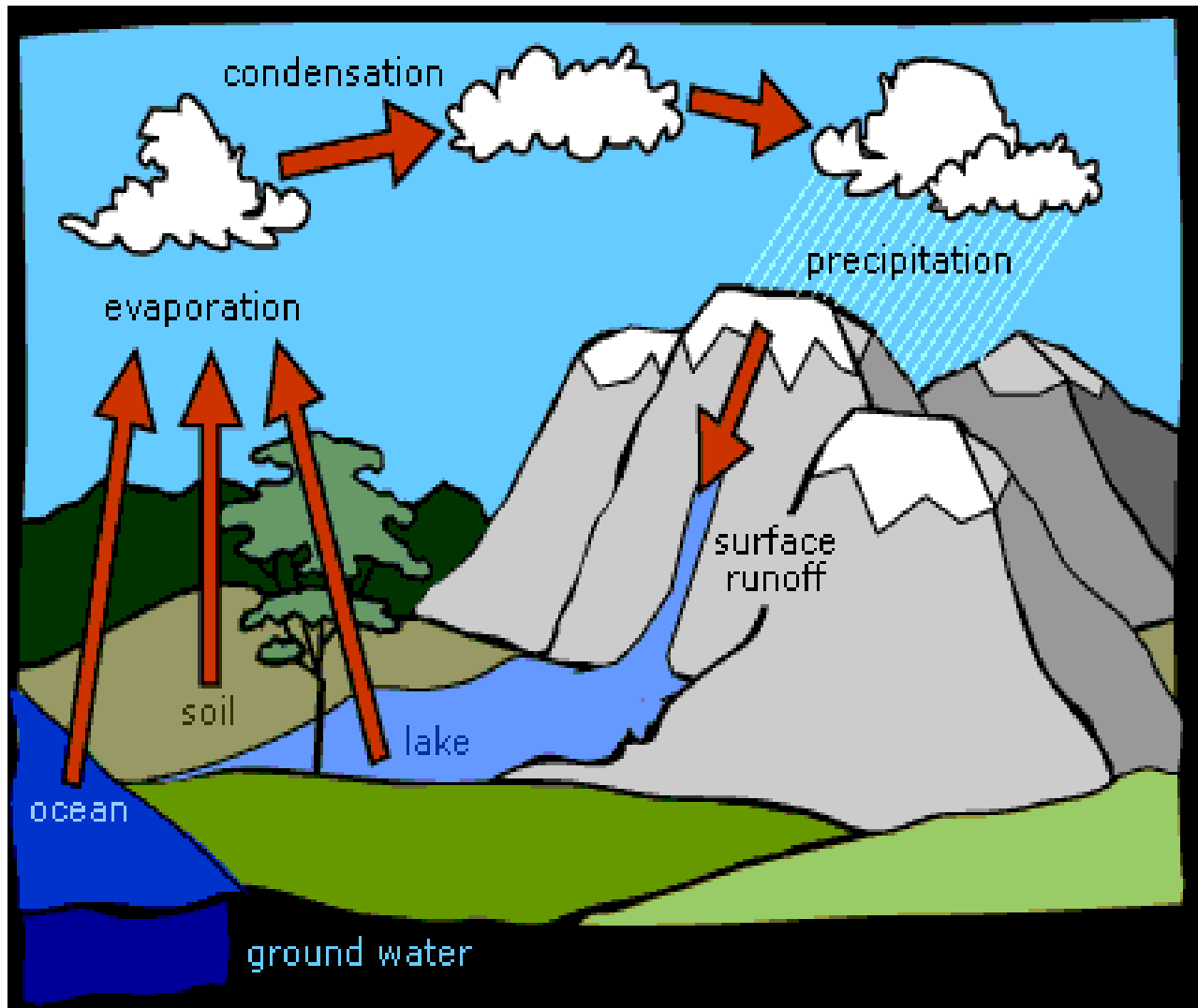


Ethiopia Meteorological Institution



Hydro Meteorological and flood monitoring Bulletin for
March, 2023

Foreword

This Monthly Hydro meteorological Bulletin is prepared and disseminated by the Ethiopia Meteorology Institute (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 km². 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 $11^{\circ}40'$ and $15^{\circ}12'$ N, and $36^{\circ}30'$ and $39^{\circ}50'$ 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 13° N South of Gondar to $11^{\circ}30'$ N, and west of $39^{\circ}45'$ 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 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.

Danakil – Afar Catchment: -

East of 40° E of Tigray, North of 11° N of Wollo, narrow coastal strip south of $14^{\circ}30'$ 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 $11^{\circ}40'$ 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

Gulf of Aden – Aysha Catchment): -

northwestern highlands and a number of seasonal wadies from the southeast highlands.

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.

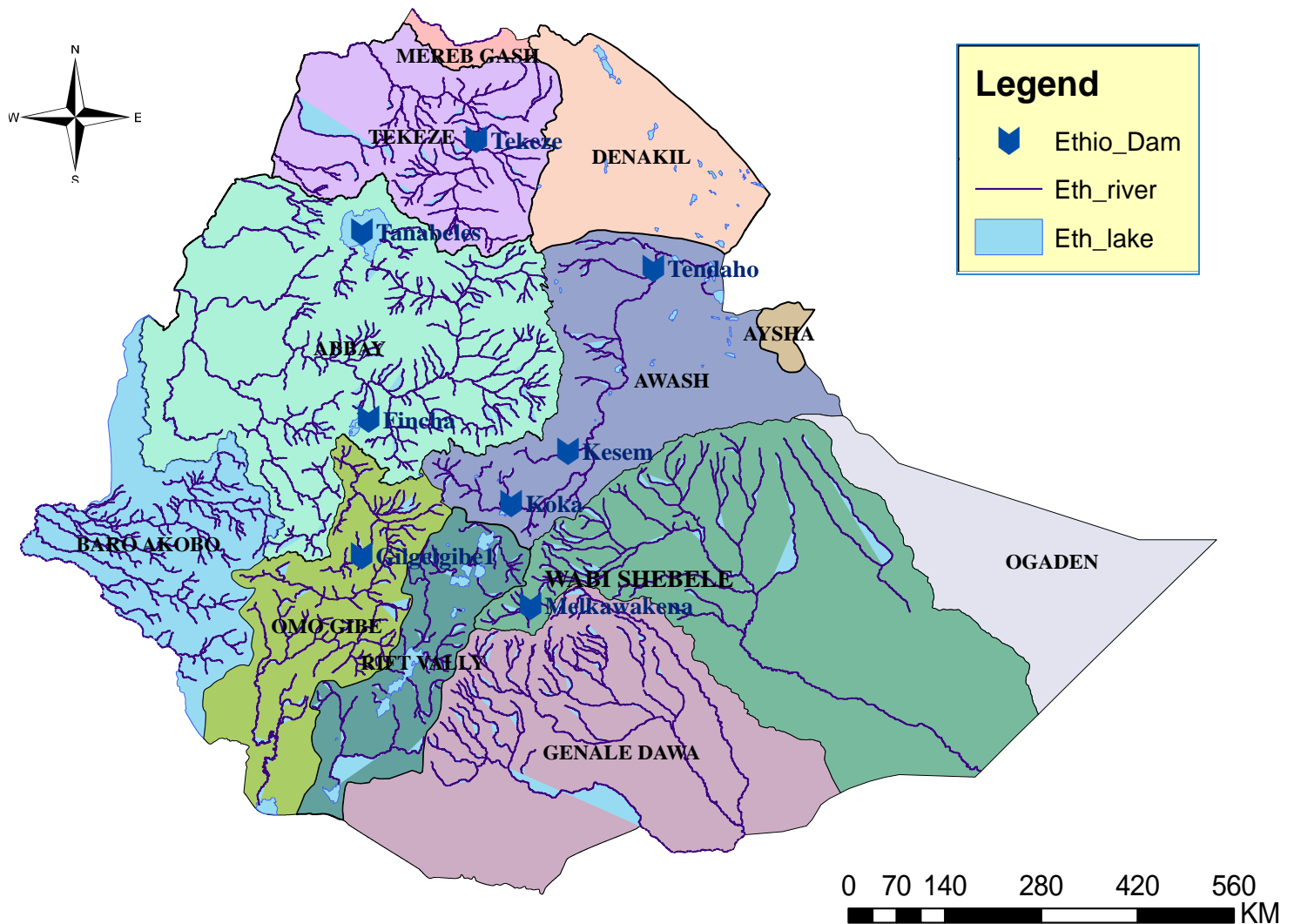
Genale Dawa Catchment: -

The western half of Bale (South of Goba) and southeast, southwestern and northeastern parts of Sidamo. The catchment constitutes three river systems namely Dawa, Genalle and Wabi Gestaro that meet each other before they cross the Ethio-Somalia border.

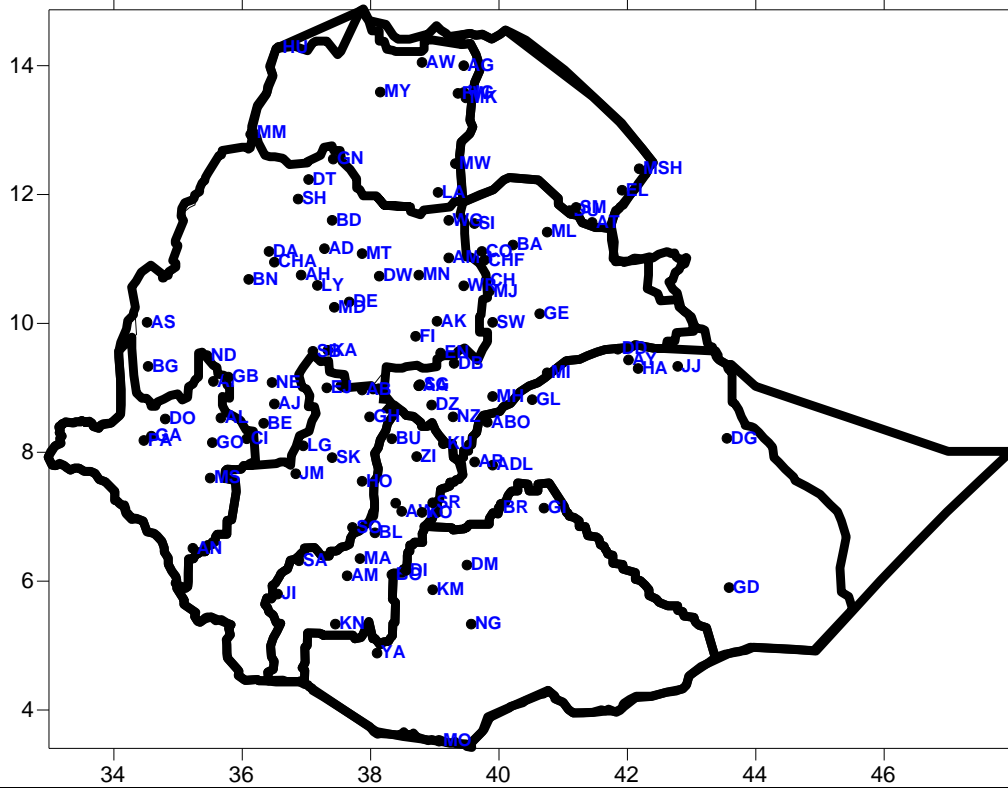
IV. Major River Catchments in Ethiopia, Location and Spatial Status

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

V. Basin map of Ethiopia



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	Debre markose	DE	Jimma	JM	Negele	NG
Alge	AL	Debre Tabor	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		

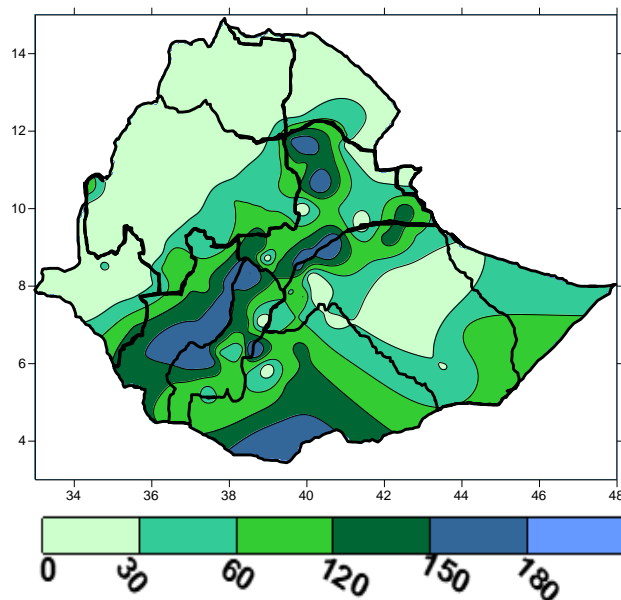
The above stations have five basic meteorological elements they send daily records for Addis Ababa main office of EMI. We use the meteorological elements which are the main factors for hydro meteorological impacts. These are rainfall, temperature, wind speed, evaporation and sunshine duration. This information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

Belg(February-May) :- It is known that Belg is the second small rainy season from February to May across eastern half, central and southern portion of the country. Belg rain benefiting catchments are Awash, Tekeze, eastern Abay, Wabishebele, Genale Dawa, Rift Valley and OmoGibe basins. Belg season is characterized by warm and humid weather condition within those Belg months and also the highest air temperature value is observed over most middle and lower catchments of main river basin.

Precipitation

We used Isohyetal approach which is lines of equal precipitation is drawn taking to consideration over drainage basins from observation taken as a number of rain gauge stations.

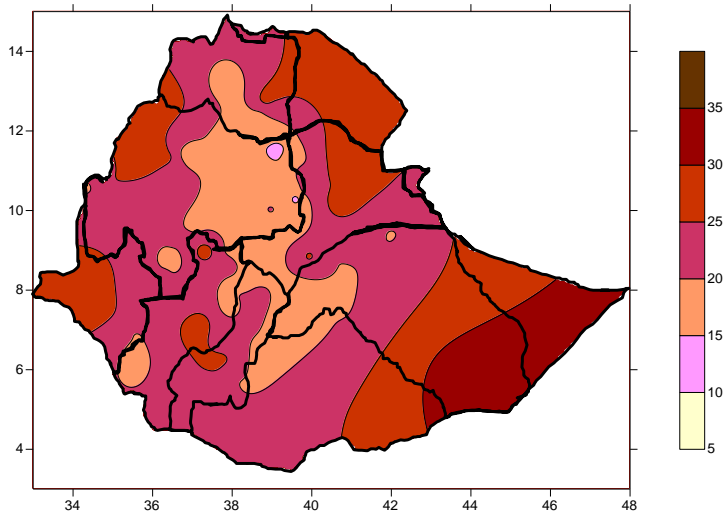
During March the better rainfall amount and distribution was observed over most Belg benefiting and adjacent catchments. In line to this most of OmoGibe, rift valley, Genale Dawa, Awash, Wabe shebele, upper BaroAkobo and Middle Eastern parts of Abay, catchments were received from 30mm up to 180mm rainfall. Over the rest most of Abay, Tekeze, Afar Denakil and central Wabishebele catchments were observed below 30mm rainfall shown below in figure (1).



(Fig.1) Monthly precipitation of March, 2023

Temperature

The monthly average temperature of March was Decrease compared with previous February month over upper and middle parts of over most river basins. In this case during March most places of the upper Awash, Wabishebele, OmoGibe, Tekeze, and Rift Valley, central and eastern parts of Abay catchments average monthly temperature were recorded below 20°C. The rest most of Afar Denakil, Ogaden, lower Wabishebele, Genaledawa, Abay, BaroAkobo, Awash, Tekeze, Ogaden some parts of lower Rift Valley and Afar Denakel average monthly temperature were experienced above 25°C shown below in figure (2).



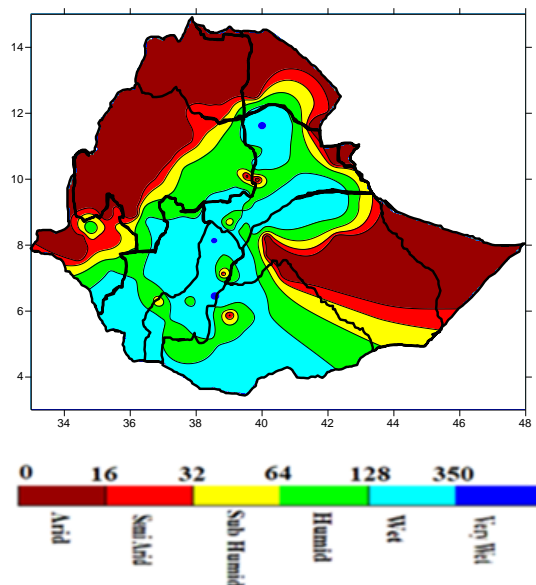
(Fig. 2) Mean monthly Temperature of March, 2023.

Assessments of Aridity Index

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 were show wet condition. Deep green wet and light green to yellow value indicates humid to semi humid and pink to red values show semi dry to dry condition.

The moisture performance of March had shown more moisture performance over most Belg rain benefiting catchments of south, central, South Eastern and some of south western catchments. Inline to this most of Omo gibe, Rift valley, Awash, Genale Dawa, upper Wabe shebele, Baro Akobo, and Middle Eastern Abay catchment were performed humid to wet moisture conditions. The rest north, north western and south eastern border catchment were dominated under dry and semi dry.

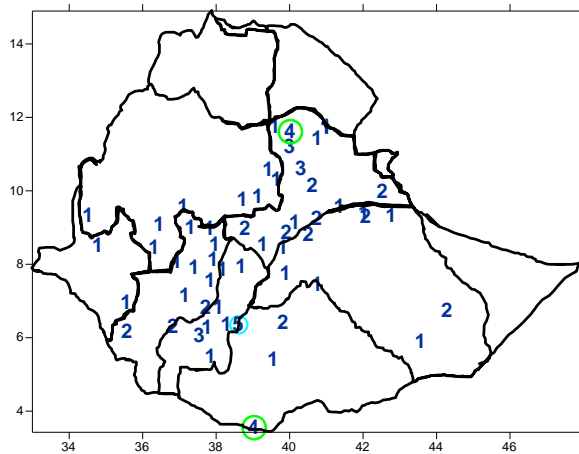
(3).



(Fig.3) Aridity Index of March, 2023

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

During March the occurrence of heavy fall was experienced most parts of Belg moisture benefiting areas and adjacent, therefore, most of Awash, rift valley, upper, few station of upper and lower Genale Dawa and upper Baro Akobo station were observed, the maximum frequency observed at lower Awash at Chifra station for four days, and upper and lower Genale Dawa station 4 and 5 days Moyale and Robe respectively. The maximum Amount of March month heavy fall was recorded at Dalifagi station 107.4mm, at 25th a day and 104mm chifra station on 13rd a day, at middle and lower Awash respectively.



(Fig.4) Distribution and frequency of heavy fall days in March, 2023

Expected weather impact on water resource during the coming Month of April, 2023

During April Belg season moisture condition is perform the pick rainfall in most parts of Belg moisture benefiting catchments. According to this in the coming month Belg moisture will have better amount moisture condition and it covers wide areas over most catchments. Sometimes in some places the occurrence of heavy fall will performance in most catchments.

In line with this in the next April, most parts of, Abay, Genaledawa, OmoGibe, Rift Valley, BaroAkobo, Awash, Lower and middle Tekeze, and Upper and Lower AfarDenakel catchments will expect Humid to Wet moisture condition. However this type of better amount of moisture event will have good contribution for availability of water. The other side, the recurring high amount of moisture may be leads to flash flood and riverine flood; therefore should ready for give response and taking action.