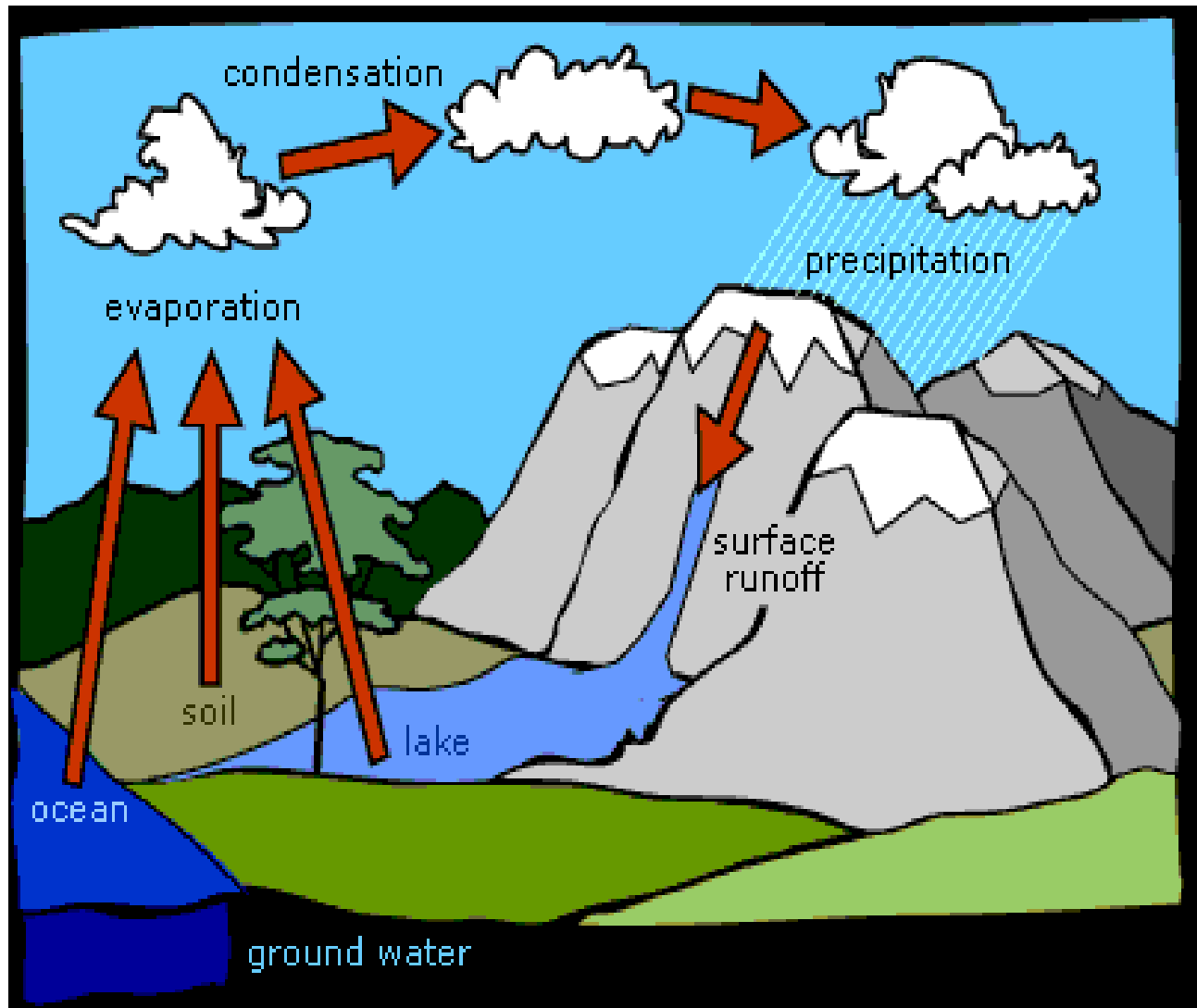


Ethiopia Meteorology Institute



Hydro Meteorological and flood monitoring Bulletin for
June, 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: -

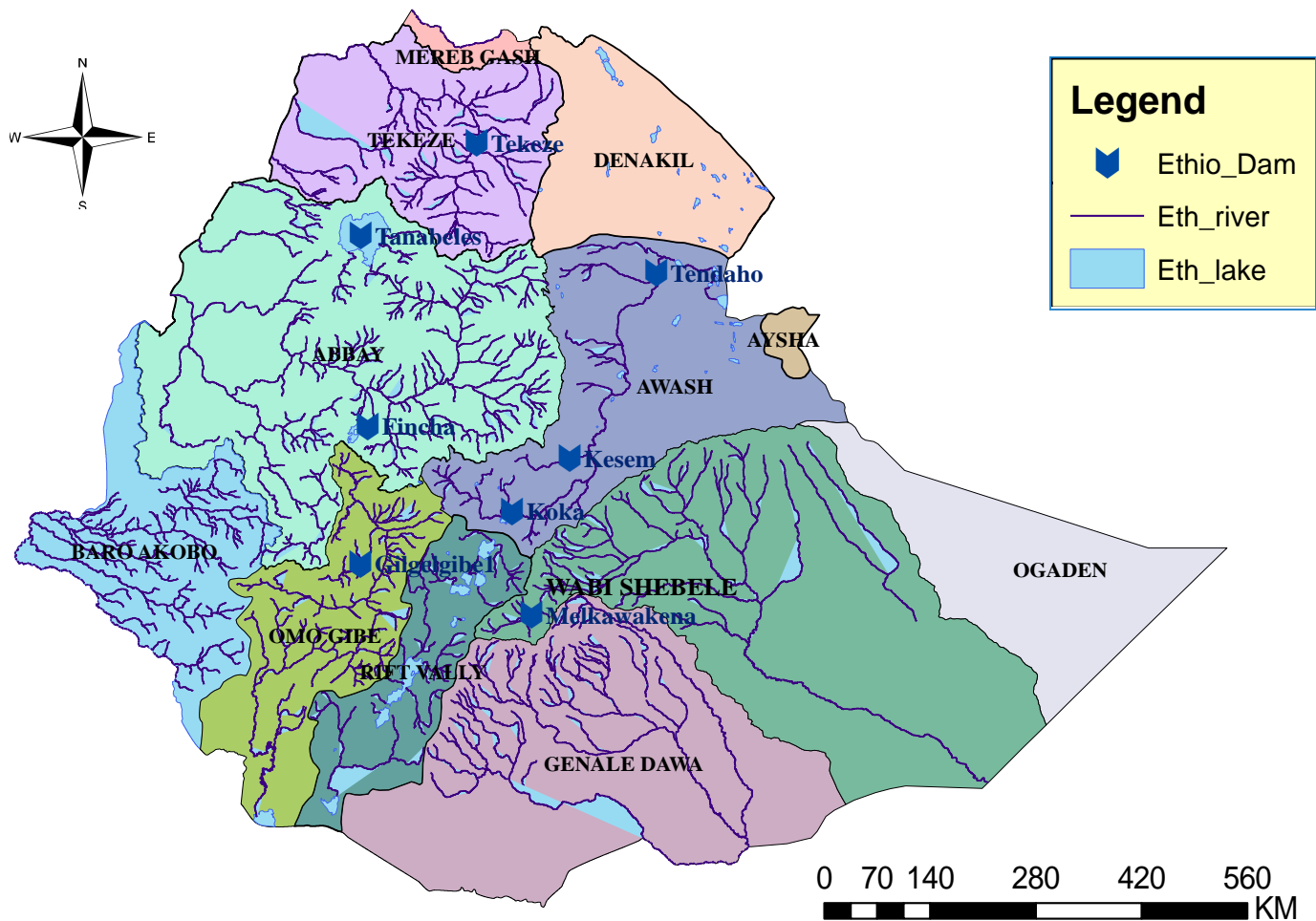
North of Garamuleta mountains, south of $11^{\circ}40'$ N of Wollo, south of 9° N of Shoa, Northern tip of Bale and North part of Arsi. The catchment has upper, middle and lower sub-catchments. In general the catchment is narrow at the upper part marked by numerous volcanic mountains and wider at the 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. |

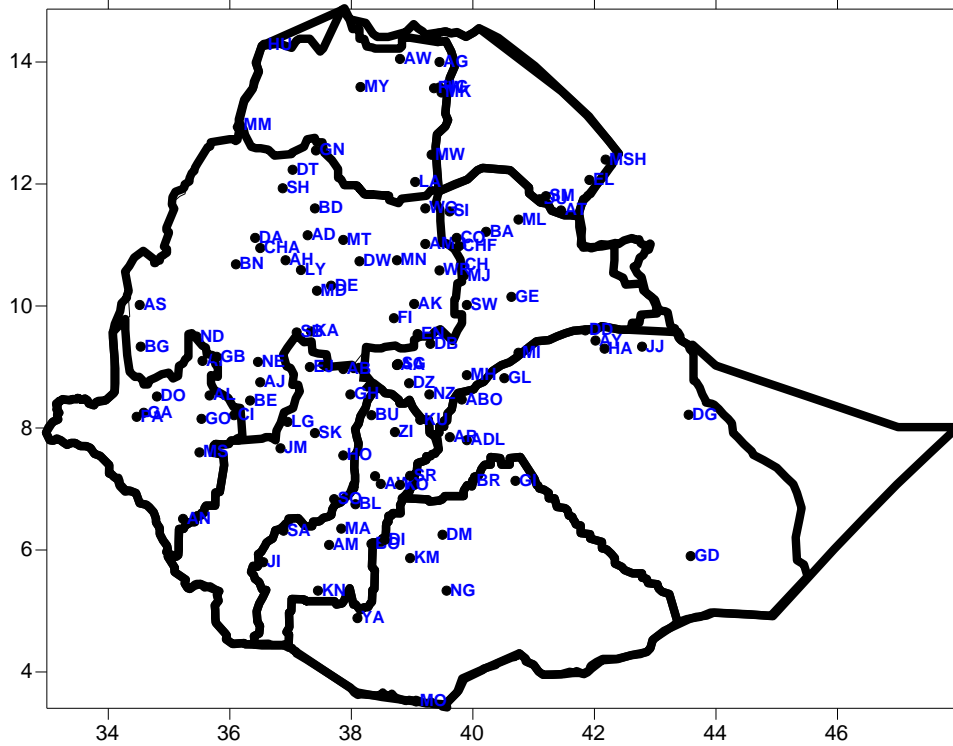
IV. Major River Catchments in Ethiopia, Location and Spatial Status

| 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 |

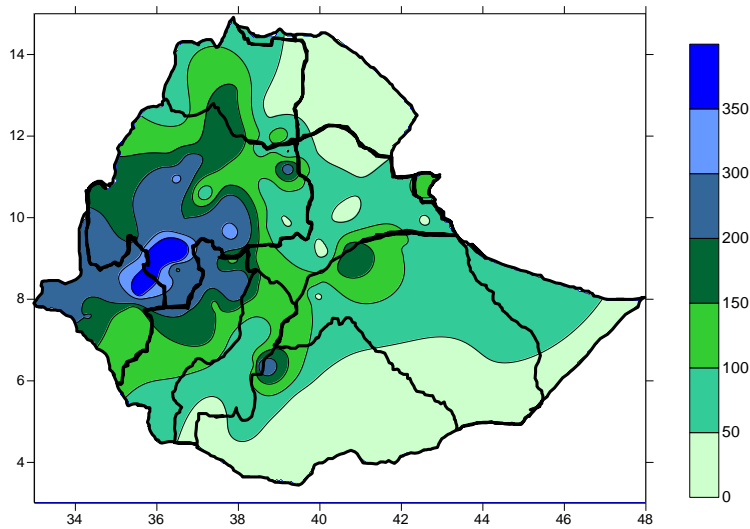
| | | | | | | | |
|---------|----|---------|----|-------------|----|----------|----|
| Beddele | BE | Gelemso | GL | Mehalmeda | MD | Wereillu | WR |
| Begi | BG | Gewane | GE | Mekaneselam | MN | Yabello | YB |
| Blate | BL | Ghion | GH | Mekele | MK | Ziway | ZY |
| Bui | BU | Gimbi | GB | Metehara | 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.

Bega(October-January) :- it is mostly a dry season for most parts of Ethiopia river basins except those basins which receive considerable amount of rainfall for Baro Akobo, lower Rift Valley, lower OmoGibe and for those which receive second rainy season such as Ogaden, middle and lower Genale Dawa and middle and lower Wabi Shebele river basins of Ethiopia. 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. In this case the availability of water is also decrease across upstream of main river basins. In some years unseasonal rain slightly fevered for water availability.

1. Precipitation

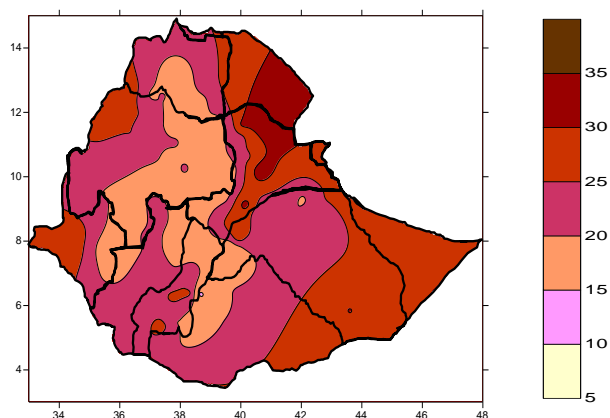
We used Isohyetal approach which is lines of equal precipitation is drawn taking to consideration over drainage basins from observation taken as a number of rain gauge stations. During June the spatial distribution and amount of rainfall was observed over western, central, south west and North West half catchments. In this case better rainfall distribution was observed over most of Abay, BaroAkobo, Tekeze, upper and middle part OmoGibe, upper Wabishebele, , Genaledawa, Rift Valley, middle Abay and few place of upper and middle Awash catchments were received from 50 up to 350mm rainfall. The rest catchments were received below 50mm rainfall shown below in figure (1).



(Fig.1) Monthly precipitation of June, 2023

2. Temperature

The monthly average temperature of June decrease over upper most catchments of main river basins because of increasing of the daily minimum temperature. during June 15 °c -20 °c mean temperature experienced, upper Omo Gibe, rift valley, Baro Akobo, Genale Dawa, and upper and middle Abay basins, and 20oC-25°C average temperature was observed over most of the central Rift valley, OmoGibe, GenaleDawa, Middle and lower Abay, lower Tekeze, upper Wabishebele, and middle Awash. The rest over most Ogden, Afar Danakil, lower Wabishebele, Awash, and BaroAkobo catchments were recorded monthly average temperature above 25°C shown below in figure (2).

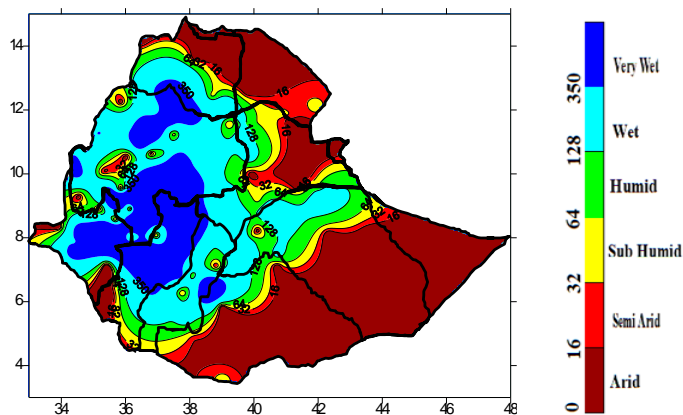


(Fig. 2) Mean monthly Temperature of June, 2023.

3. 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 very wet condition. Deep green to Light Green value indicates wet to humid, yellow value sub humid and pink to red values show semi-Arid to arid condition.

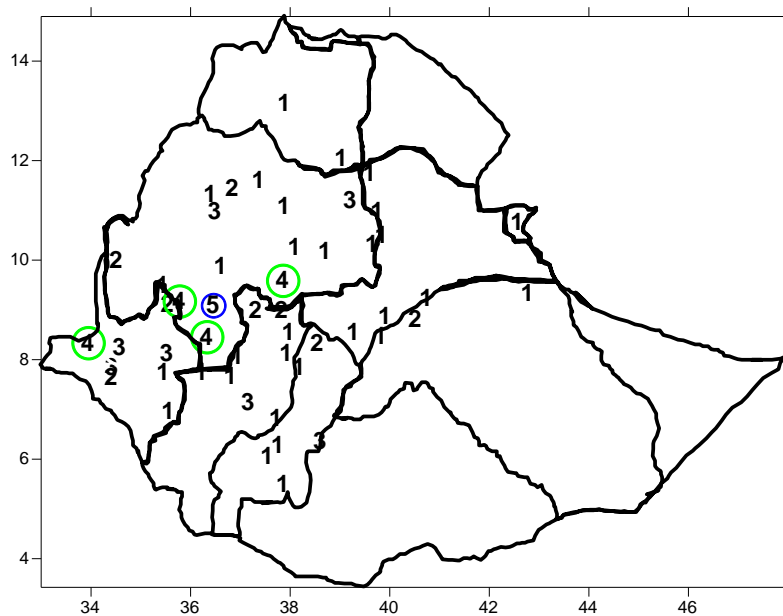
The moisture performance of June had shown better performance over most of western, south west, north western and central catchments. In line with most of Abay, BaroAkobo, Omo gibe, Rift Valley, upper and middle Awash, Upper and lower Tekeze, upper Genaledawa, and Wabishebele, catchments were performed sub Humid to very Wet moisture condition. The rest most parts of, Afar Danakil,Ogaden,middle and lower Wabeshebele, lower Tekeze, and Abay catchments were dominated under Arid and semi-Arid condition below in figure (3).



(Fig.3) Aridity Index of June, 2023.

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

The occurrence of heavy fall was observed over most parts of Abay, BaroAkobo, upper and Middle OmoGibe, Rift valley catchments were received from one to Five days during this month. The maximum frequency of heavy fall days was recorded over Abay basin at Nekemet station for five days and kachise, Bedele and Gimbi station for four days Abay basin and BaroAkobo at Lare station four for days .And maximum heavy fall recorded on A wash basin at meisso station 116 mm in June month. shown below in figure (4).



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

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

Coming July humid and wet condition will be dominated over most parts of western, northern, north western and central main river basin. Most Kiremt season moisture benefit catchments there will be a chance to get better moisture status according to the forecast information. In this case most of Abay, BaroAkobo, Tekeze, as well as upper and middle OmoGibe, Rift valley, and Awash catchments will be expected to have Humid to wet moisture condition. The occurrence of humid to wet moisture across those catchments will be benefited to good moisture occurrence. Inline to this use the opportunity for water harvesting, On the Other hand the Flood prone areas may will leads flood impact on basin and sub basins, so we advise to reduce the impact all concerned body's.