NATIONAL METEOROLOGICAL AGENCY

Meteorological Data and Climatology Directorate

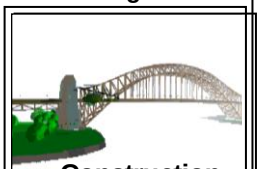
ANNUAL CLIMATE BULLETIN

For the year 2016

Some Applications of Climate Information

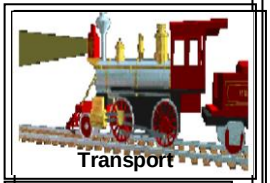
Disaster Management

Water Resources Management



Construction

Environment & Health

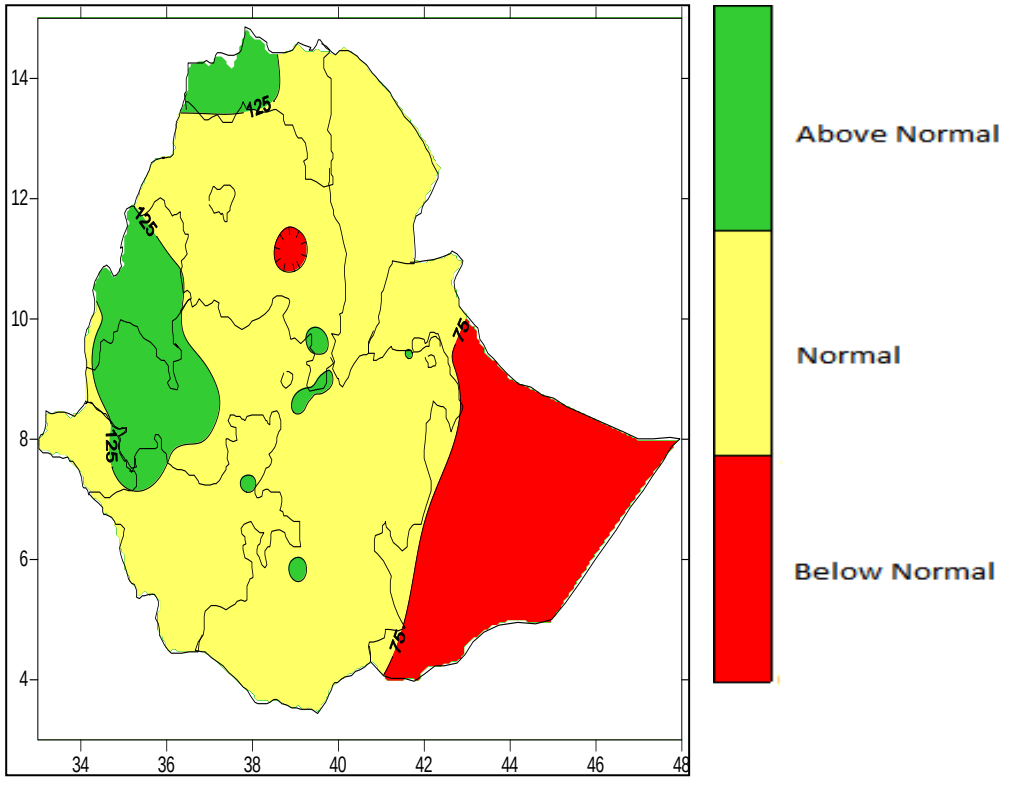


Transport

Recreation & Tourism

HIGHLIGHTS

The rainfall performance of the year 2016 was normal to above normal over most parts of the country. However, Much area of Somalia pocket area of Amhara had experienced below normal rainfall during this year 2016. On the other hand northern central and Western parts of the country are much wetter than 2015 last year annual rainfall and also southern part of the country much direr. In particular, the extreme maximum temperature values had exceeded 48.0^{o}C over Afdera, , Elidar, Enticho, Gulbake, Ukuna and Mayhanes. On the other hand, nights and early mornings were cold over the highlands of northeast, central and southern Ethiopia during the dry season (Bega). In association with this, minimum temperature values below the freezing point (-5.0^{o}c) were recorded over Botar Bacho Bekoji, Chancha, Dinsho, Debre Berha and Combocha. .



Percent of Normal Rainfall of the year 2016

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Foreword

This climate bulletin is prepared and disseminated by the National Meteorological Agency (NMA). It is aimed at providing climatological information to different services of the community involved in various socio- economic activities.

The information contained in the bulletin is believed to assist planners, decision-makers and the community at large by providing details of the climatic conditions of the nation in a given period.

This bulletin differs from the other real time and near real time bulletins issued by the Agency, which for their input depend only on meteorological stations equipped with single side band radio for data transmission. Though this bulletin is not real time, published with a delay of at least two months, the information contained in this bulletin is based on data coming from a much larger number of meteorological stations. Moreover, the information contained in this bulletin is not sector-specific and a wide range of users can benefit from it.

The Agency disseminates monthly, seasonal and annual climatological bulletins in which all-necessary climatological information and significant climatic anomalies are highlighted.

We have a strong belief that various socio-economic activities related to planning disaster mitigation, water resources management, construction, environmental protection, transportation, recreation, tourism and others will be benefited most by the careful and continuous use of this bulletin. Meanwhile, your comments and constructive suggestions are highly appreciated to make the objectives of this bulletin a success.

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1. Introduction

1.1. General

In this bulletin the annual climate summary of the country for the year 2016 is presented. For convenience the climate summary of the year is done on seasonal basis.

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

Belg is a short rainy period from **February to May** over much of the Belg-growing areas, where as over the southwestern parts of the country it denotes the start of the long rainy season. Over the western parts of the country also the rainy season starts during March/April. However over the northwestern parts of the country, this season is predominantly dry except for the month of May. Southern and southeastern parts of the country are expected to get their long rainy season during this time starting in March and peaking in April. The climate of the season is mostly hot and moist.

Kiremt is the period from **June to September.** It is the main rainy season in which the major food crops of the country are produced. The magnitude of rainfall is higher as compared to the other seasons for many parts of the country. Normally, the southern and the southeastern lowlands of the country receive little or no rain during this season, except for little amount of rainfall that occurs towards the end of the season.

Bega is the period from **October to January**. It is a harvesting season for various parts of Ethiopia. Bega is normally a dry season characterized by cool nights and early mornings over the highlands of northern, northeastern, central and eastern Ethiopia and by hot days over various parts of the country. It is also a short rainy season for places over southern, southeastern and southwestern parts of the country. Depending on the influences from mid-latitude rain-bearing systems, some places over central, northern and northeastern Ethiopia also receive occasional showers.

1.2. Summary

The rainfall performance of the year 2016 was above normal to normal over most parts of the country. However, southern of SNNPR pocket area of Tigray and portions of southern Oromia, much of Somali and had experienced below normal rainfall during this year 2016.

Higher values of extreme maximum temperature values were recorded, mostly during the hot season (Belg) 2016. In particular, the extreme maximum temperature values had exceeded 42^{o}C over Dubity, Elidar, Fugnido, Gambla, Jikawo, Metema, Mille, Quara, Gode and Semera. On the other hand, nights and early mornings were cold over the highlands of northeast, central and southern Ethiopia during the dry season (Bega). In association with this, minimum temperature values below the freezing point (0^{o}c) were recorded over Debre Berhan, Mehal Meda, Shahura, Lay bar, Bui, Jijiga, Ginir and Pawe.

2.1. Surface

- The mean central pressure value of the Mascarine High was ranging from about 1022hpa to 1024hpa and it was centered between 27°S to 35°S latitudes and 60°E to 90°E longitudes.
- The mean central pressure value of the Azores High was ranging from about 1022hpa to 1032hpa and it was centered between 30° to 40°N and 5°W to 50°W.
- The mean central pressure value of the St. Helena High was ranging from about 1020hpa to 1024hpa and it was centered between 20°S to 35°S and 0° to 20°W

2.2. Lower Troposphere (850 hpa Vector Wind)

Towards the end of the Belg season, weak cross equatorial flow was observed over the Horn of Africa, Arabian Sea and the adjoining areas of northern and south Indian Ocean. The cross equatorial flow further intensified during the Kiremt season and the speed of the average wind exceeded 15m/sec during the peak of the season. This cross equatorial flow weakened in the succeeding months and replaced by northeasterly flow during Bega 2015/2016 the first month January.

2.3. Middle Troposphere (500 hpa Geopotential Height)

The geopotential height values were dominantly near normal over much of the Mediterranean Sea and the adjoining areas.

2.4. Maximum Wind at 200 hpa level

Strong upper troposphoric easterly flow, associated with the Tropical Easterly Jet (TEJ), was dominant over the tropical areas between West Africa and India during Kiremt, while strong westerly flow (more than 50 meters per second), associated with the Subtropical Westerly Jet, prevailed over the subtropical areas during the rest of the year 2016.

2.5. ENSO conditions

The oceanic and sub-surface oceanic conditions across the Tropical Pacific showed near average to a moderate-strength La Niña condition during the year 2012. Further strengthening of mature cold episode (La Niña) conditions throughout the tropical Pacific towards end of the year, While Tahiti – Darwin remained strongly positive and the equatorial SOI remains positive during the season.

Reference: Climate Diagnostics Bulletins published during the year 2016.

3. **Weather**

3.1. Temperature

Higher values of extreme maximum temperature values were recorded mostly during the hot season (Belg 2016), refer to table 3.1.1 . In particular, the extreme maximum temperature values had exceeded 48.0^{o}C over Afdera, , Elidar, Enticho, Gulbake, Ukuna and Mayhanes. On the other hand, nights and early mornings were cold over the highlands of northeast, central and southern Ethiopia during the dry season (Bega). See the table 3.1.2. In association with this, minimum temperature values below the freezing point (-5.0^{o}c) were recorded over Botar Bacho Bekoji, Chancha, Dinsho, Debre Berha and Combocha.

Table 3.1.1 Annual Extreme Maximum Temperature Values Greater Than or equal to 45^{o}C during the year 2016

Name	Extreme Maximum Temperature	Month	date
Afdera	49.5	6	22
Aisha	45.5	6	29
Badme	46.9	4	18
Baeker	46.4	3	28
Bambudi	45.4	2	25
Bidu	46.8	3	19
Elidar	48.2	9	4
Enticho	49.2	2	9
Gulback	48.5	4	27
Mandura	47.0	1	6
Mayhanes	48.0	2	8
Metema	45.8	3	1
Ukuna	48	4	10

Table 3.1.2. Annual Extreme Minimum Temperature Values less than -3^{o}C during the year 2016

Name	Annual Extreme Minimum Temperature	month	Date
Belle	-4	11	14
Dinsho	-6	12	31
Combolcha	-6	11	1
Botar Bacho	-6.5	12	27
Chancho	-5.1	12	11
Debre Berhan	-6.3	11	1
Sarmider	-4.6	11	19
Siadebr	-4	12	31
Tikur Enchine	-4	12	8
Dera	-7	12	29
Korem	-4	10	27

3.2. Rainfall

The rainfall performance of the year 2016 was normal to above normal over most parts of the country. However, Much area of Somalia pocket area of Amhara had experienced below normal rainfall during this year 2016 (fig 3.2.3).

The annual total rainfall amount of the year 2016 exceeded 1000mm over most part of specially the highland of Amhara, Benishangul-Gumuz, Western part if Oromia and most part of SNNPR, western Tigray and Gambella. In association with this, the annual total rainfall amount reported over **Antago, Gundil and Genabosa** was **2719.9 mm, 2699.2 mm and 2636.6 mm r**espectively. On the other hand, the annual total rainfall amount was below 500mm over most portions of Afar and Somali. Refer to figure 3.2.1 and table 3.2.2.

Table 3.2.1. Heavy fall of greater than 65 mm with in 24 hrs during the year 2016

Name	Maximum rainfall greater than 65mm	Month	Day
Axum	98.2	7	24
Debark	160.2	3	23
Ginir	103	4	30
Guguftu	98.6	8	10
Hagere Mariam	103.5	5	11
Harar	105.7	4	14
Limu Genet	96	5	8
Mahoni	100	11	28
Majete	97.5	4	14
Meko	111.4	7	23
Melka Sedi	164.2	4	14
Meragna	107	7	3
Mudula	122.8	5	9
Ticho	96	8	20
Axum	98.2	7	24
Debark	160.2	3	23
Ginir	103	4	30

Table 3.2.2 Annual total Rainfall Amount in excess of 1250 mm during the year 2016

Name	Total Rainfall
Agaro	2546.7
Areka	2194.6
Atnago	2719.9
Dengoro	2168.9
Elias	2590.4
Genabossa	2636.6
Gundil	2699.2
Kidamaja	2357.6
Limu Genet	2324.8
Meko	2164.9
Neshi	2144.2
Somodo	2446.5
Tsegdie (Kirakir)	2196.9

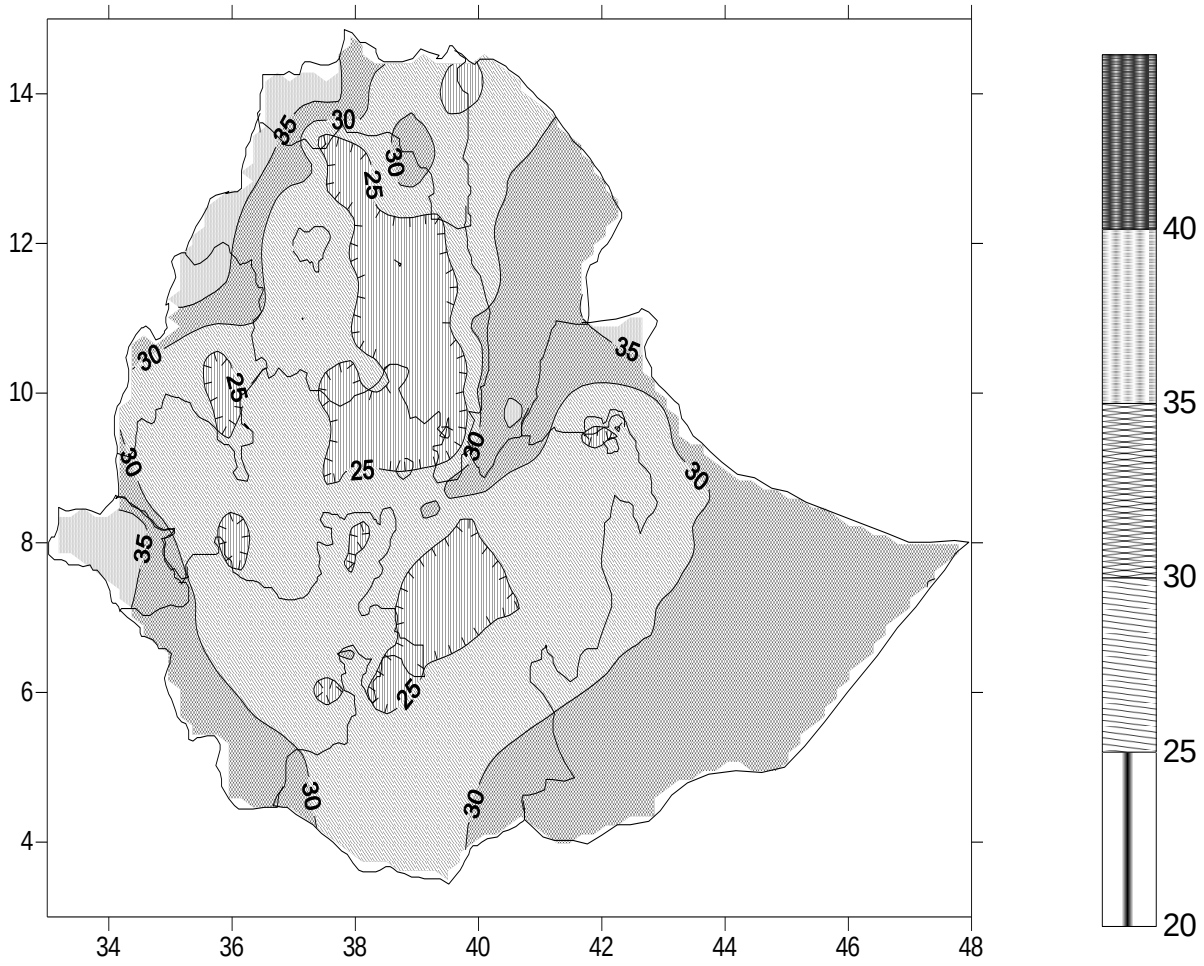


Figure 3.1.1. Mean Maximum temperature in ^{o}C for the year 2016

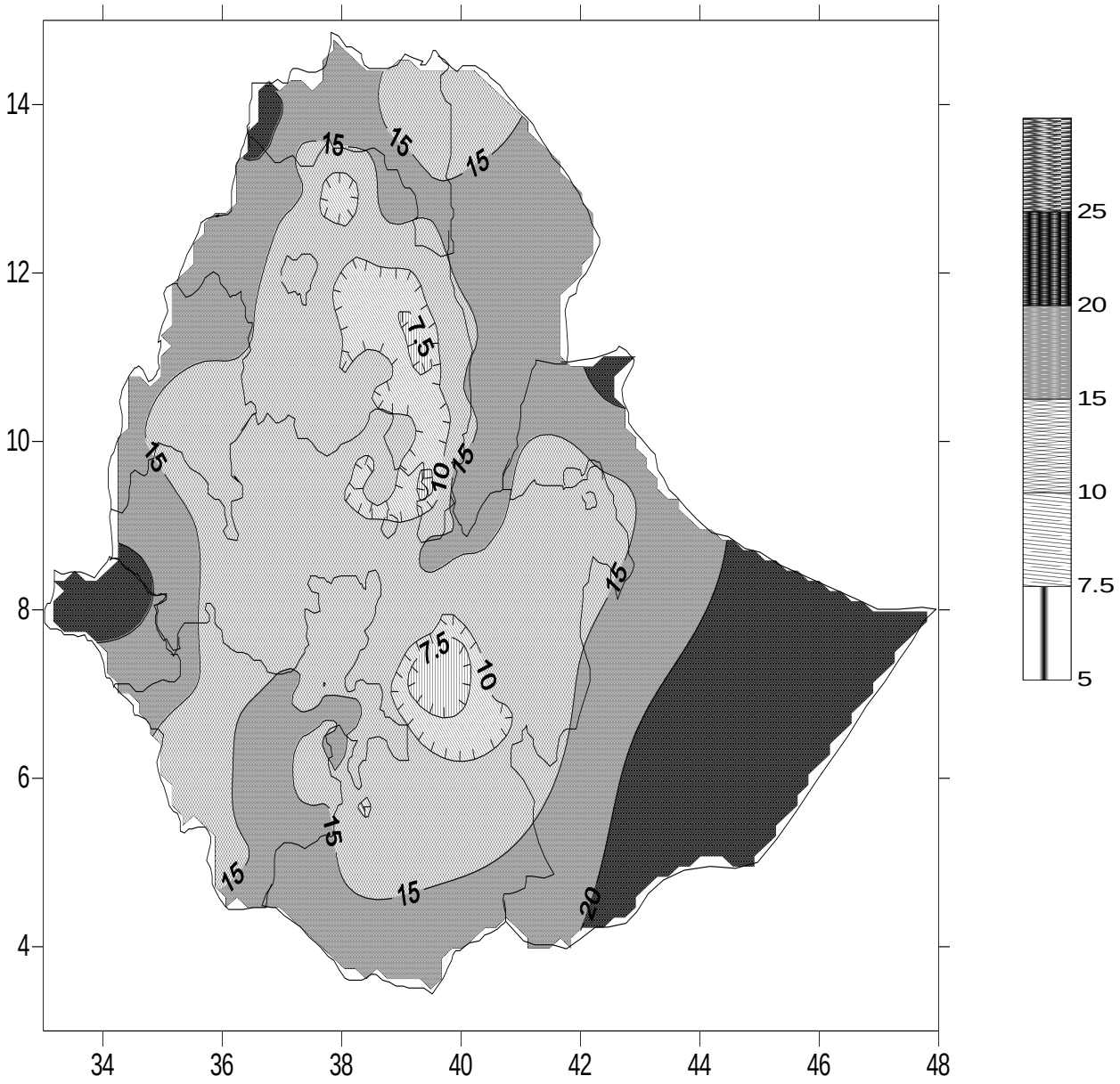


Figure 3.1.2. Mean minimum temperature in ^{o}C for the year 2016

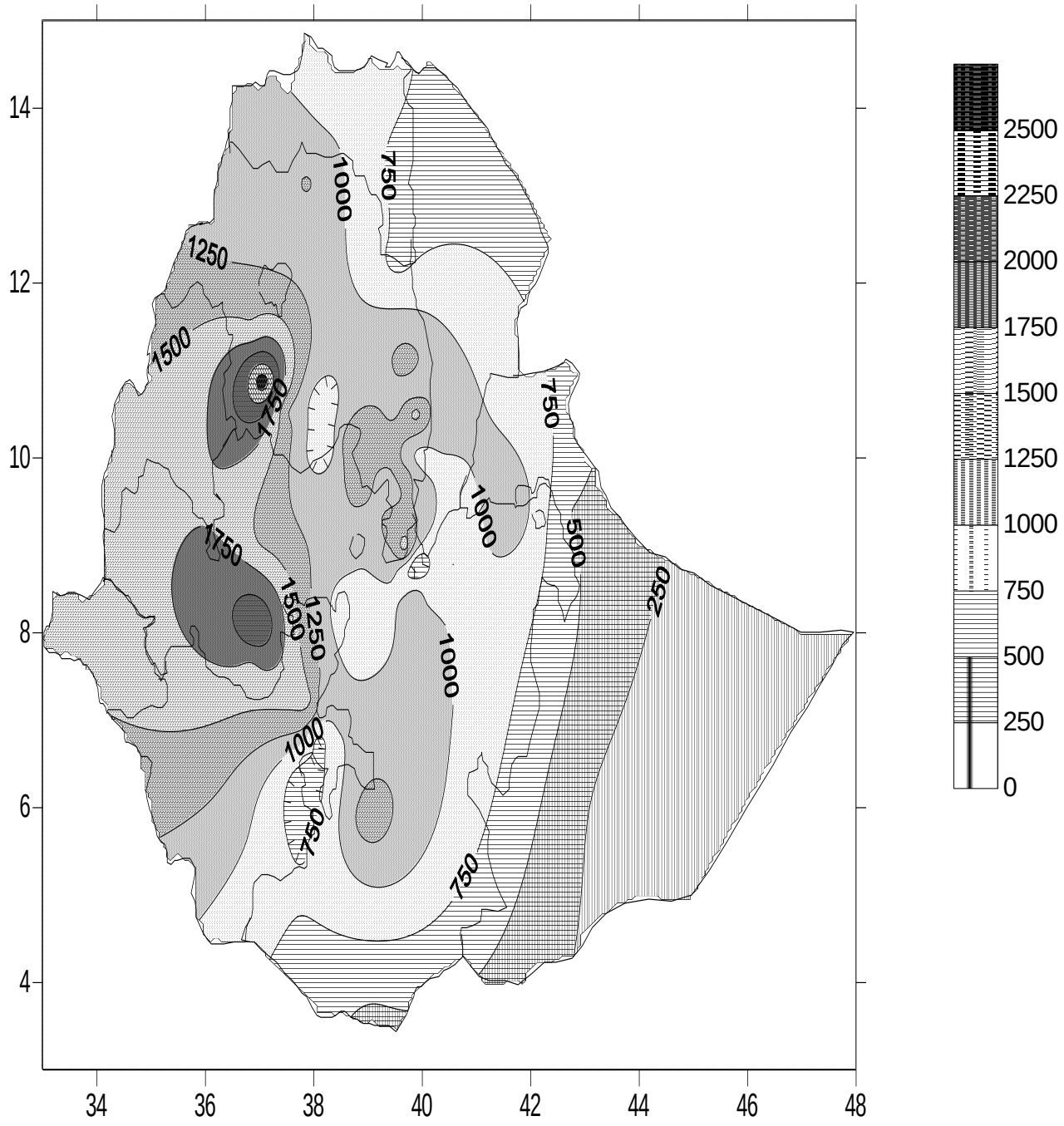


Figure 3.2.1. Annual total Rainfall amount in mm of the year 2016

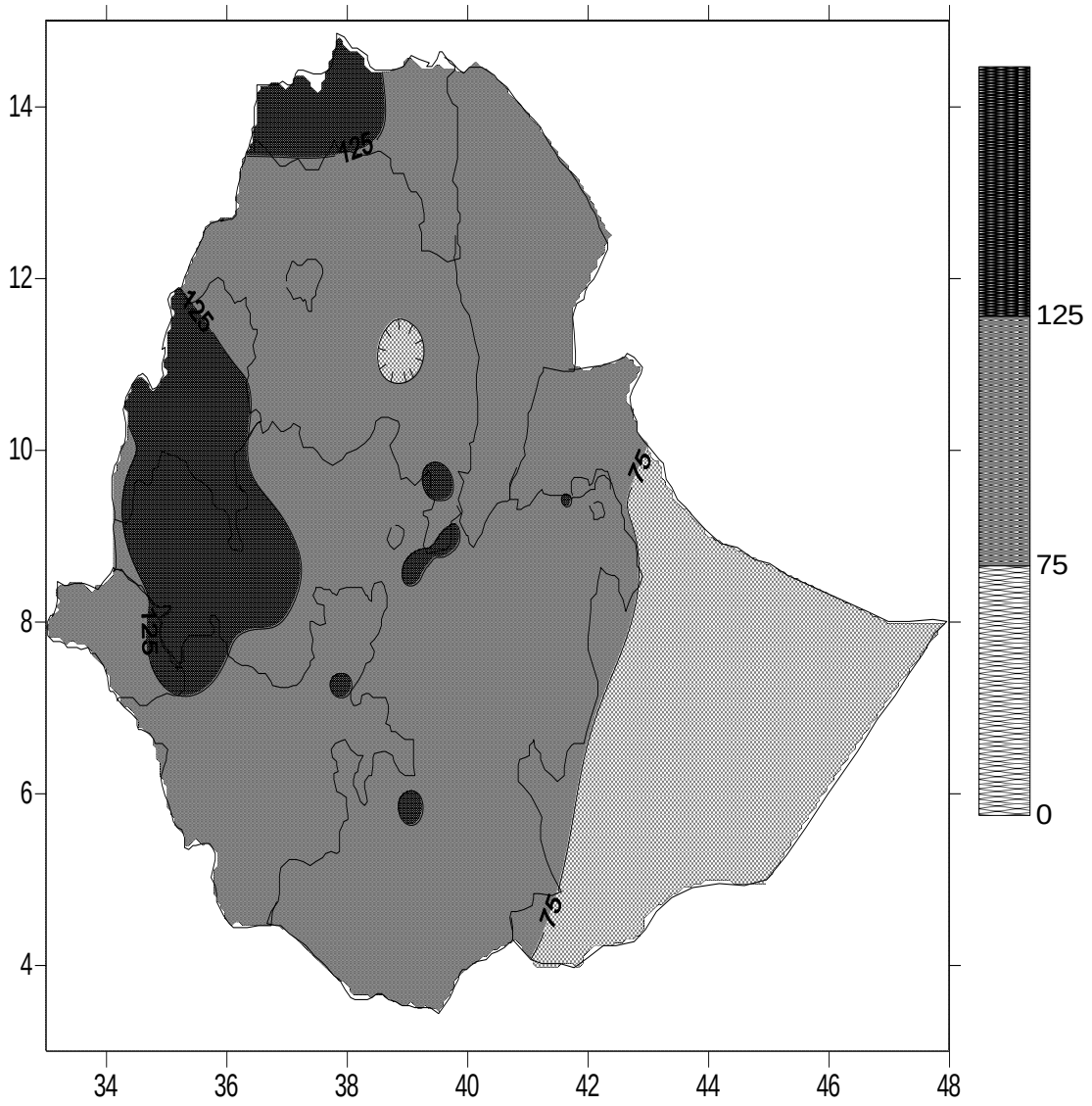


Figure 3.2.2. Percent of normal rainfall for the year 2016

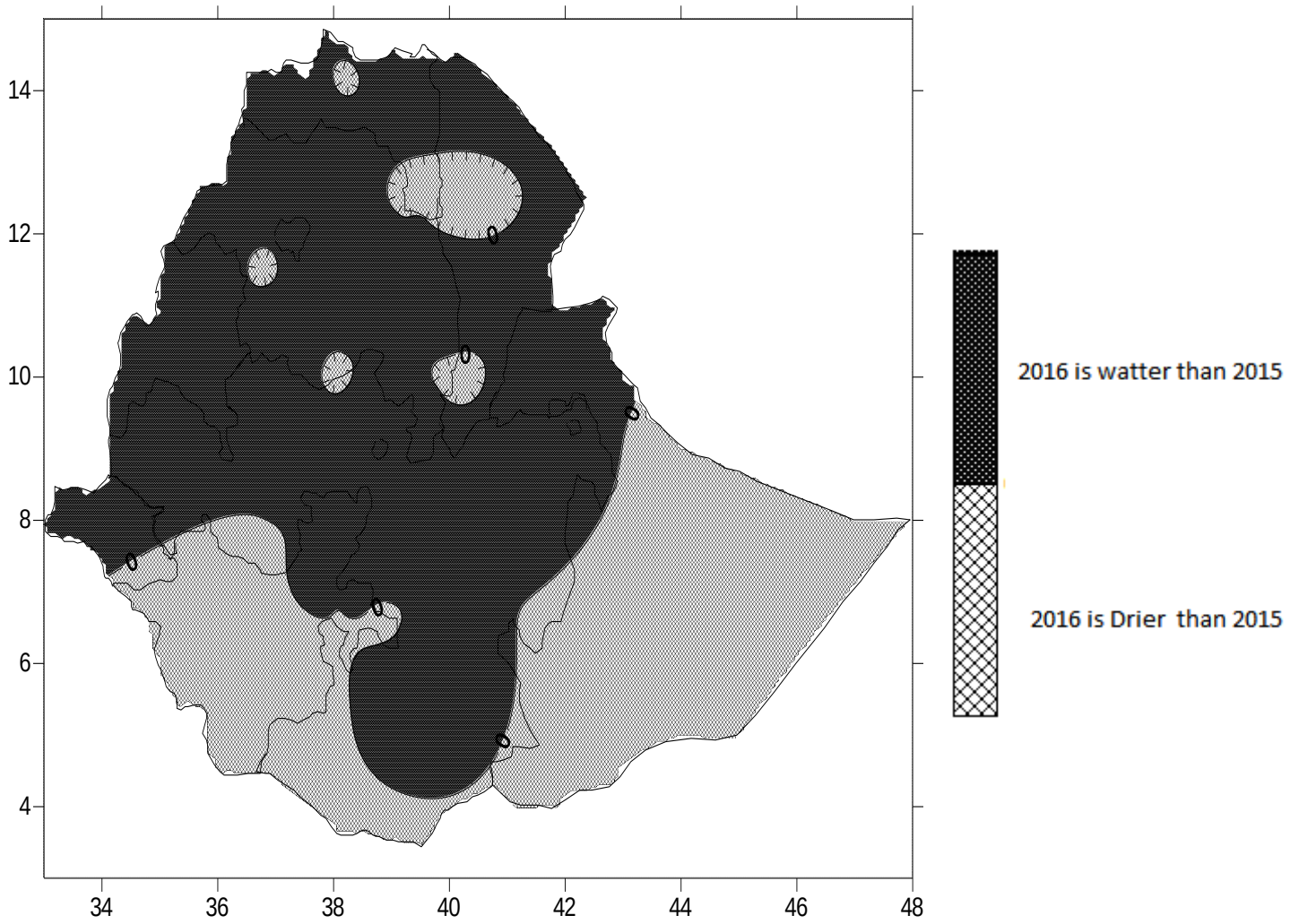


Figure 3.2.3. Annual Total Rainfall Amount of 2016 *minus* Annual Total Rainfall Amount of 2015

3.3 Wind

The ***WIND ROSE*** diagrams presented in table 3.3.1a to 3.3.1d show the wind conditions that prevailed during the three seasons over Addis Ababa Observatory, Mekele, Bahir Dar and Awassa, respectively of the long term conditions.

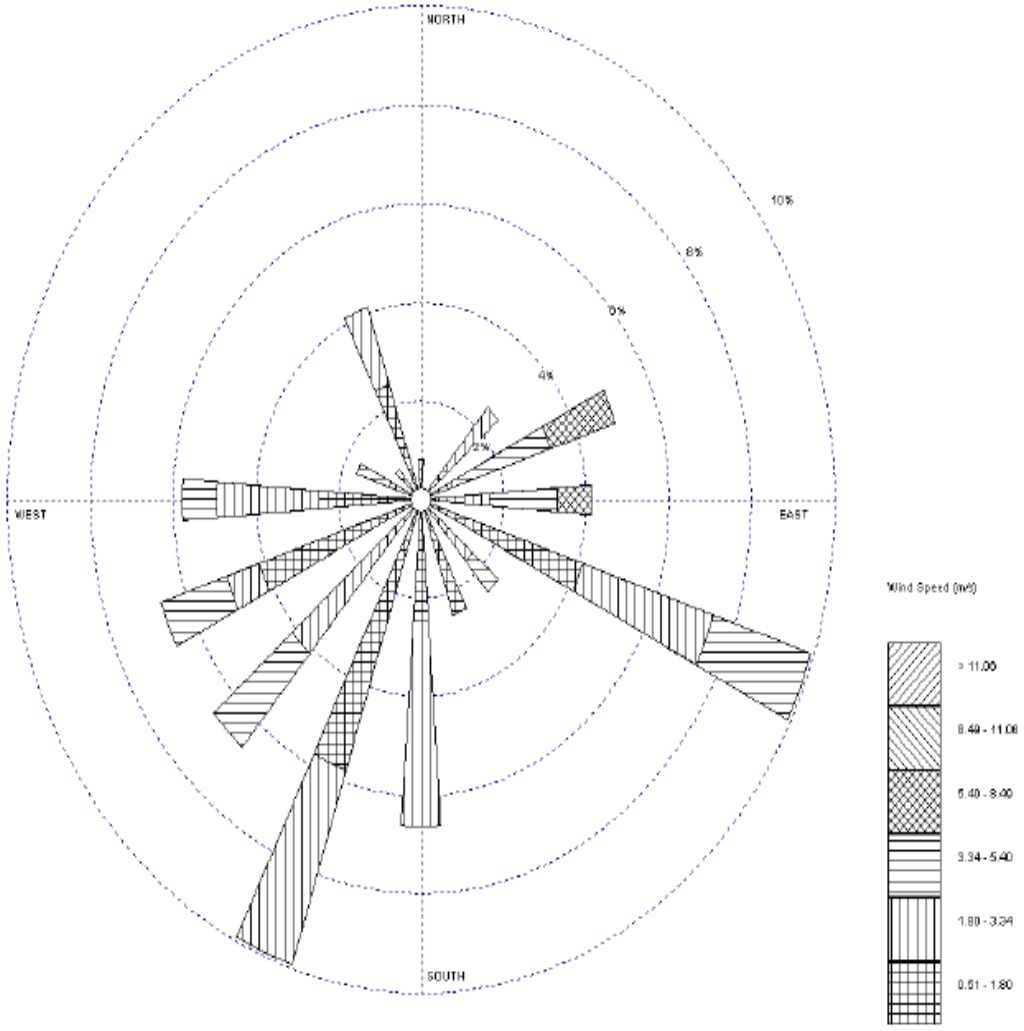
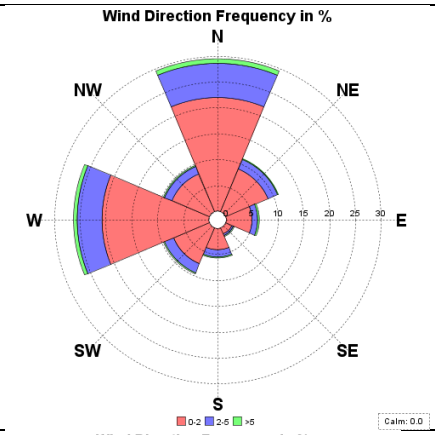
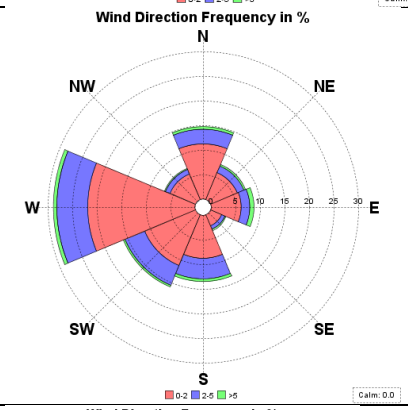
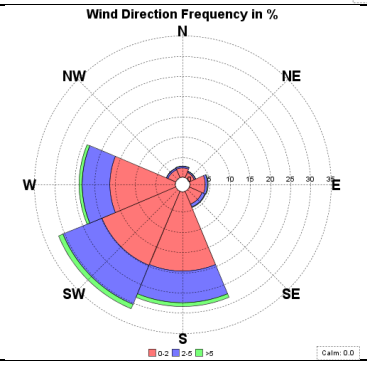
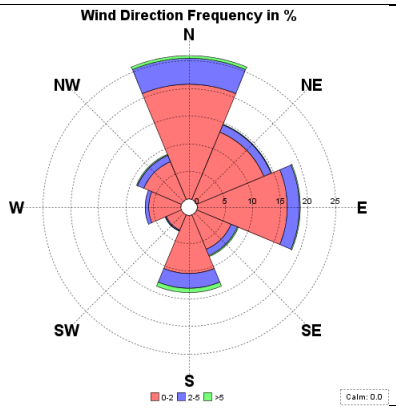
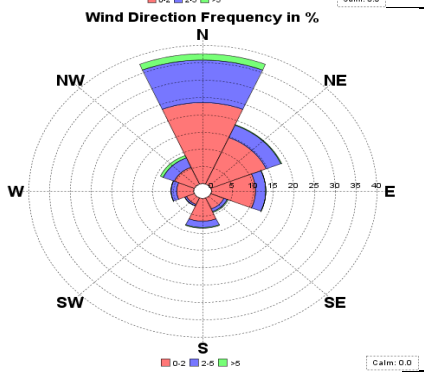
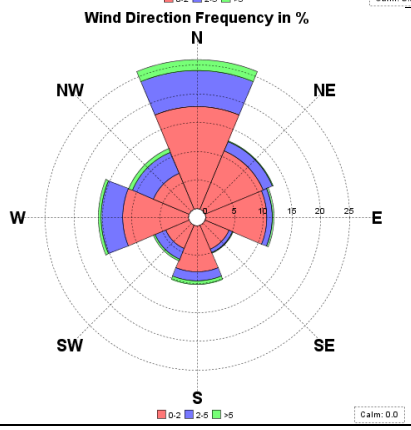


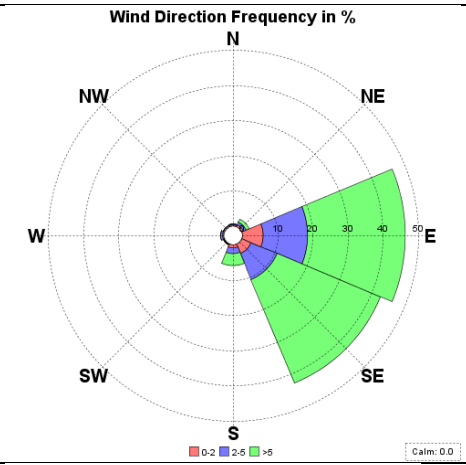
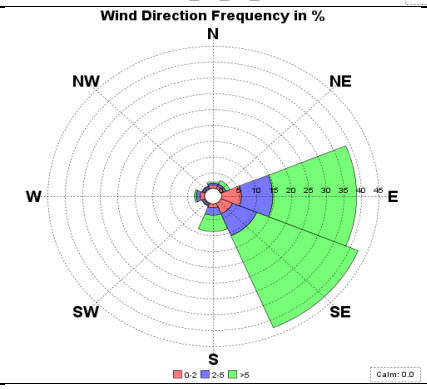
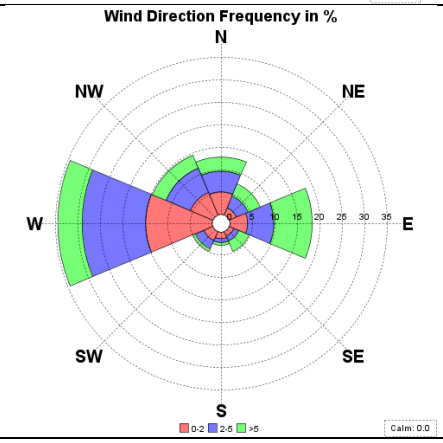
Figure 3.3.1 Sample wind rose diagram. The center on the diagram (where the head of each bar ends) represents a meteorological station into which the wind blows, while its tail shows where the wind comes from. The length of the bar is proportional to the frequency of the wind having a specific direction and speed range. The percentage points on the concentric circles can be used to make comparisons among the lengths of the bars and so as to easily identify the more prevalent direction. The shadings on the bar represent a specific speed range in meters per second as shown on the key.

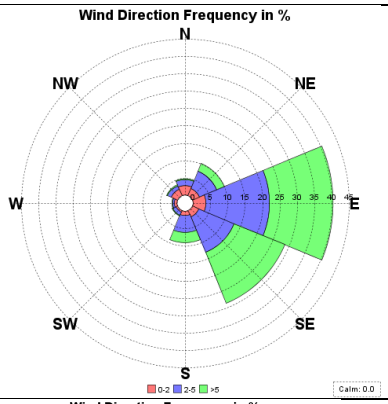
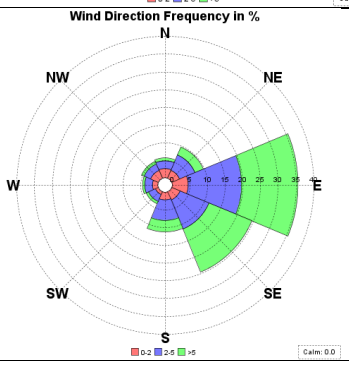
Table 3.3.1 WIND ROSE diagrams over selected stations showing the prevalent wind in the three seasons:

a. Awassa, b. Bahir Dar, c. Mekele and d. Addis Ababa

Station (Season) (a)	Based on long term data (1981-2010)
Awassa (Bega)	
Awassa (Belg)	
Awassa (Kiremt)	

Station (Season) (b)	Based on long term data (1981-2010)
Bahir Dar (Bega)	
Bahir Dar (Belg)	
Bahir Dar (Kiremt)	

Station (Season) (c)	Based on long term data (1981-2010)
Mekele (Bega)	
Mekele (Belg)	
Mekele (Kiremt)	

Station (Season) (d)	Based on long term data (1981-2010)
Addis Ababa Bole (Bega)	
Addis Ababa Bole (Belg)	
Addis Ababa Bole (Kiremt)