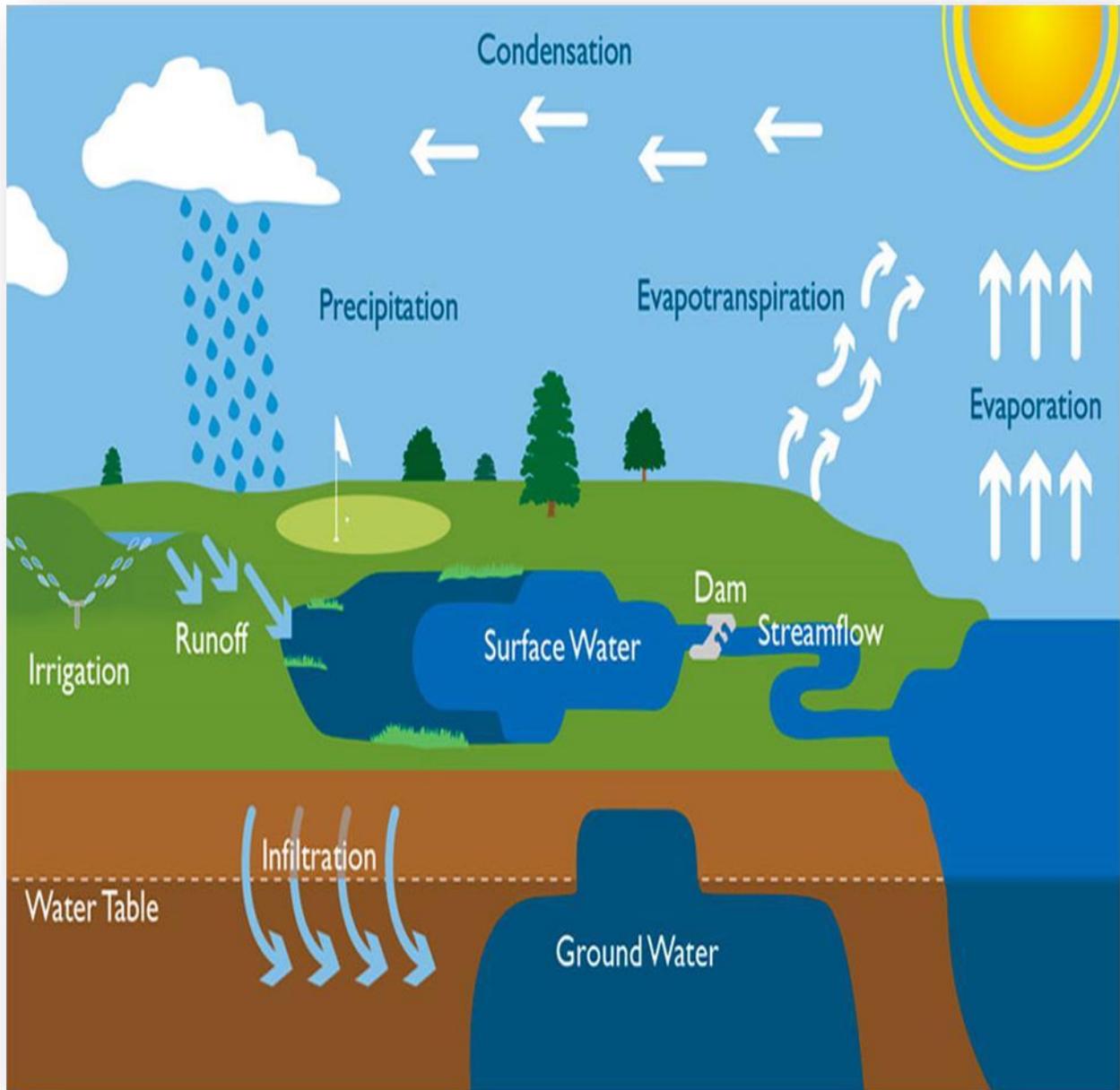


# Ethiopia Meteorology Institute



Hydro Meteorological and flood monitoring Bulletin for Bega, 2025/26  
impact assessment and Hydro meteorological impact outlook for Belg,  
2026

## **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.

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## 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<sup>2</sup>. The varied topography of the country shows extreme changes in altitude with its lowest point at about 120 meters below sea level (Kobat Sink Afar depression) and its highest point about 4620 meters above sea level (Ras dashen.). These physiographic 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 comprises 7 catchments with only 11 percent of the water resource and while the west comprises 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° 04' and 15° 02' N, and 36° 03' and 39° 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 39° 45' E of Wollo, 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 Tena, 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.

Danakil – Afar Catchment: -

East of 40° E of Tigray, North of 11° N of Wollo, Narrow coastal strip south of 14° 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° 40' N of Wollo, south of 9° 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.

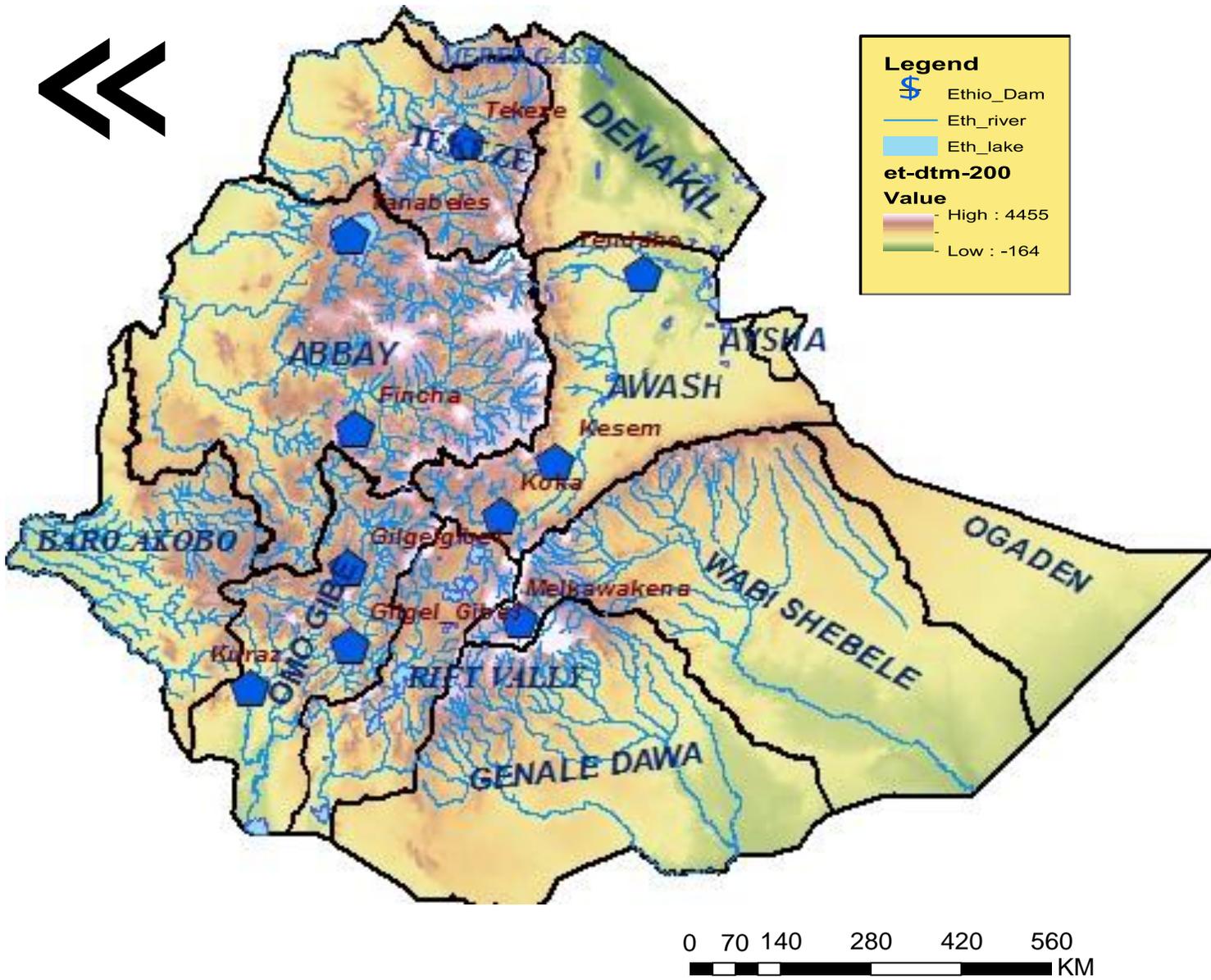
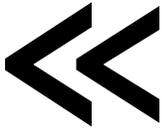
Genale Dawa Catchment: -

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.

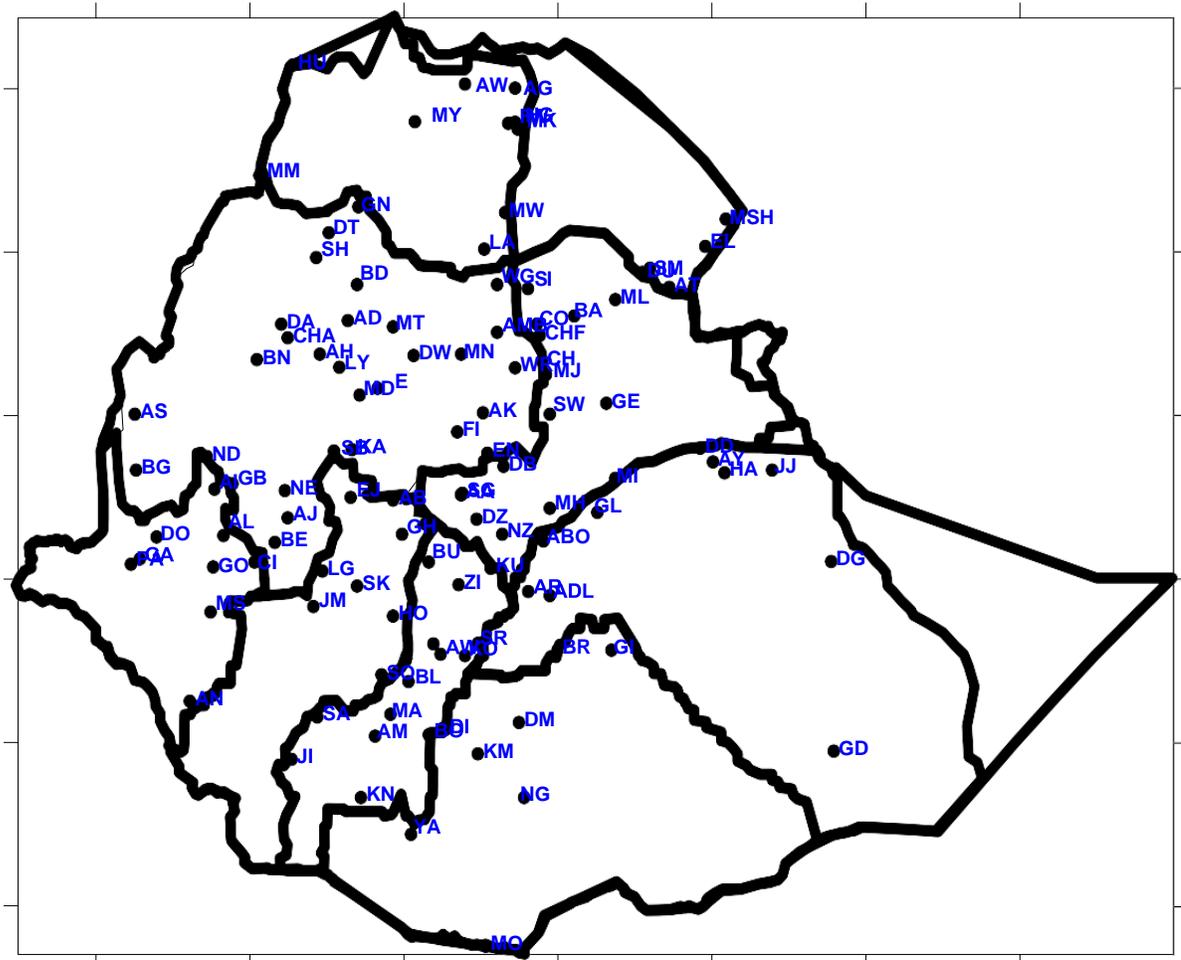
### III. Major River Catchments in Ethiopia, Location and Spatial Status

No.	Catchement Name	Area (km <sup>2</sup> )	Length in Kilo meter			Volume of water bm <sup>3</sup> /An num	Altitude (meter)  <i>Peaks (Highest &amp; Lowest)</i>
			Within Eth.	Outside Eth.	<i>Total</i>		
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.



<b>STATION</b>	<b>CODE</b>	<b>STATION</b>	<b>CODE</b>	<b>STATION</b>	<b>CODE</b>	<b>STATION</b>	<b>CODE</b>
A.A (Bole)	<b>AA</b>	Cheffa	<b>CHF</b>	Gonder	<b>GN</b>	Mille	<b>ML</b>
Abomsa	<b>ABO</b>	Chercher	<b>CH</b>	Gore	<b>GO</b>	Mira Abaya	<b>MR</b>
Adet	<b>AD</b>	Chira	<b>CI</b>	Hageremariam	<b>HG</b>	Motta	<b>MT</b>
Adigrat	<b>AG</b>	Combolcha	<b>CO</b>	Harer	<b>HA</b>	Moyalle	<b>MO</b>
Adwa	<b>AW</b>	Dangla	<b>DA</b>	Hossana	<b>HO</b>	Mytsebery	<b>MY</b>
Aira	<b>AI</b>	Debrebrhan	<b>DB</b>	Humera	<b>HU</b>	Nazaret	<b>NZ</b>
Alem ketema	<b>AK</b>	Degehabur	<b>DG</b>	Jijiga	<b>JJ</b>	Nedjo	<b>ND</b>
Alemaya	<b>AY</b>	Debremarkose	<b>DE</b>	Jimma	<b>JM</b>	Negele	<b>NG</b>
Alge	<b>AL</b>	Debre Tabore	<b>DT</b>	Jinka	<b>JI</b>	Nekemt	<b>NE</b>
Ambamariam	<b>AMB</b>	Debre Zeit	<b>DZ</b>	Kachise	<b>KA</b>	Pawe	<b>PA</b>
Ambo	<b>AB</b>	DembiDolo	<b>DO</b>	Kibremengist	<b>KM</b>	Sawla	<b>SA</b>
Arbaminch	<b>AM</b>	Dilla	<b>DI</b>	Konso	<b>KN</b>	Sekoru	<b>SK</b>
Arjo	<b>AJ</b>	DireDawa	<b>DD</b>	Kulumsa	<b>KU</b>	Semera	<b>SM</b>
ArsiRobe	<b>AR</b>	Dolomena	<b>DM</b>	Koffele	<b>KO</b>	Freweyni	<b>FW</b>
Assaita	<b>AT</b>	Dubti	<b>DU</b>	Konso	<b>KN</b>	Shahura	<b>SH</b>
Assossa	<b>AS</b>	Ejaji	<b>EJ</b>	Kulumsa	<b>KU</b>	Shambu	<b>SB</b>
Awassa	<b>AW</b>	Elidar	<b>EL</b>	Lalibela	<b>LA</b>	ShewaRobit	<b>SW</b>
Ayehu	<b>AH</b>	Enewary	<b>EN</b>	Layber	<b>LY</b>	Shire	<b>SR</b>
Aman	<b>AN</b>	Elidar	<b>EL</b>	Limugenet	<b>LG</b>	SholaGebeya	<b>SG</b>
Bale Robe	<b>BR</b>	Enewary	<b>EN</b>	Maichew	<b>MW</b>	Sirinka	<b>SI</b>
BahiDar	<b>BD</b>	Fitche	<b>FI</b>	Mankush	<b>MA</b>	Sodo	<b>SO</b>
Bati	<b>BA</b>	Gambella	<b>GA</b>	Masha	<b>MSH</b>	WegelTena	<b>WT</b>
Beddele	<b>BE</b>	Gelemso	<b>GL</b>	Mehalmeda	<b>MD</b>	Wereillu	<b>WR</b>
Begi	<b>BG</b>	Gewane	<b>GE</b>	Mekaneselam	<b>MN</b>	Yabello	<b>YB</b>
Blate	<b>BL</b>	Ghion	<b>GH</b>	Mekele	<b>MK</b>	Ziway	<b>ZY</b>
Bui	<b>BU</b>	Gimbi	<b>GB</b>	Metehara	<b>ME</b>		
Bullen	<b>BN</b>	Ginir	<b>GI</b>	Meisso	<b>MS</b>		
Chagni	<b>CG</b>	Gode	<b>GD</b>	Metema	<b>MM</b>		

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. Bega season description**

Bega from October to January is mostly an arid season for most parts of the river basin except Ogaden, lower and middle Wabishebele, Rift valley, lower OmoGibe, middle and lower Genale Dawa as well as lower Rift Valley catchments. The main rainy months with Bega season are October and November provides rainfall mainly for southern, south eastern and south western catchments. Sunny and windy condition dominated across many river basins thus it increase the loss of water by evaporation. Surface runoff not occurs during Bega hence, the flow of river water is low. In the meantime springs and ponds starting to dry up after mid Bega season. Availability of water is also decrease across upstream of main river basins. In some years unseasonal rain slightly fevered for water availability.

### **Methods**

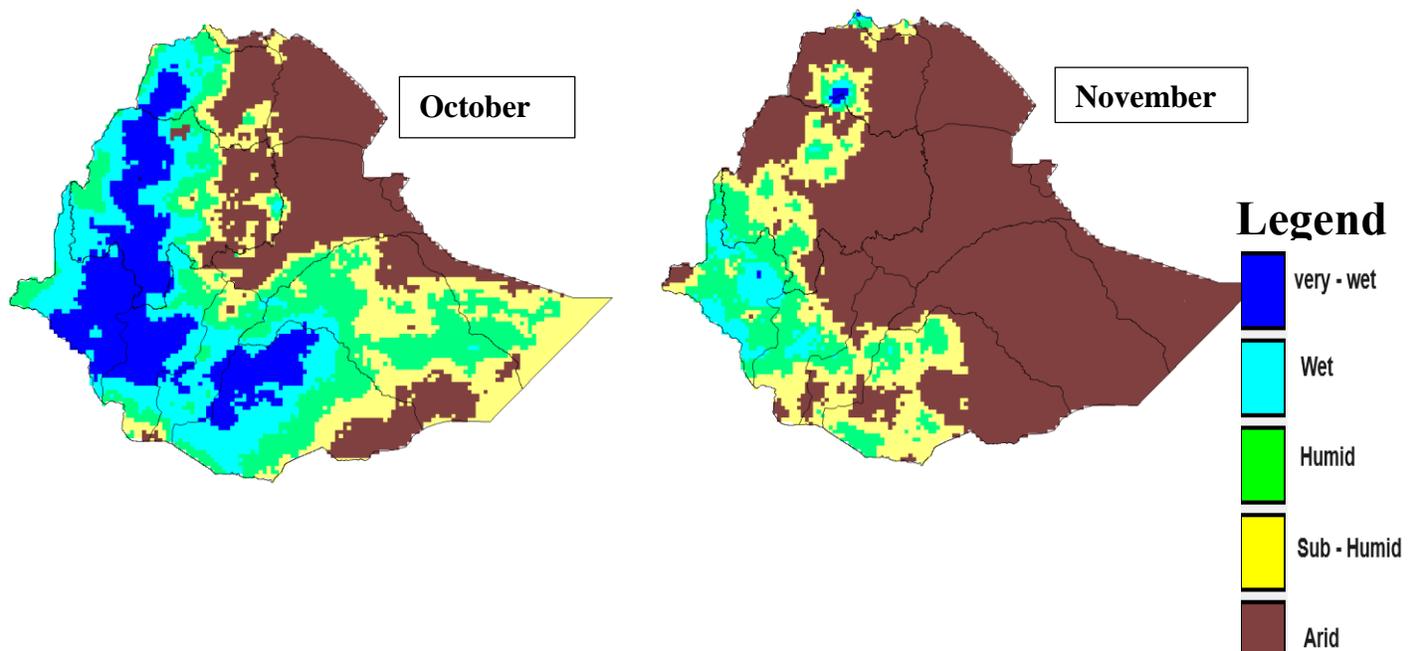
To compute the aridity index, we use Thornthwaite method, which is computed from the monthly values of rainfall and evaporation. The evaporation is computed empirically from mean monthly air temperature. In assessing the effectiveness of rainfall, in terms of water availability relationships between 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 to yellow value indicates humid to semi humid and pink to red values show semi dry to dry condition.

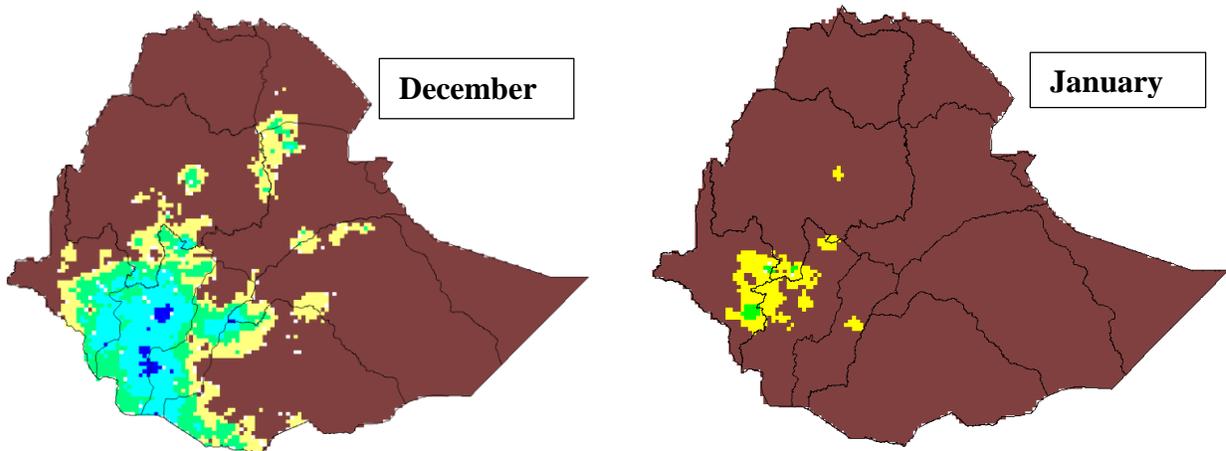
Where  $R_f$  = monthly rainfall in mm;  $T$  = monthly mean temperature in °C

## **2. Surface Water status for Bega 2025/26 at different river basins**

**October and November:** most part of in Omo Gibe, Genale Dawa, Wabi Shebele, lower Abay Baro Akobo, Rift Valley, Middle and lower of Tekeze, River basins have experienced humid to wet moisture condition. This condition has positive impact for water availability over Bega Benefiting catchments. Other River basins most of Awash, Afar Danakil and upper Tekeze above was dominantly prevailed under arid and semi-Arid condition.

December and January the wet condition has decrease from the northern and North West shift area of south western and south eastern catchments, especially to Bega benefiting catchments during those months most parts of Omo Gibe, Rift valley, upper part of Baro Akobo, few upper Genale Dawa Humid to wet moisture condition, and the rest most part of Awash, Wabe Shebele, Ogaden, Tekeze, and Abay were performed Arid conditions.



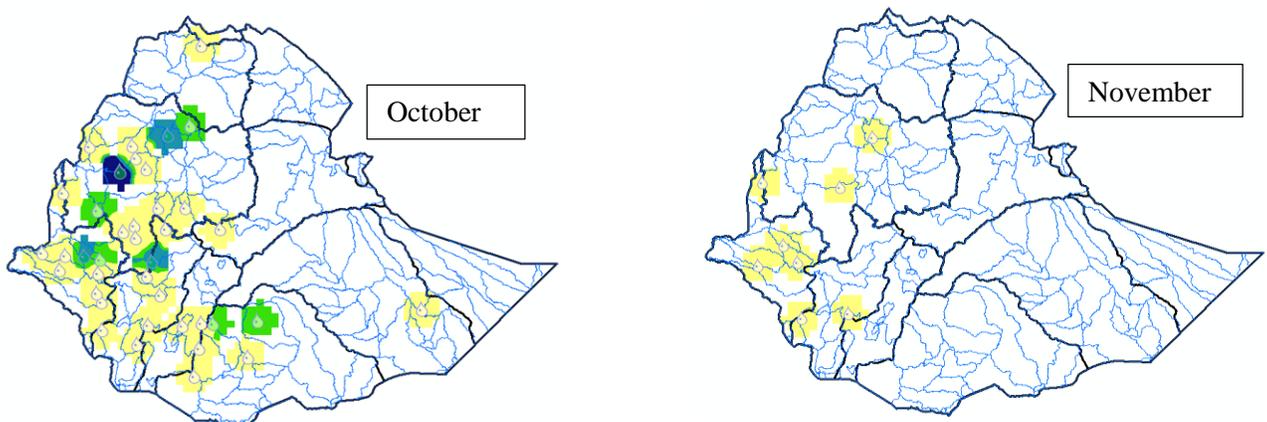


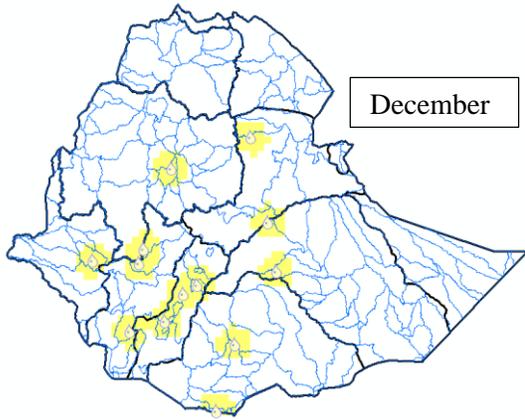
**(Fig.1) Surface Water status 2025 to January 2026.**

**Distribution of heavy fall days exceeding 30mm during October to January, 2025 over different river basins.**

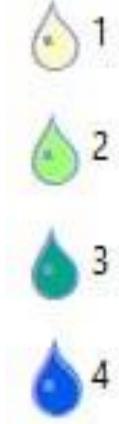
In October, 1-4 days' heavy fall was recorded over Abay, Baro-Akobo, Omo-Gibe Rift- Valley, and Genale-Dawa Catchments. Maximum frequency of heavy fall days was observed over, Abay catchment for 4 days.

In November and December, heavy fall was observed over Baro Akobo, Abay, Rift Valley, and Omo Gibe catchments. Heavy fall was observed for one day over different stations. The season of maximum frequency observed in Middle Abay was four days in the month of October at Bullen station, and the month of January had no heavy rainfall at any station.





### Legend



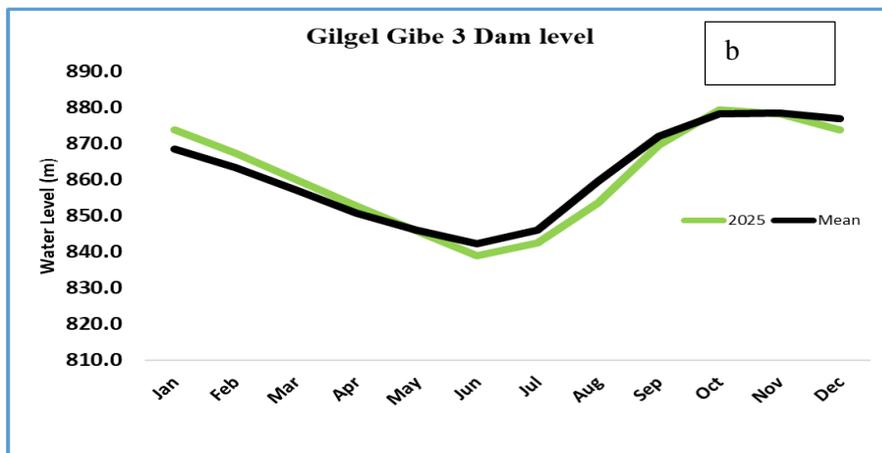
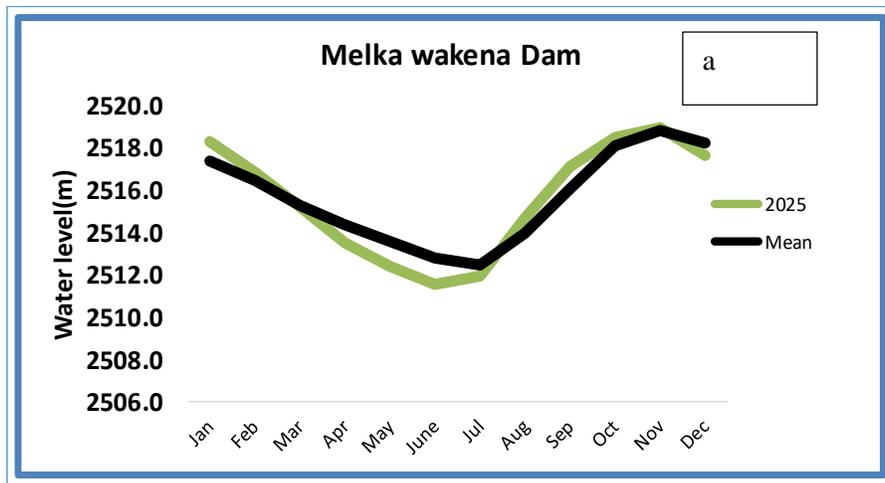
**Distribution of heavy fall exceeding 30 mm per day over different river basins  
2025/26**

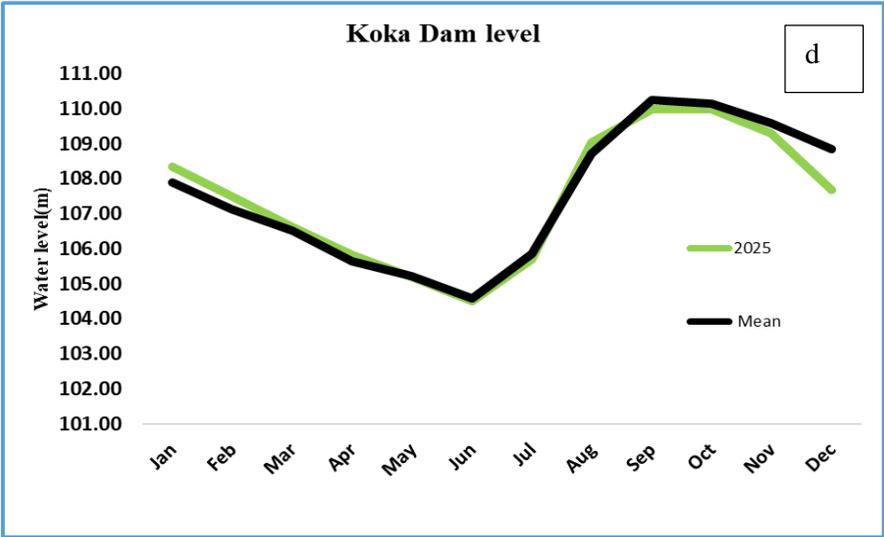
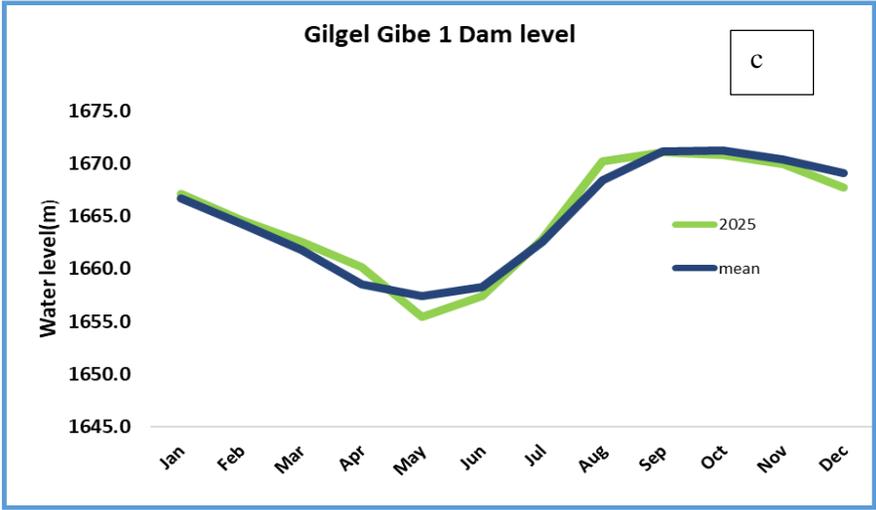
(Fig 2) Distribution of heavy fall October to December, 2025

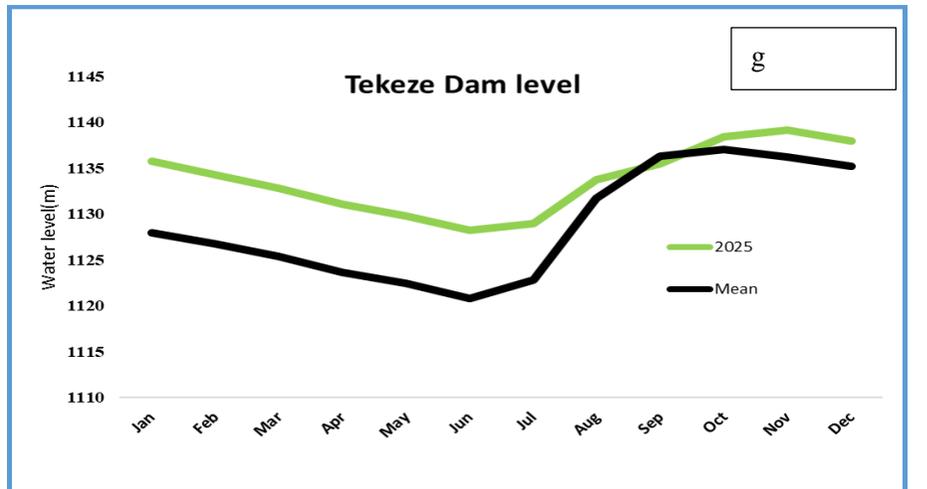
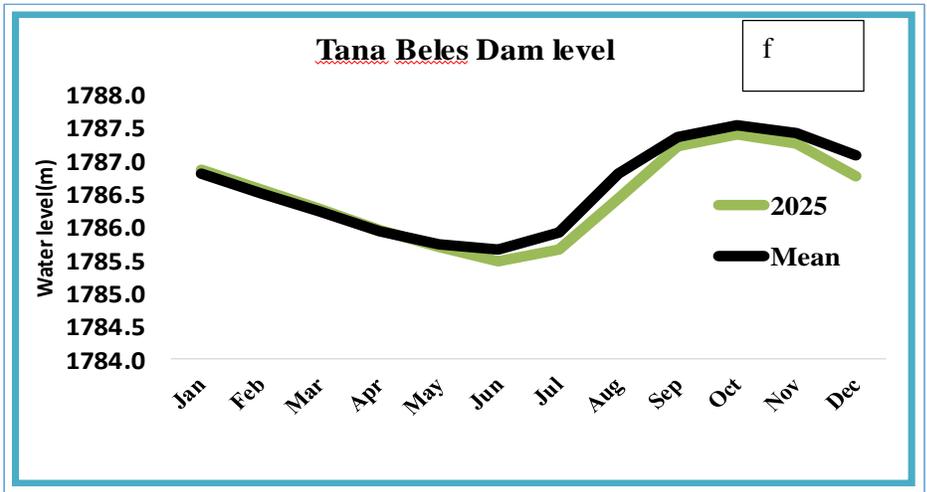
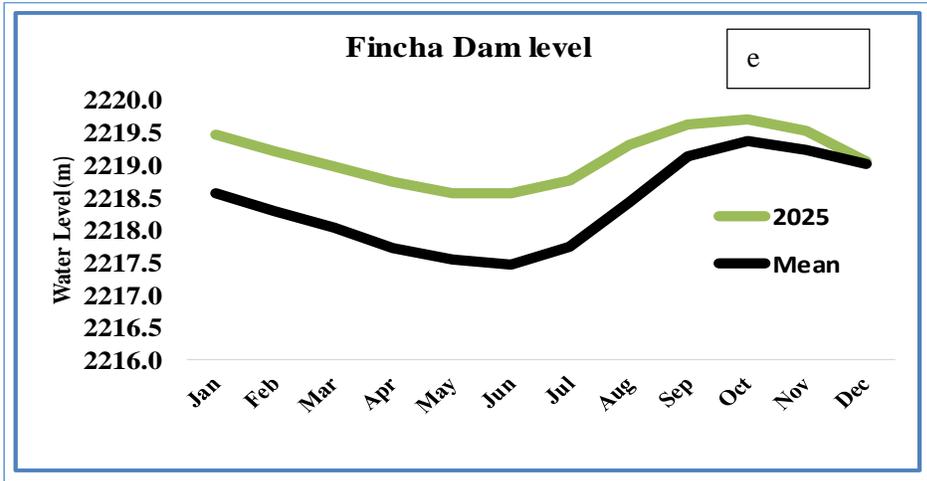
**Performance of Dams and Reservoirs water level in Bega 2025/26 season compared to long mean**

The main source of runoff is rainfall which is the input for Dams, reservoirs and ponds but in Bega season runoff is not occur and flow of river is less. While during in some years Bega may give rain for some catchments which contribute for availability of water. The Performance of 2025 was sub humid to wet October; therefore, the current dams and reservoirs water level in comparison to long mean had shown better condition.

Shown below in figure 4a-g).







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

### **3. Summary**

In **October** most part of Abay, Baro Akobo, Omo gibe, Rift Valley, Genale Dawa, upper Wabi Shebele and lower Tekeze had experience humid to wet moisture condition. This condition has positive impact for water availability over Bega Benefiting catchments. Moisture status of November was weaker than October. In October, 1-4 days' heavy fall was recorded over Abay, Catchments.

In December and January heavy fall was observed over upper part of Baro Akobo, rift valley, middle and lower Awash, Genale Dawa and upper Wabi Shebele for one days.

## **Conclusion**

- The moisture performance of Bega 2025/26 was experienced under sub humid to wet most Bega moisture benefiting basins.
- Better moisture performance was observed in October over most catchments of southern, south west, south eastern, Central and western catchments of the country.
- Reservoirs and dams water level performance have shown better status in comparison to year mean water level.

## **Hydro-Meteorological Impact Outlook for Belg 2026 over Different River Basins**

### **1. Introduction**

Belg rainfall contributed for surface runoff about 5 to 7% during wet Belg season. Seasonal rainfall benefiting catchments are found across eastern half, central and southern portion of the country. It has more benefited to compensate the shortage of water when there is a good performance of rainfall. Belg rain contributes to minimize extended dry condition (Bega season) and evaporation effect from open

water surface across Belg rain benefiting catchments. Another main feature of this season is occurrence of high temperature over most river basins.

## **2. Selected analogue Year**

For the upcoming **Belg 2026 season**, the selected analogue year **2023** was analyzed using probabilistic seasonal forecasts and mapped across catchments. Among the analogue years, **Belg 2023 serves as the most suitable reference, providing valuable insights into the expected Surface water availability and Ground water recharge as well as reservoir and Dam water storage for the 2026 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°

**February:-** Based on the three analogue years, Belg moisture benefiting catchments start getting some amount of moisture over few basins, and the current Belg status the moisture early onset most Belg benefit areas, therefore most basins will be performed arid to and semi-Arid, but few places of the basin are sub-humid to humid moisture conditions, such as most of Omo Gibe, Rift valley, Upper Awash, Few areas middle Eastern Abay.

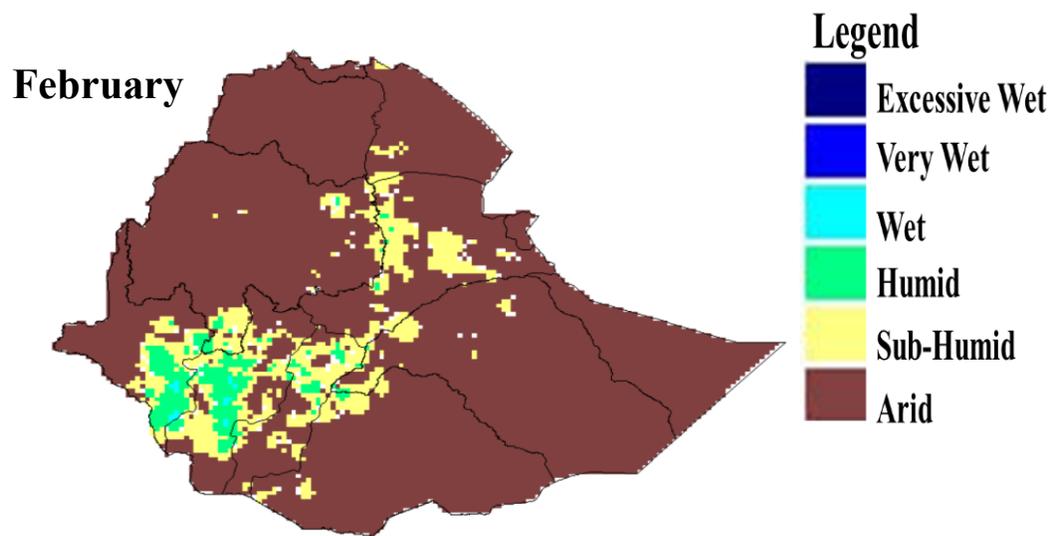


Figure 1. Surface water availability over catchments on February

**March:** Belg moisture begins to spread across the catchments, with **humid to wet conditions** dominating most of Abay, Omo-Gibe, Rift Valley, Genale-Dawa, Wabi-Shebele, Awash, and upper Baro-Akobo, and Afar Danakil supporting increased surface water availability.

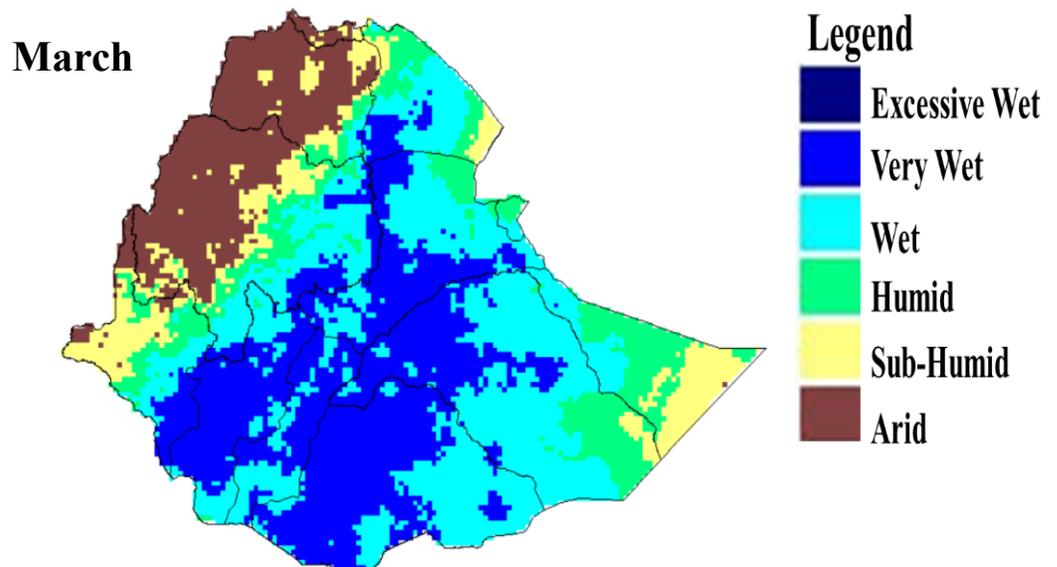


Figure 2. Surface water availability over catchments on March

**April:-** In this month Better moisture condition performed across Belg benefiting catchments of the selected analogue years 2023. In line with this, most parts of Omo Gibe, Rift valley, Genale Dawa, BaroAkobo, Wabi Shebele and upper and middle Abay and Awash, Afar Danakil catchments were performed under wet to very wet moisture condition.

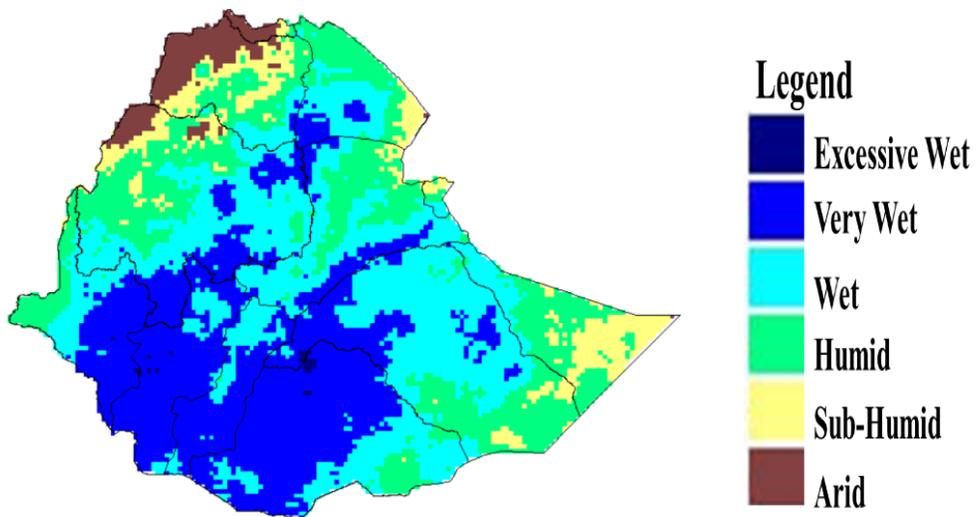


Figure 3. Surface water availability over catchments on April

**May:** In 2023, most Belg-Benefiting catchments experienced wet conditions, except the edges of lower Genale Dawa and adjacent areas of Wabe Shebele basins, to Enhance the availability of surface water and ground water recharge over Belg Benefiting catchments.

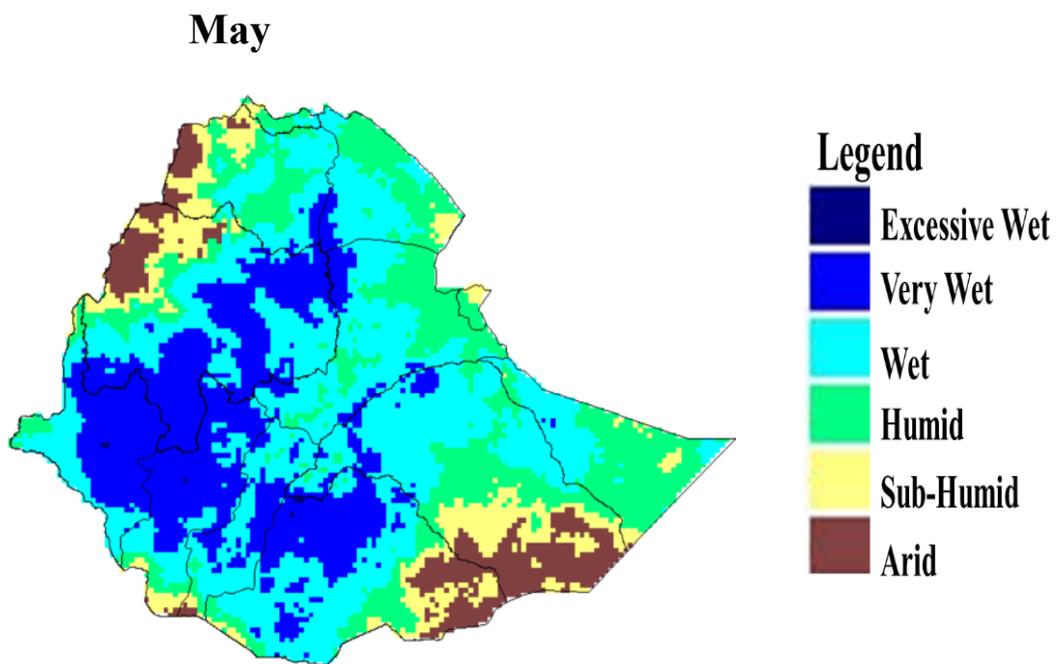


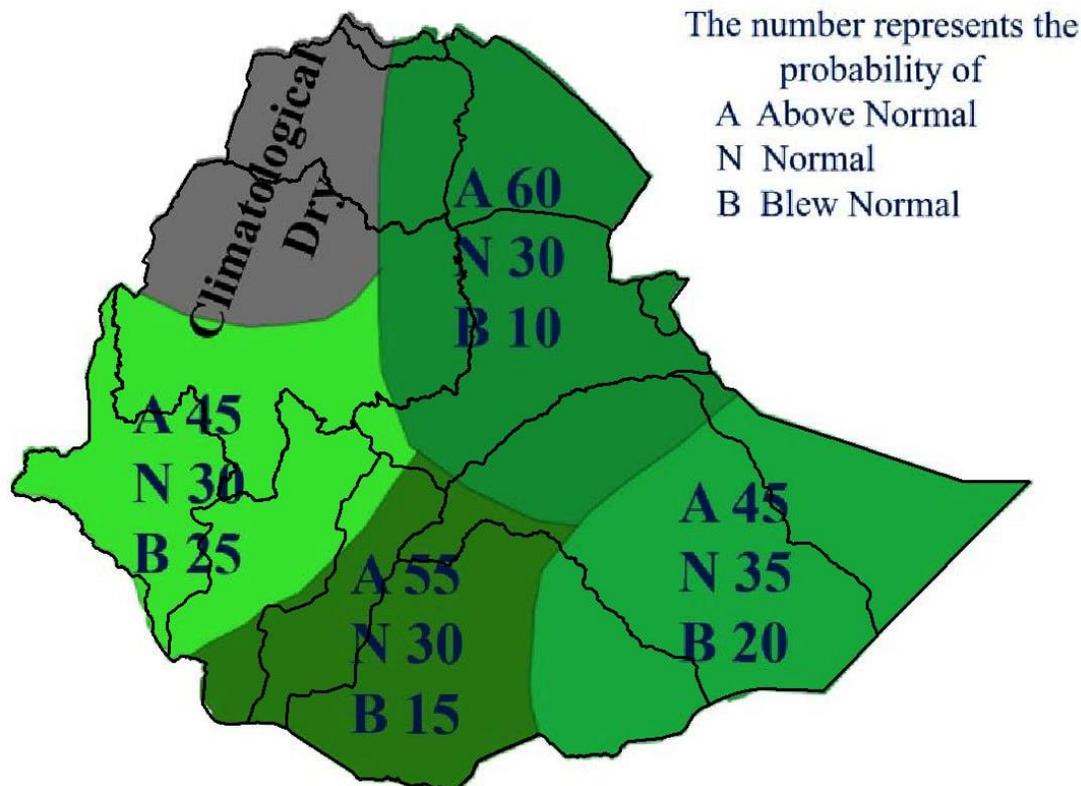
Figure 4. Surface water availability over catchments on May

## Summery and advisory for coming Belg (FMAM), 2026

For **Belg 2026**, rainfall in the Belg-benefiting catchments is anticipated to be **normal to above normal Rainfall condition**. February is expected to remain **mostly dry**, while from March through May, the catchments are likely to experience better **conditions**, to increase the availability of **surface water and groundwater recharge**.

### Tercile probability on basin map for coming belg 2026 Season

During the coming Belg 2026 season (typically *February to May*), meteorological forecasts indicate that Most of Belg Benefiting catchments are likely to receive above Normal **rainfall amounts over Most of Genale dawa, and lower Reft vally and close to normal or above normal rainfall condition over Wabeshebele, Awash Afar Denakel, Ommo Gibe, Baro Akobo and Upper and Middle Abay Basins**. This pattern has important implications for both surface water discharge (rivers, streams, reservoirs) and groundwater resources across the Belg Benefiting catchments in the country.



### **Possible Positive Impact**

- ❖ More surface water flow: rainwater flows out into rivers, streams, and tiny depressions, thus increasing water availability in these water bodies.
- ❖ More water storage in rivers, streams, ponds, etc.: increased water level in rivers, streams, ponds, etc., thus providing more storage space in natural or artificial water storage structures.
- ❖ Recharge to groundwater: rainwater percolates into the ground, thus recharging water in wells, etc.
- ❖ Water available for all needs: water available for drinking, domestic, irrigation, industrial, etc., along with power generation from hydroelectric power plants
- ❖ Better chances of collecting rainwater: increased rainwater storage in ponds, etc., thus building up water supplies for future use.
- ❖ Better chances of building up community resilience: water supply ensures no drought-like situations develop in the community.

### **Expected Negative Impacts**

- ❖ Flood Risk in Low-Lying Areas
- ❖ Normal rainfall above average can lead to floods in low-lying areas.
- ❖ Floods can be particularly damaging to agricultural lands and settlements in such areas.
- ❖ Flash Flood Hazards in Urban and Riverbank Areas
- ❖ Flash floods pose a threat to human lives and properties in urban areas as well as along riverbanks.
- ❖ Flooding can occur due to drainage system overload in urban areas.

### **Soil Erosion and River Sedimentation**

- ✓ Flooding due to excessive rains can lead to an increase in erosion.
- ✓ Flooding can also lead to a decrease in the storage capacity of reservoirs, ponds, etc.

### **Water Contamination**

- ✓ Flooding can lead to an increase in turbidity levels of water.

- ✓ Flooding can be particularly hazardous to water used in urban areas as well as in agricultural areas.

### **Damage to Infrastructure**

- ✓ Flooding due to excessive rains can lead to an increase in flow rates.
- ✓ Flooding can be particularly damaging to roads, bridges, etc.

### **Advisory and Recommendations**

- ❖ Flood prevention should be enhanced to protect lives and property in flood-prone areas.
- ❖ The harvesting and storage of rainwater should be improved by capturing and storing rainwater in reservoirs to increase the quantity of available water.
- ❖ Groundwater recharge should be encouraged by adopting strategies that enable rainwater to recharge groundwater for use in various forms in the future.
- ❖ The management of water quality should be ensured by strictly controlling wastewater and runoff in areas prone to contamination.
- ❖ The management of catchment and water resources should be achieved by organizing the catchment area to enhance the use of water resources.