffele	**KO**	Freweyni	**FW**
Assaita	**AT**	Dubti	**DU**	Konso	**KN**	Shahura	**SH**
Assossa	**AS**	Ejaji	**EJ**	Kulumsa	**KU**	Shambu	**SB**
Awassa	**AW**	Elidar	**EL**	Lalibela	**LA**	ShewaRobit	**SW**
Ayehu	**AH**	Enewary	**EN**	Layber	**LY**	Shire	**SR**
Aman	**AN**	Elidar	**EL**	Limugenet	**LG**	SholaGebeya	**SG**
Bale Robe	**BR**	Enewary	**EN**	Maichew	**MW**	Sirinka	**SI**
BahiDar	**BD**	Fitche	**FI**	Mankush	**MA**	Sodo	**SO**
Bati	**BA**	Gambella	**GA**	Masha	**MSH**	WegelTena	**WT**

Beddele	**BE**	Gelemso	**GL**	Mehalmeda	**MD**	Wereillu	**WR**
Begi	**BG**	Gewane	**GE**	Mekaneselam	**MN**	Yabello	**YB**
Blate	**BL**	Ghion	**GH**	Mekele	**MK**	Ziway	**ZY**
Bui	**BU**	Gimbi	**GB**	Metehara	**ME**		
Bullen	**BN**	Ginir	**GI**	Meisso	**MS**		
Chagni	**CG**	Gode	**GD**	Metema	**MM**		

The above stations have five basic meteorological elements they send daily records for Addis Ababa main office of EMI. We use the meteorological elements which are the main factors for hydro meteorological impacts. These are rainfall, temperature, wind speed, evaporation and sunshine duration. This information is important to guide for different water resource activities.

1. **Kiremt season description**

Kiremt from June to September is mostly wet to very wet season for most parts of the river basin except south and south eastern basins such as lower and middle Wabishebele, lower Rift valley, lower OmoGibe, middle and lower Genale Dawa catchments. It has significant important for water resource of the country. The main source of runoff is Kiremt seasonal rainfall, which occur high flow period and maximum availability of surface and ground water over those catchments.it is known that Kiremt season rainfall covers the water demand of all reservoir and river basin water storage. Dam, reservoir and ponds can capture the highest volume of water during this season. The occurrence of flood and land slide is widely known phenomenon over flood prone area and rugged surface of the country during Kiremt season respectively.

Methods

To compute the aridity index we use Thornthwait method, which is computed from the monthly values of rainfall and evaporation. The evaporation is computed empirically from mean monthly air temperature. In assessing the effectiveness of rainfall, in terms of water availability relationships between the rainfall and air temperature has been worked out in terms of moisture indices. The aridity index values above 350 which shaded in Blue green very wet and 128 were show wet condition. Light green humid, yellow sub- humid and red values show dry condition.

Where RF= monthly rainfall in mm; T= monthly mean temperature in °C

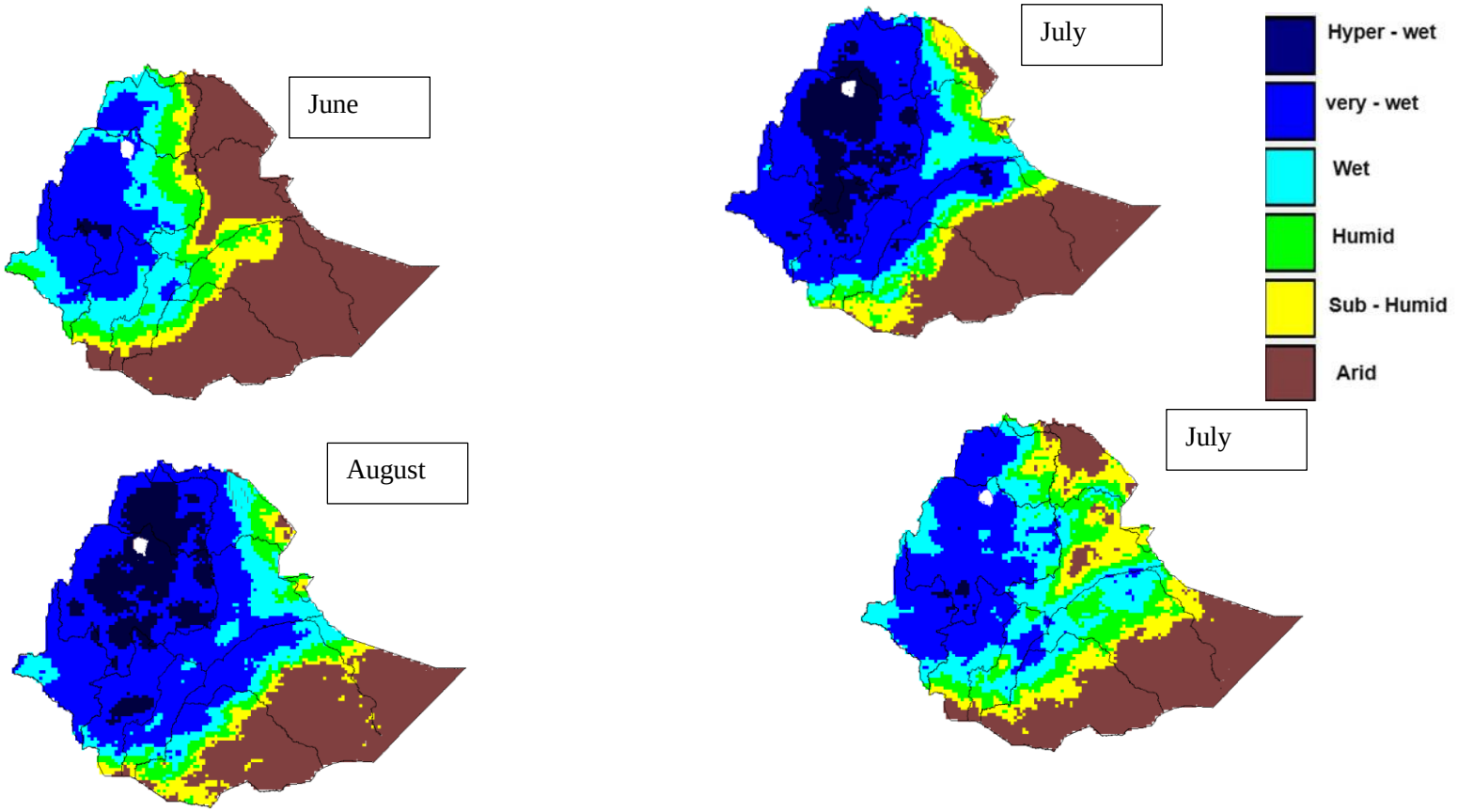
2. Aridity status for Kiremt 2024 at different river basins

June:- In this month, part Abay, BaroAkobo, Tekeze, upper and middle Omo gibe, central rift valley, upper Awash , wabe shebele and Genale Dawa, River basins have experienced humid to wet moisture condition.

During: July wet moisture condition has increase from western Shift to northern and north east catchments, especially to Wards into Kiremt benefiting catchments during this month most Abay, Tekeze, Afar Danakil, Awash, OmoGibe, Central Rift valley; upper Wabeshebele and Genale Dawa had Humid to wet moisture condition.

August during this month most of Abay, Tekeze, Afar Danakil, Awash, OmoGibe, Central Rift Valley ,upper and middle GenaleDawa, upper Wabeshebele and Ogaden basins experienced humid to very wet and additionally upper and middle Abay ,Tekeze and middle OmoGibe had experience Hyper wet conditions.

September , this month moisture condition shift form east and north east to south west and western catchments inline to this most of Abay, BaroAkobo, OmoGibe ,upper and middle Wabeshebele, upper Genale Dawa, and few place of Afar Danakil had experienced sub humid to wet moisture condition. Shown below in figure 1



(Fig.1) Aridity Index for June, to September 2024.

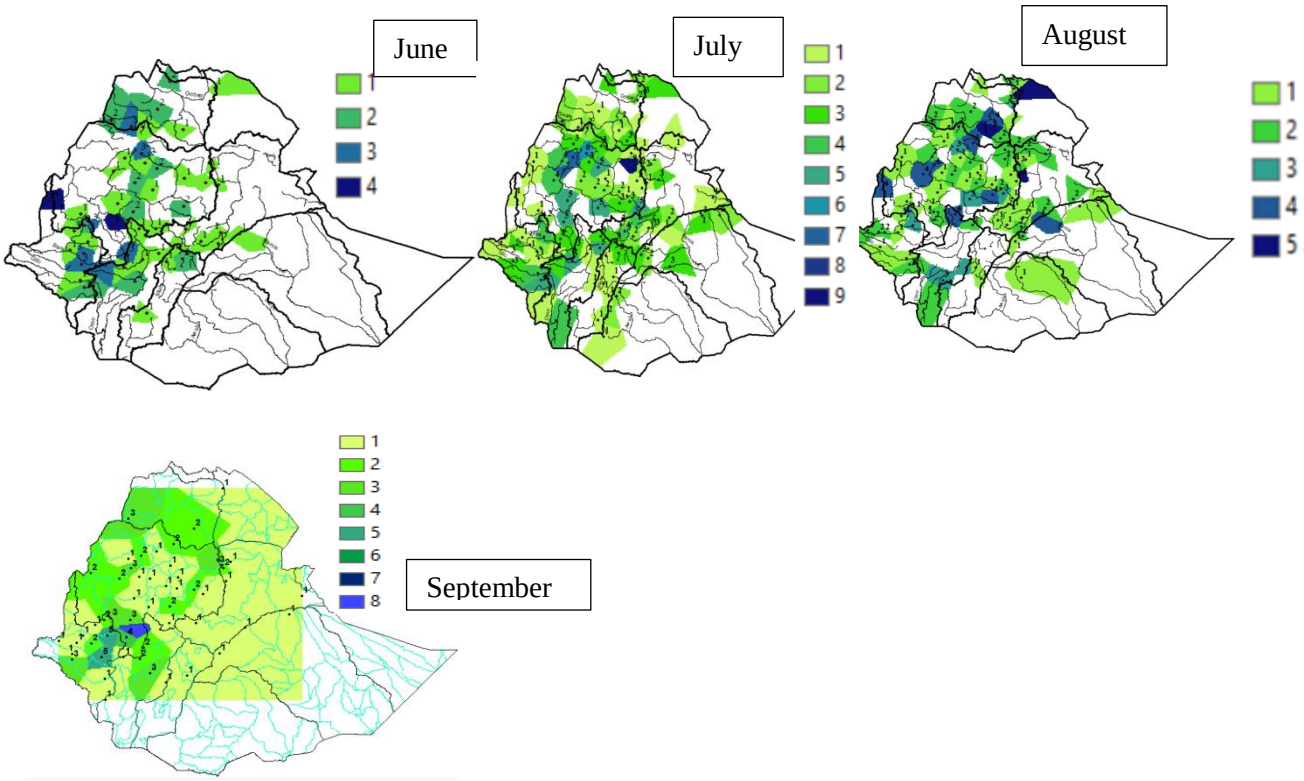
Distribution of heavy fall days exceeding 30mm during June to September 2024 over different river basins.

In June, heavy fall frequency was recorded over Abay, Baro-Akobo, Omo-Gibe, and Rift-Valley, Catchments. Maximum frequency of heavy fall days was observed over Abay catchment for 4 days.

July 1-9 day's heavy fall was observed over most of Abay station, BaroAkobo station, Tekeze station, upper and middle Awash, Omo Gibe, and few Afar Danakil stations. Maximum frequency of heavy fall observed over Abay for 9 Days

August: During this month heavy fall frequency observed over most of Abay, Baro Akobo, Tekeze, OmoGibe, and upper Central Rift Valley.

September: During this year Heavy fall frequency observed over most of Abay station, BaroAkobo station, upper and middle Tekeze station, OmoGibe stations, Maximum heavy fall frequency for 8 days over Middle Abay basin at Arjo station.



Distribution of heavy fall exceeding 30 mm per day over different river basins 2024

(Fig 2) **Distribution of Heavy fall June to September 2024.**

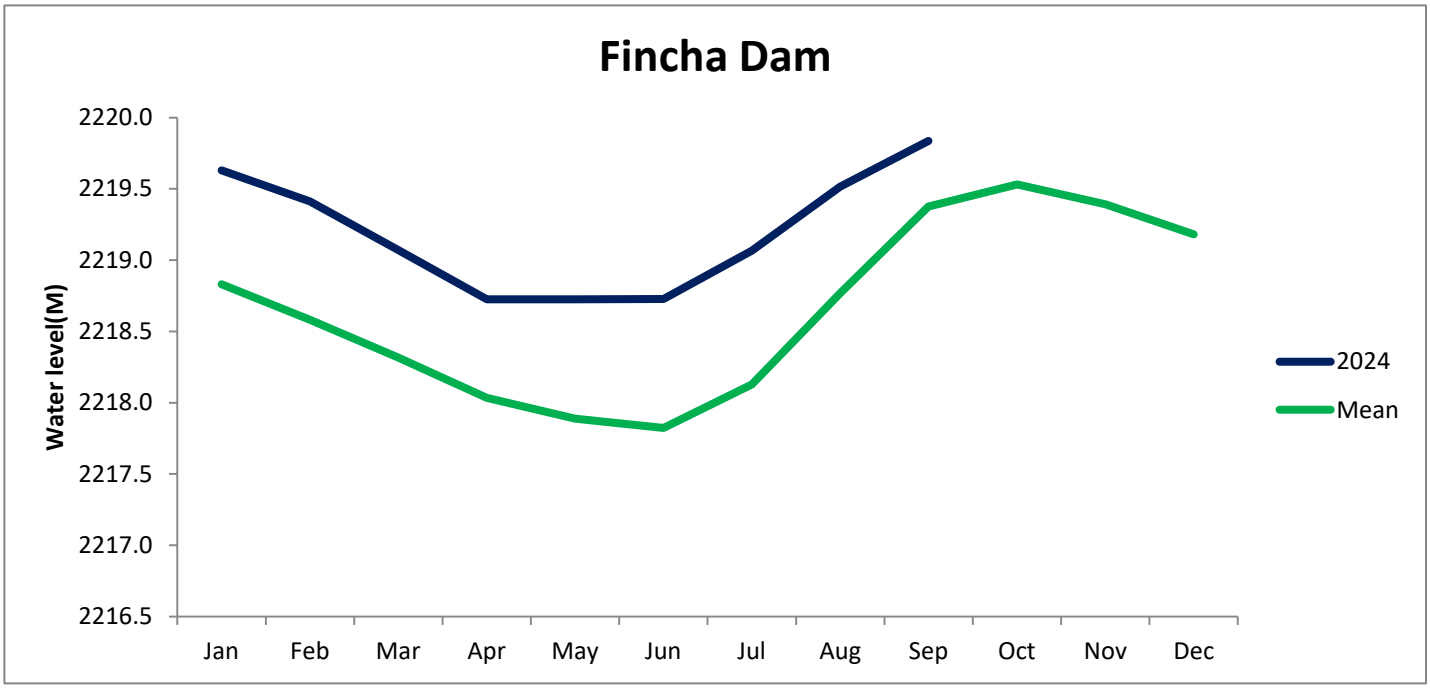
3. Performance of Dams and Reservoirs water level in Kiremt 2024 season compared to long mean

The main source of runoff is rainfall which is the input for Dams, reservoirs and ponds. Kiremt season is the main source water and flow of River is high during this period. The current

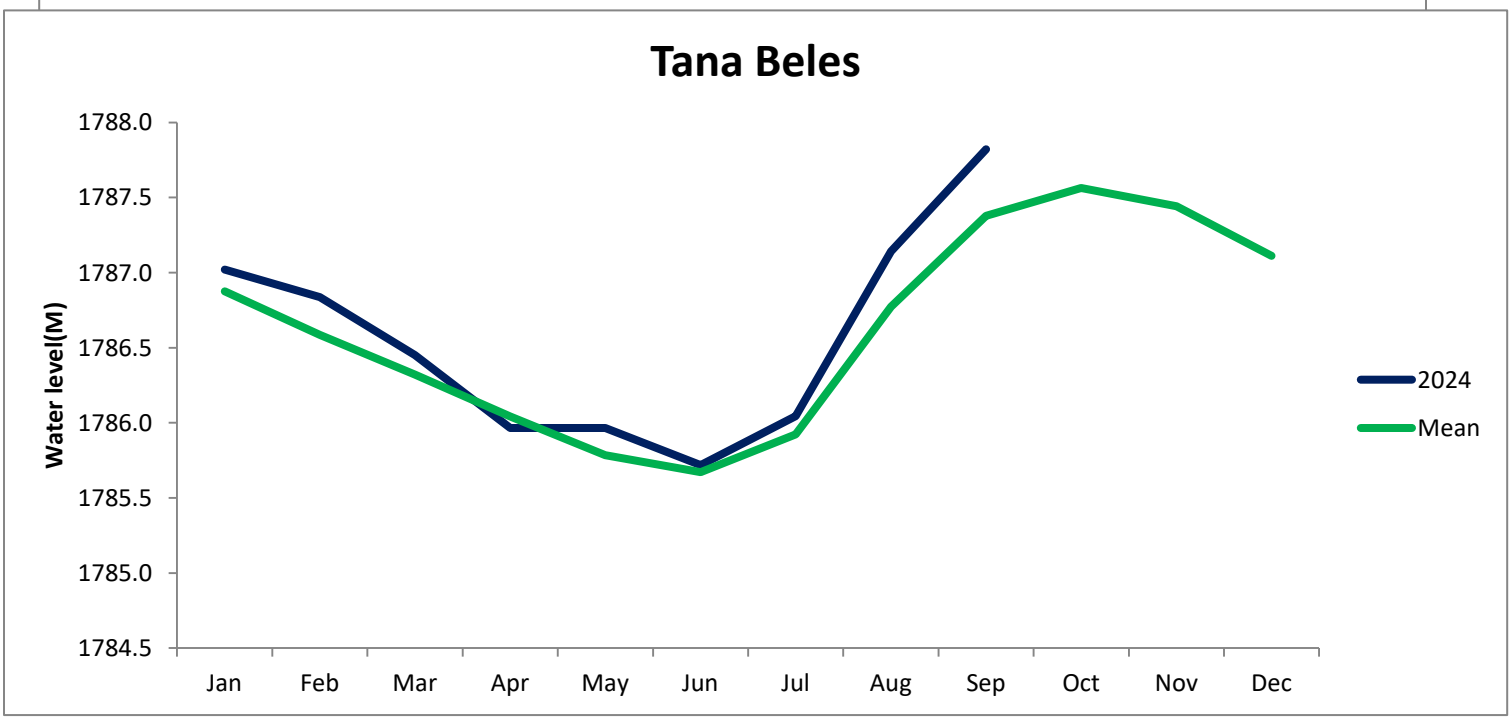
year Kiremt 2024 rainfall had better condition to all man made Dam, natural river, other water body and reservoir experience good performance except Gilge Gibe 3, shown below in figure (4a-h).

Data source: EPA (NGCC)

a,

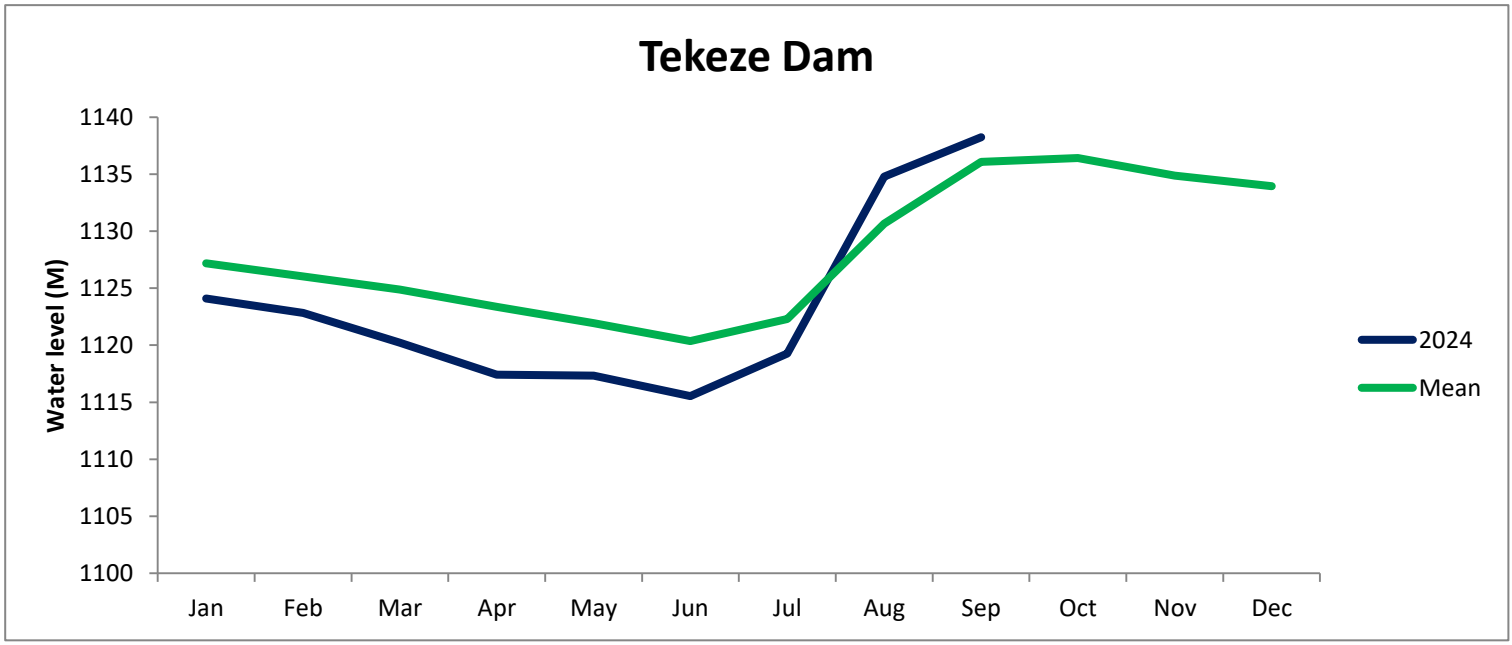


b,

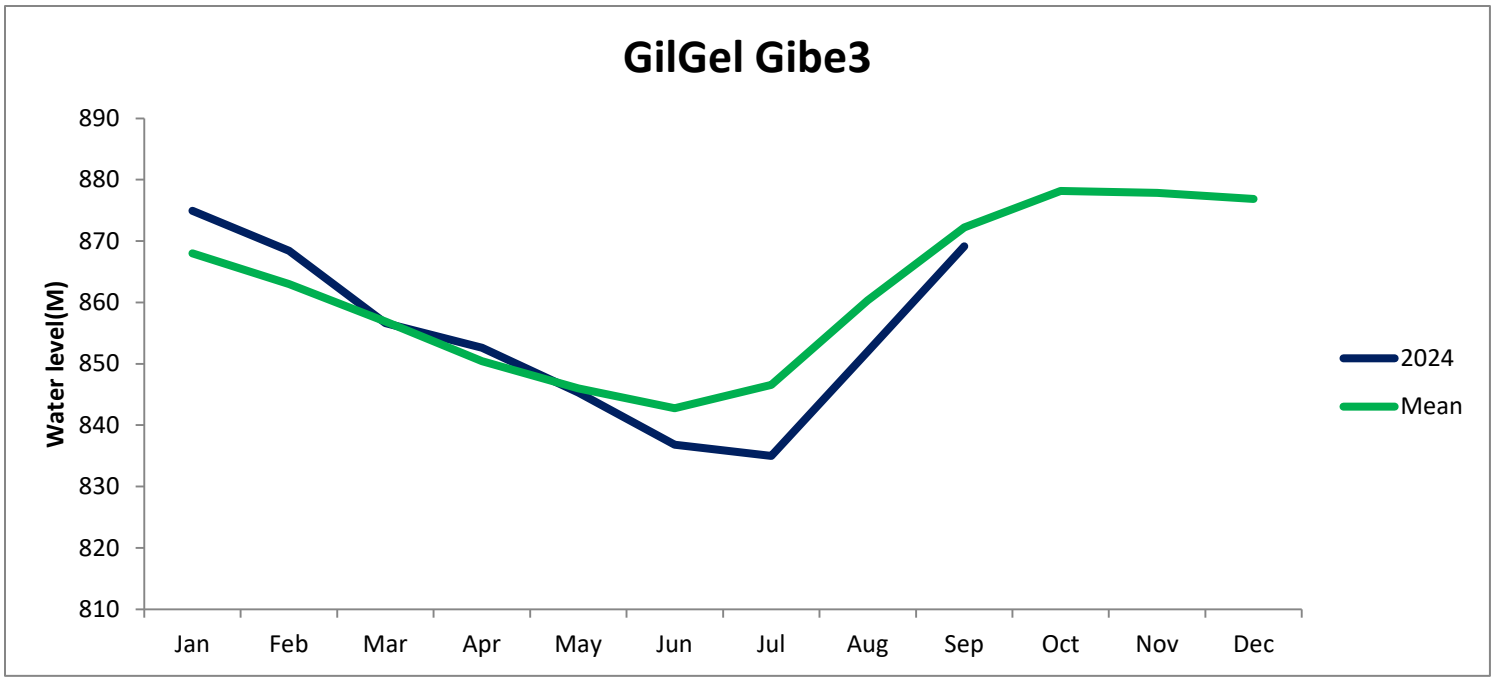


c

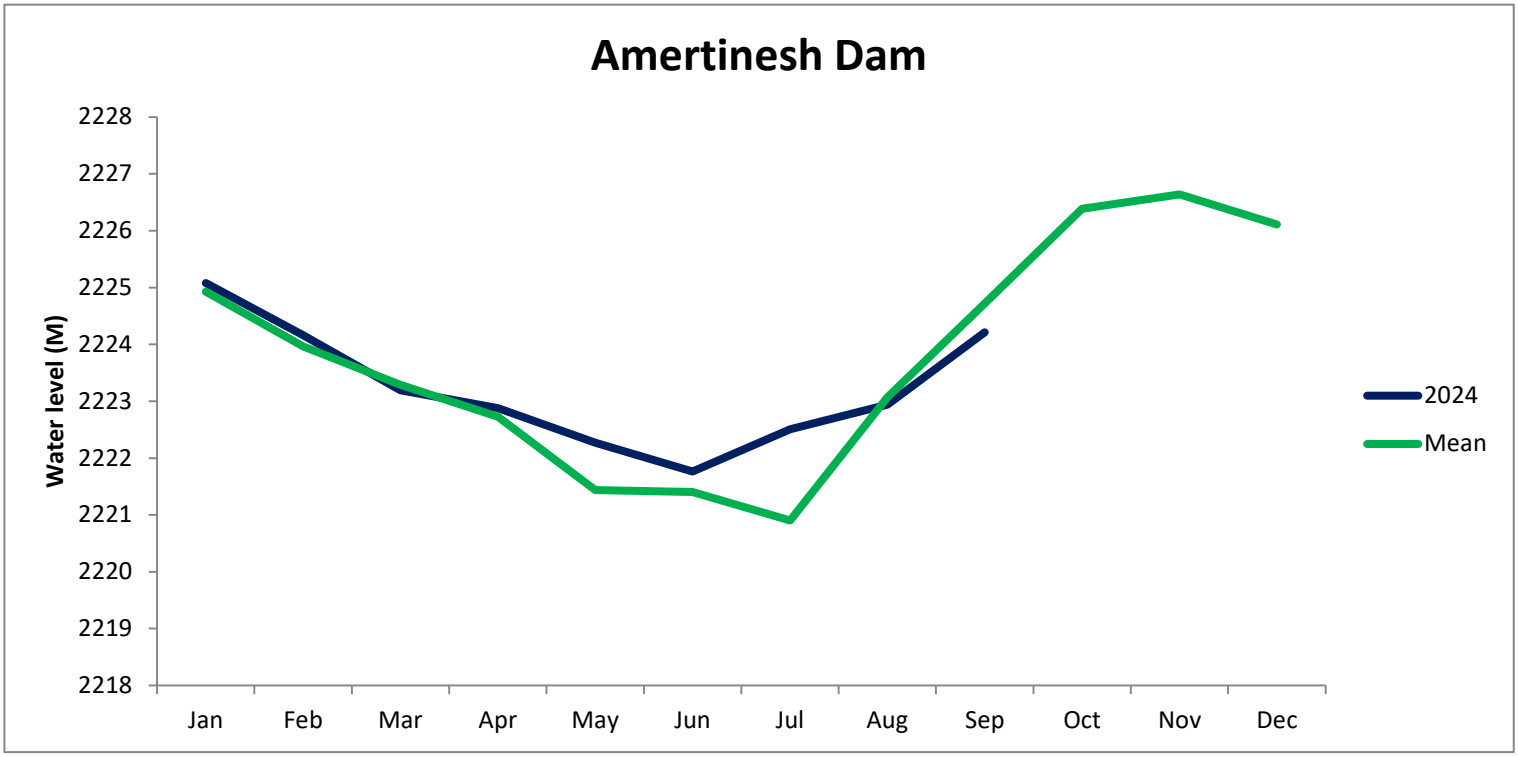
d


Tekeze Dam
Water level (M)
1140
1135
1130
1125
1120
1115
1110
1105
1100
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2024
Mean

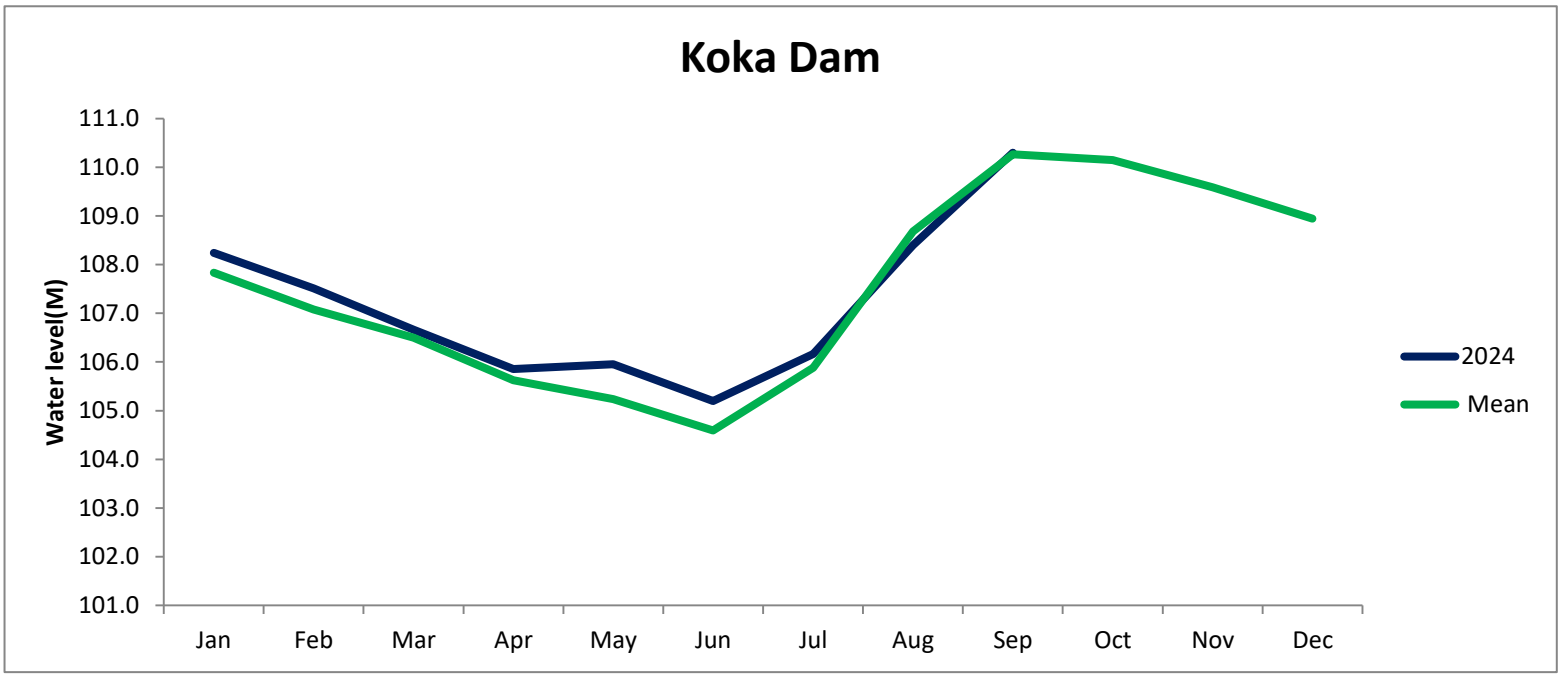
e


GilGel Gibe3
Water level(M)
890
880
870
860
850
840
830
820
810
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2024
Mean

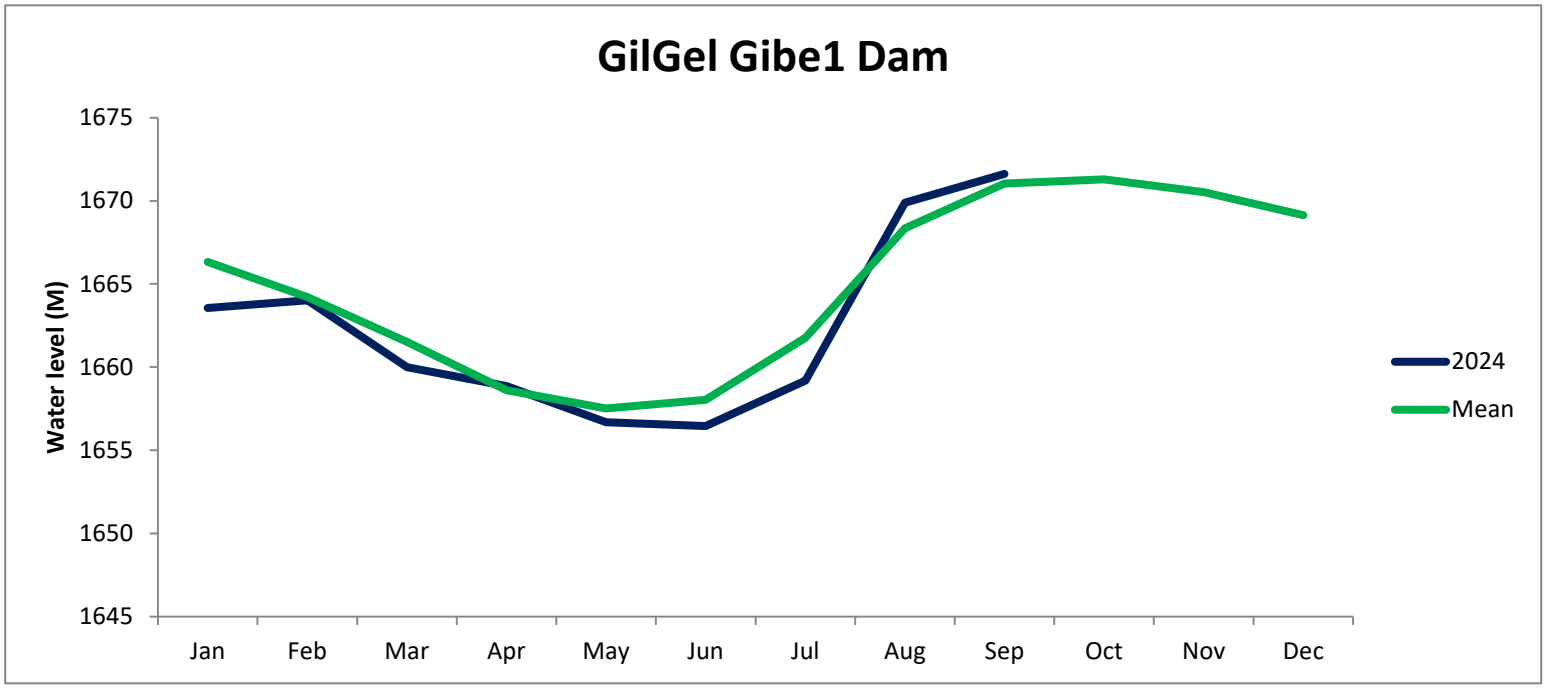
f


Amertinesh Dam
Water level (M)
2228
2227
2226
2225
2224
2223
2222
2221
2220
2219
2218
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2024
Mean

g


Koka Dam
Water level(M)
111.0
110.0
109.0
108.0
107.0
106.0
105.0
104.0
103.0
102.0
101.0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2024
Mean

h


GilGel Gibe1 Dam
Water level (M)
1675
1670
1665
1660
1655
1650
1645
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2024
Mean

(Fig.4a-h) Water level of different dams.

4. Summary

In **June to September most** part of Abay, BaroAkobo, Tekeze, OmoGibe, Upper and middle central Rift Valley, upper Wabishebele, and Genale Dawa had experience humid to wet moisture condition. During July and September maximum heavy fall frequency experienced July 9 days and September 8 days respectively. This condition has positive impact for water availability over Kiremt Benefiting catchments. Inline to this most dams of the country had good performance compared to current status in to Average long mean performance.

Conclusion

- The moisture performance of Kiremt 2024 was experienced under humid to very wet condition over most river basins. and after July some catchments had hyper moisture conditions
- Better moisture performance was observed in July over most catchments of southern, south west, north eastern, Central and western catchments of the country.
- Reservoirs and dams water level performance have shown better status in comparison to the mean.

Hydro-meteorological outlook for Bega 2024-25 over different river basins

1. **Introduction**

Bega from October to January is mostly an arid season for most part of the river basin except Ogaden, Lower and middle Wabeshebele, lower OmoGibe middle and lower Genale Dawa as well as lower central rift valley catchments. The main rainy month Bega season is October and November provides rainfall mainly for southern, south eastern and south western catchments. Sunny and windy condition dominated across many river basin thus it increase the loss of water by Evaporation. Availability of water is also decrease across upstream of main river basin. In some years unseasonal rain slightly fevered for water availability.

2. **Selected analogue Year**

For the coming Bega season the selected analogue year**1995/96 and 2020/21** Were compared based on probabilistic seasonal forecast for **Bega 2024/25** and viewed out on catchments based map using geostatistical kriging method. Among those **2020 is** the best analogue years that can inform the Aridity status in the coming Bega season.

3. **Methodology**

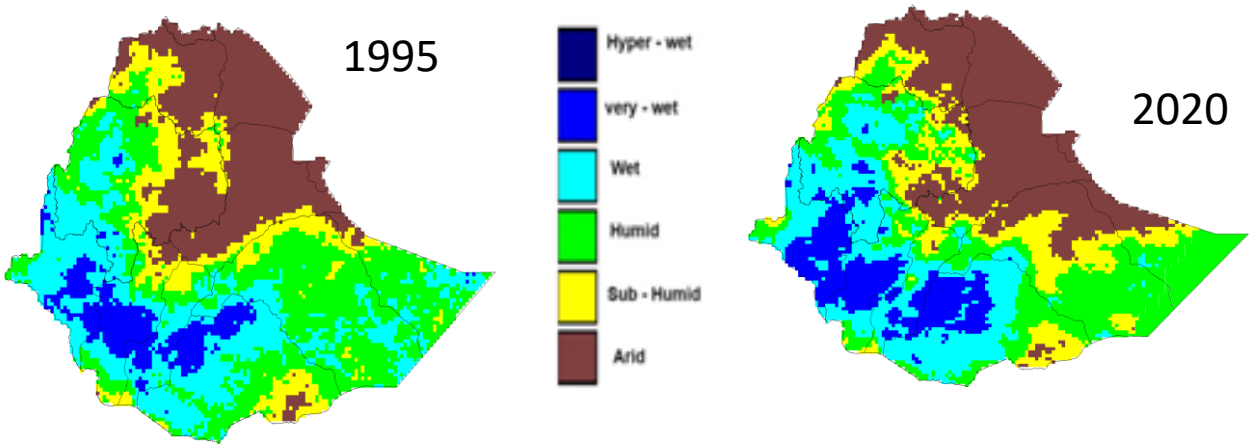
Thornthwaite introduced the concept of the precipitation effectiveness index, which is computed from the monthly values of rainfall and evaporation. The evaporation is computed empirically from mean monthly air temperature. In assessing the effectiveness of rainfall, in terms of water availability relationships between the rainfall and air temperature has been worked out in terms of moisture indices.

Where, Rf= monthly rainfall in mm;

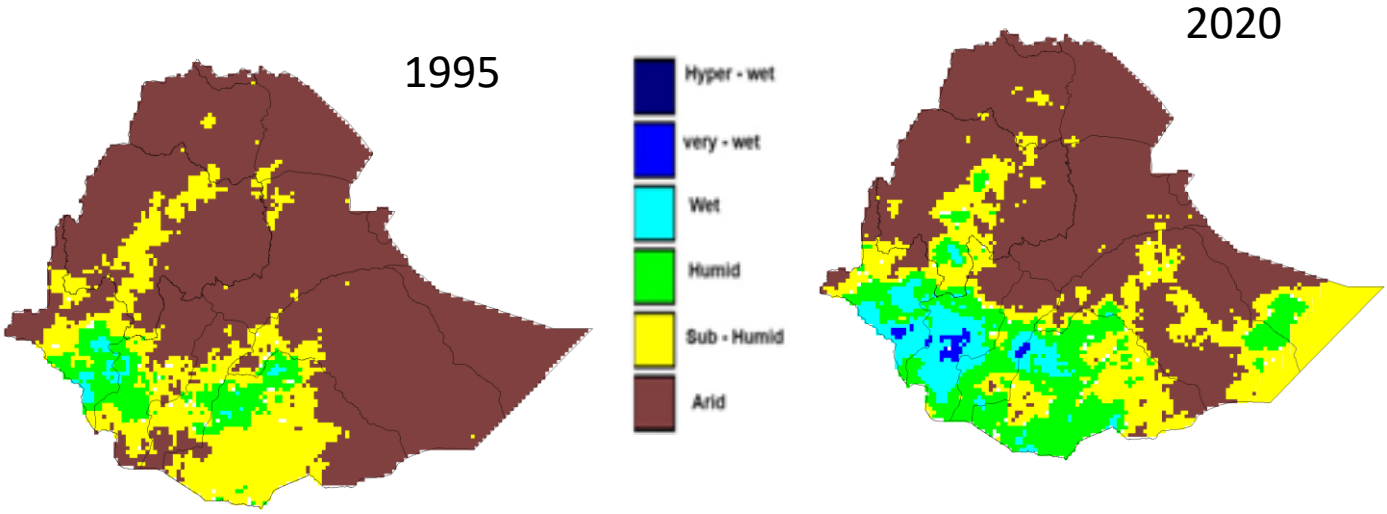
T = mean monthly temperature in C°

1. **October** - Based on the three analogue years, Bega moisture benefiting catchments start getting some amount of moisture over most basins, this Bega status the most of BaroAkobo,

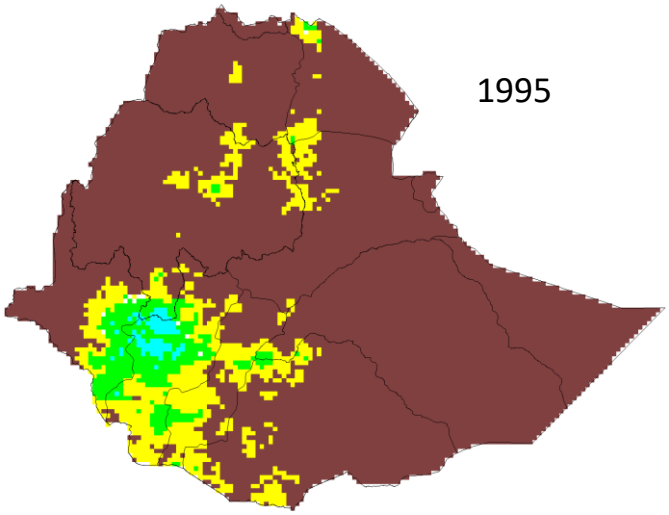
Wabeshebele, GenaleDawa, Ogaden, and lower Abay basin had performed sub-humid and wet moisture condition.

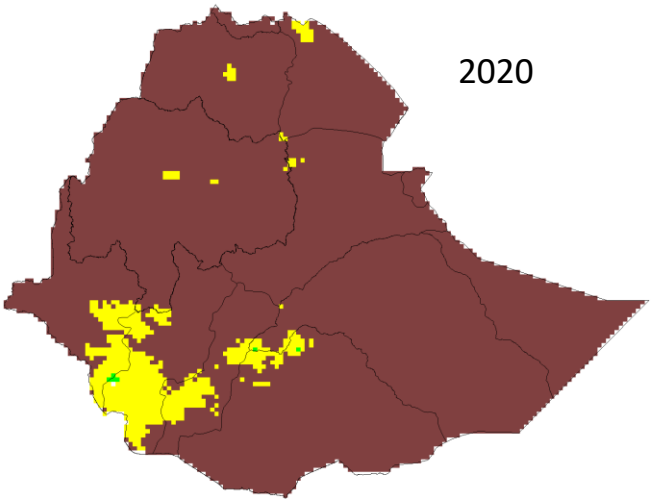


November:- In this month, there would be starting spatial distribution moisture become decreasing compared to the previous month october. According to this, except middle and lower OmoGibe, upper and Middle BaroAkobo, GenaleDawa and lower Ogaden showed domination of arid moisture condition.

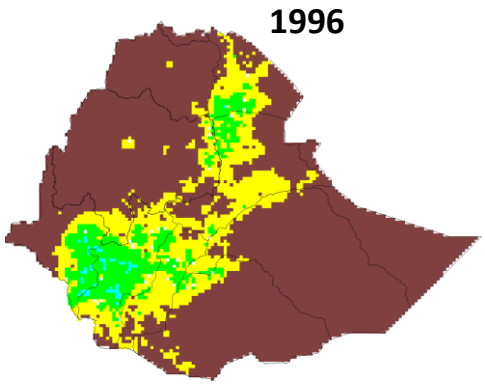


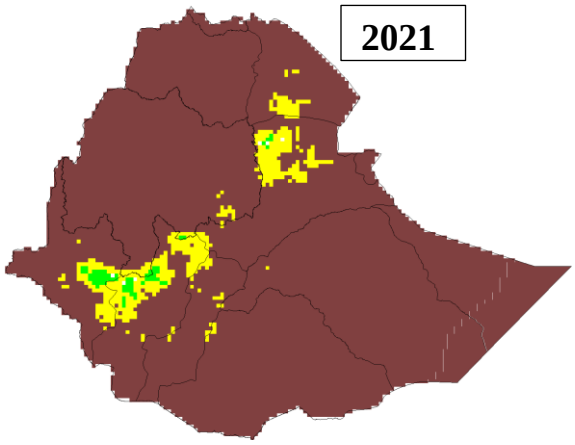
2. **December**:-In this month dry moisture distribution performed across Bega benefiting catchments. Whereas: middle and lower Omo Gibe, Rift valley, GenaleDawa, upper and middle BaroAkobo, catchments were performed under sub humid to humid moisture condition. The rest most basins under arid moisture condition.





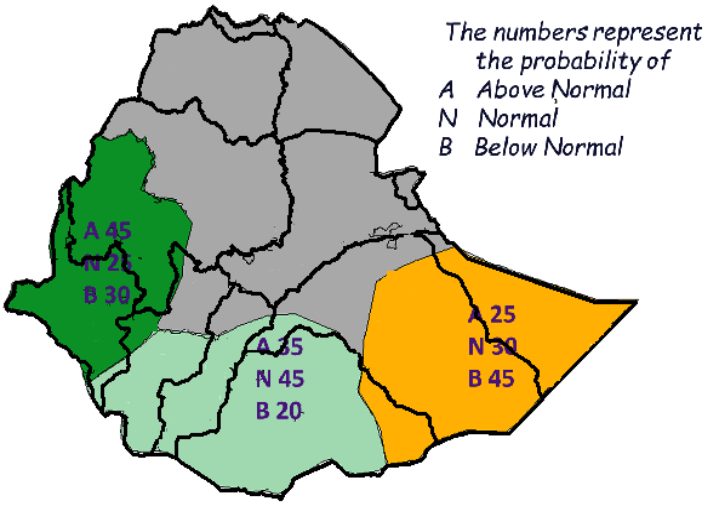
3. **<u>January</u>: -** During this month, dries month of the season of Bega therefore most River basins had dominate Arid moisture condition However, during 1996 analogue year most of OmoGibe and central rift valley, few area of Eastern lower Awash had hub humid condition.





Hydro-Meteorological Summery and advisory for coming Bega (ONDJ), 2024-25

Tercile probability map of Bega 2024/25



Positive impact

- improve water level on rivers for small irrigation farms and livelihood
- get better availability of moisture condition for water resources over southern half and belg benefit of river basins in october and November 2024

Negative impact

- The **performance** Water availability in **south and southeastern catchments can be** Negatively affecting due to insufficient moisture conditions in the basin
- Early depletion of water resources; may lead to scarcity on surface and ground water resources.
- During Bega **sunny and windy weather condition** may cause the rate of evaporation .

Advisory

- Wisely using and effective water management.
- Identify and emphasize water shortage Area.
- Manage demand water.
- Save water for sustainable use.
- Managing day to day activities from water pollution and depletion.
- store Water for later use during dry months.
- Reservoirs (artificial lakes) constructed behind dams in rivers can collect water during wet period**.**