Federal Democratic Republic of Ethiopia

Ministry of Water, Irrigation and Electricity

National Meteorological Agency

Applied Meteorological Services Case Team

Climate Information For The Health Sector

May 2018

Foreword

This "Climate Information for the Health Sector" Bulletin has been designed to convey essential information regarding the monitoring of human comfort conditions based on the analysis of temperature and humidity data and also for the monitoring of Malaria outbreak areas based on the analysis of temperature and precipitation data.

Since the monitoring of temperature and rainfall over a given area can be used to assess the likelihood of outbreak of Malaria with a lag of two months, this information can be an important for early warning tool if used judiciously.

The major objective of this bulletin is in line with the National Meteorological Agency's strategy of diversifying climate application products to the basic developmental sectors (such as the Health, the water, the agricultural sector etc…). This bulletin can be a very important source of information to Health professionals engaged in the monitoring of Public Health, to Tourism Agents and institutions who advise tourists regarding the comfort conditions of the places to be visited by the tourists and to the researcher who is interested in the field of Bio-Climatology.

We have the opinion that careful and continuous use of this bulletin can benefit to the improvement of early warning and preparedness in the Heath sector.

Meanwhile, your comments and constructive suggestions are highly appreciated to make the objective of this bulletin a success,

This same bulletin can be accessed online at: http://www.meteo-ethiopia.net/health.htm

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1. Rainfall, Temperature and Humidity Conditions during May 2018.

Based on the national meteorological data of May 2018 report; total amount of monthly rainfall 80 mm and above were recorded over Western Amhara, Benshangul Gumuz, Western Oromia, Gambela, SNNPR, Southern and South eastern Oromia, Western Somale and Dire Dawa. and monthly mean relative humidity 60% and above were recorded over Eastern and Western Somale, Southern and South Eastern Oromia, Dire Dawa, SNNPR, Gambela, Western Oromia, Western Benshangul Gumuz and Pocket areas of Amhara and Afar Region. Similarly the distribution of rainfall was recorded highest to normal over most parts of the country; accordingly above average to Very Much Above Average rainfall distribution was registered over Northern and North Western Border areas, Pocket areas of Eastern Amhara, Western Oromia, South Western Gambela, Eastern SNNPR, Dire Dawa and Eastern Somale of the country; On the other hand; below normal rainfall distribution was observed over South Eastern Tigray, Western Afar, Southern Amhara and Northern Oromia Adjoining Areas, Pocket areas of Eastern Oromia and Eastern Somale and the Other Most parts of the country was recorded Average Rain fall Decile.

Regarding rainfall, humidity and rainfall deciles outputs, normal and above normal rainfall amount was recorded over most parts of the country; as a result most Southern, south western and Western high and lowland portion of the country recorded above normal rainfall and favorable for the existence and distribution of malaria was observed over those areas of the country during the month of May 2018 (fig.1a), (fig. 1b).

As per Grover-Kopek et al. 2006, the climatic conditions is favorable for transmission of malaria in Africa are; when the monthly precipitation accumulation is at least 80 mm, the monthly mean temperature is between 18°C and 32°C and the monthly mean relative humidity is at least 60%.; Accordingly the same method was applied on Temperature, Rainfall and Humidity using meteorological data of May 2018 collected from some representative meteorological stations of Ethiopia in order to demarcate all the possible malaria expected areas of the country (fig. 4).

On the basis of the above principle and other related output like the deciles map *(fig. 1b*), assessments of May 2018 rainfall, temperature and humidity with respect to the distribution of malaria, values of monthly mean temperature 18^0C to 32^oC was observed over most high and low land areas except Some Central highland parts of the country and those areas of the country was below 18 ^{o}C shaded in deep blue color and Eastern Afar and Northern Somale was above 32 ^{o}C (fig. 2a). At the same time most parts of Southern, South Western and Western parts of the country recorded above 80 mm of monthly total rainfall (fig. 1a) and 60% and above monthly mean relative humidity was recorded over Southern, South Eastern and South western parts of the country (fig. 2b). Based on the above explained the climatic conditions for favorable for the survival and distribution of malaria was observed over most lowland areas of Western Benishangulgumz, western oromia, Gambela, SNNPR, Southern and South Eastern Oromia and South Western Somale Regions of the country during the month of May 2018 (fig.4).

For furthermore and detailed information with respect malaria, the monthly mean minimum and maximum temperatures summary maps of May 2018 were posted on page four, (figures 3 (a) and 3(b)).

In principle, areas of favorable climate conditions for the existence and distribution of malaria can be summarized as follows;

if there is an area which satisfies the above three stated conditions with respect to the current monthly rainfall, temperature and humidity data; that specific portion of the area will be clearly marked in light yellowish background which is superimposed with red square pattern

Rainfall, Temperature and Humidity Assessment during the month of April 2018.

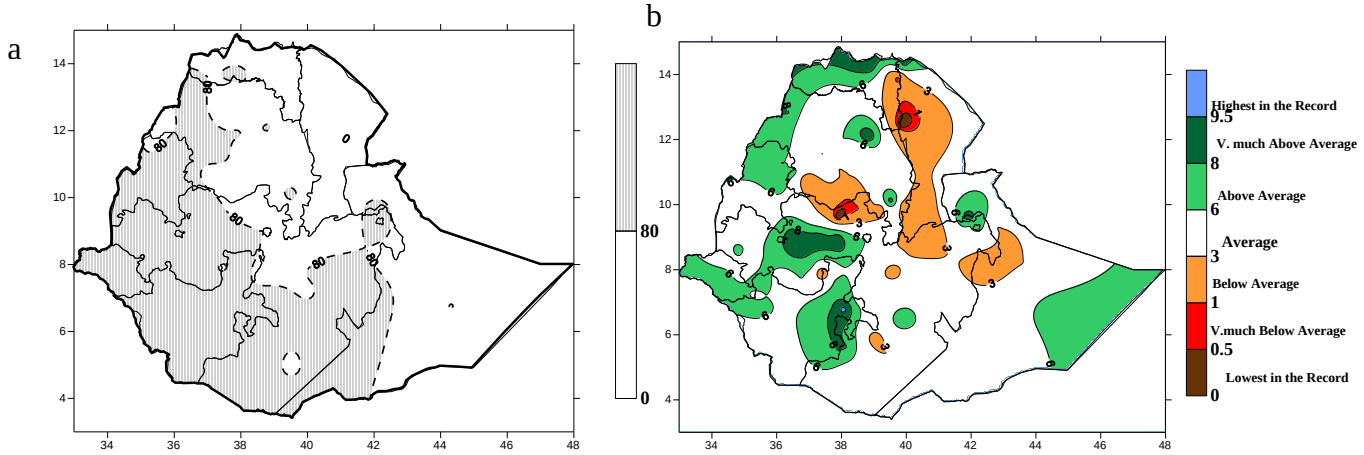

Fig. 1:- Rainfall assessment of May 2018

(a) Monthly total rainfall amount of May 2018 in mm. Hatched areas had monthly rainfall amount of 80mm and above

(b) Rainfall deciles of May 2018. Areas shaded in green color indicate wetter than normal condition, while areas shaded red color indicate rainfall deficiency

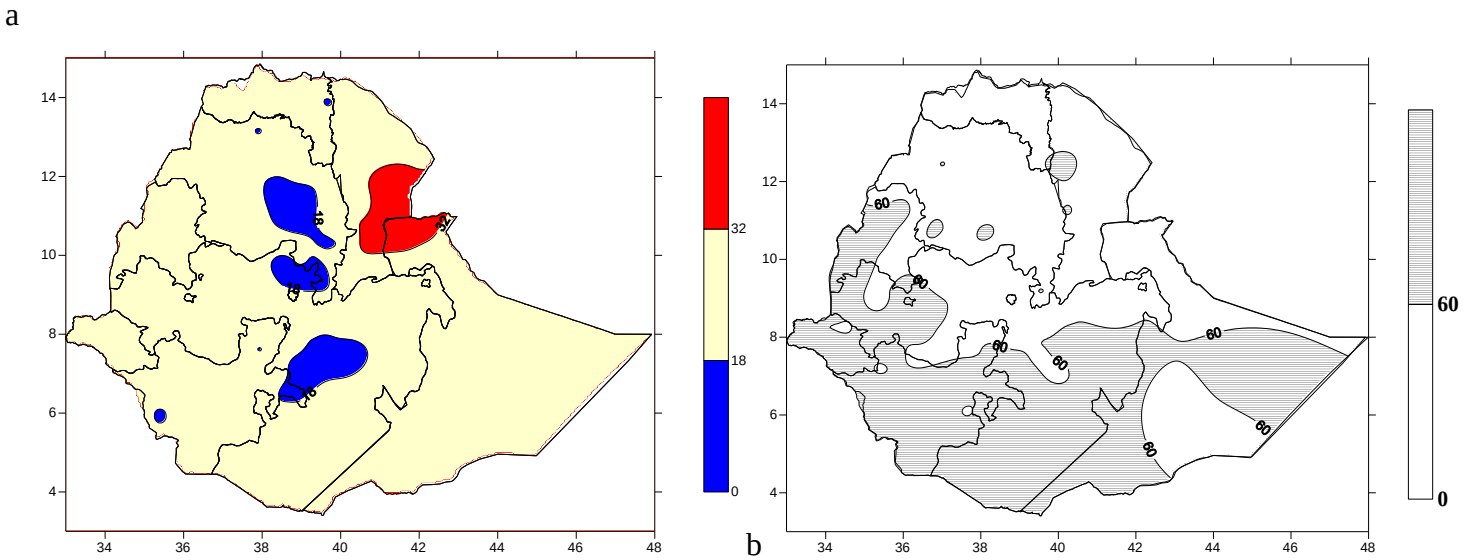

Fig. 2:- Mean Monthly Temperature and Average Monthly relative humidity assessment of May 2018.

(a) Monthly mean temperature in degree centigrade of May 2018 . Areas shaded in light yellowish color had monthly mean temperature of 18 to 32 ^{o}C and areas with temperature greater than 32^{0}C shaded in red color while areas shaded in deep blue color had monthly mean temperature less than 18 ^{0}C

(b) Monthly average relative humidity in % of May 2018 . Hatched areas had monthly average Relative humidity of 60% and above.

Average temperatures for the month of May 2018

a

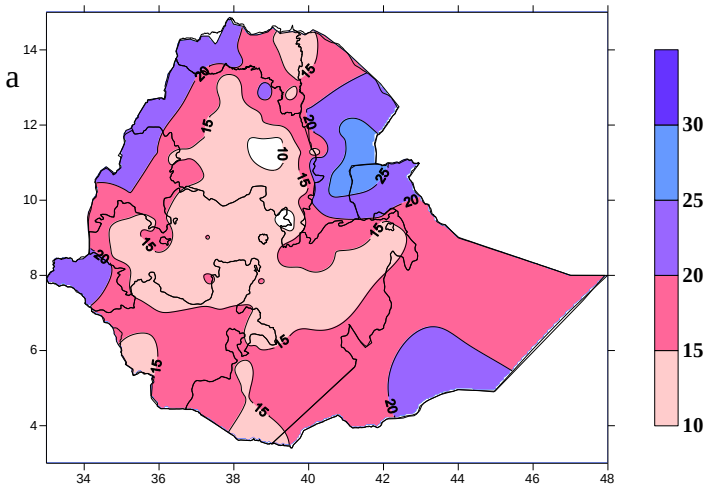

Fig 3:- (a). Monthly Average minimum temperature in degree Celsius during May 2018.

b

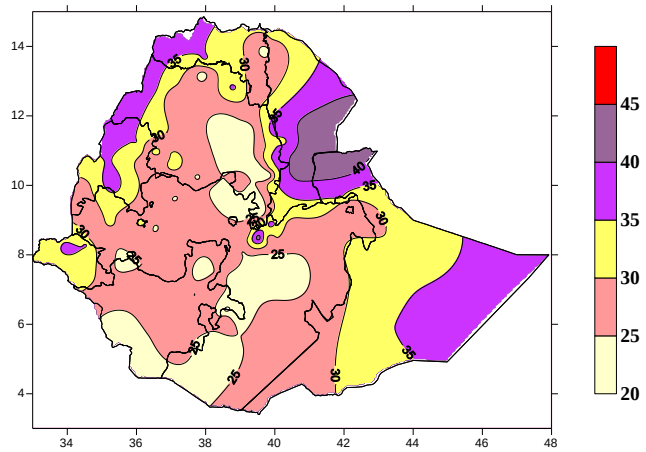

Fig 3:- (b). Monthly Average maximum Temperature in degree Celsius for the month of May 2018.

Malaria prone areas during the month of May 2018.

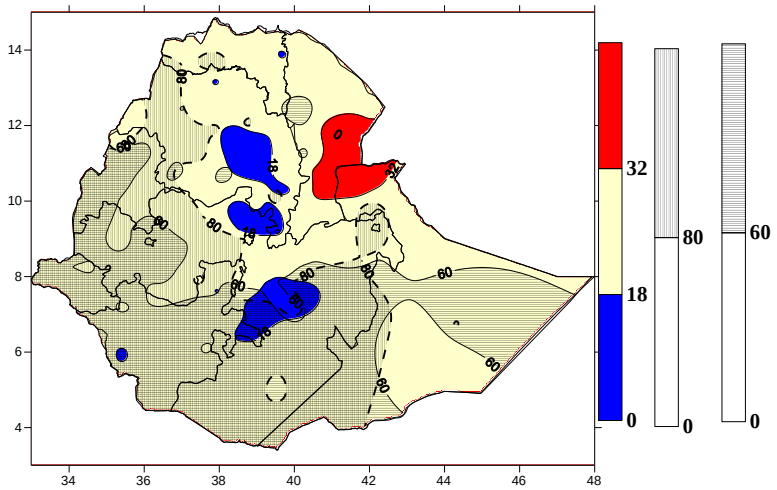

Fig 4:- Combined temperature, rainfall and relative humidity analysis for May 2018. Areas under square patterns with yellowish background color are assumed to satisfy favorable climatic conditions for malaria.

The above combined map was proposed to show the effect of monthly temperature, rainfall and relative humidity with respect to the survivable and distribution of malaria during the month of May 2018. Regarding to this issue; Areas under red squared patterns with light yellowish background colors are assumed to satisfy suitable climatologically condition for the existence and distribution of malaria whereas areas whose monthly average temperature below 18^0C and lowland areas whose monthly average temperature greater than 32^0C are marked in deep blue and red color respectively and those portion of the country were not favorable for the distribution of malaria.

According to the above principle; areas whose average temperature between 18 and 32 degree Celsius, total rainfall 80 mm and above together with a monthly average relative humidity of 60% and above were observed over **most lowland areas of Western Benishangulgumz, western oromia, Gambela, SNNPR, Southern and South Eastern Oromia and South Western Somale Regions of the country during the month of May2018 (fig. 4).**

In general, the rainfall, temperature and humidity 'RTH' values with respect to survivable and distribution malaria over most low lands of the country; the current monthly assessment of temperature, rainfall and humidity satisfy the above conditions, the climate condition over the country automatically considered as favorable for the survival and distribution of malaria during May 2018.

2. Temperature Humidity Index (THI) Conditions during May 2018.

With respect to Temperature-Humidity Index (THI), the climatic condition for human being was developed by the US weather Bureau in 1959; it is applied to the temperature and humidity datum over representative stations of the country in order to review the weather condition which was comfort, moderate and discomfort over all areas covered by indicated climate data sources during the month of May 2018. According to this approach, if the 'THI' values exceed 26 almost all the population feel uncomfortable (here we refer to it as "uncomfortable"), if the ''THI'' values between 21 to 26 half of the population feel uncomfortable (here we refer to it as "moderate") and if the THI values are less than 21 almost all the population feel comfortable (here we refer to it as "comfortable") with respect to heat stress.

According to the "THI" values of the above table, the degree of human comfort with respect to heat stress can be expressed as; uncomfortable condition which was recorded over Eastern and Central Afar, Northern Somale, Western Tip Tigray And Amhara Low land areas, Western Gambela and Pocket areas of Eastern Somale; as a result uncomfortable conditions was observed over the eastern half and Western lowland areas; yet comfortable and moderate conditions were dominating over rest most parts of the country during the month of May 2018. On the other hand high land areas like Southern, Central and Northern parts of the Country were stayed comfortable for more than 65% of the observation days; furthermore the rest most parts of the country were remained moderate for more than 75% of the observation days. In most cases, both comfortable and moderate conditions with respect to heat stress were dominating over most parts of the country during the month of May 2018 (Fig. 5 and table 1).

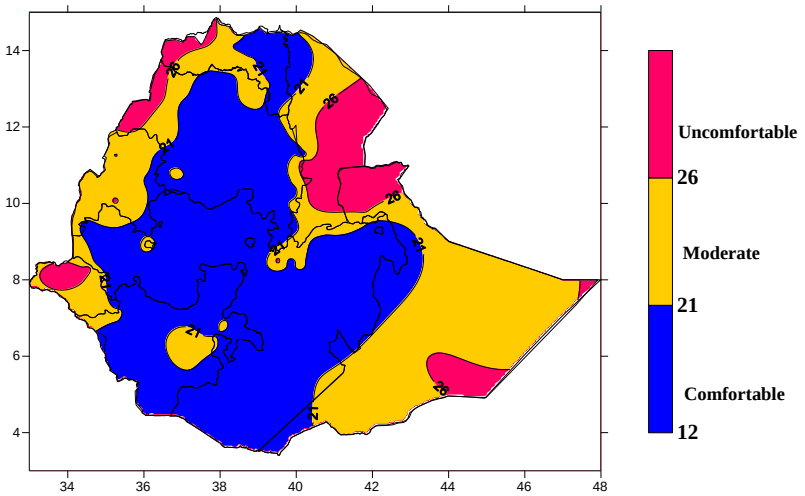

Fig.5 Average Monthly THI values for May 2018

Frequency of temperature-humidity Index (THI) from Selected Synoptic Stations during the month of May 2018.

No	Stations / May_2018	Number of Days with THI Values of			Total number of Days
		< 21 (Comfortable)	21-26 (Moderate)	>26 (Uncomfortable)	
1	Robe	29	1	1	31
2	Addisababa	26	5	0	31
3	D/Markos	20	11	0	31
4	B/Dar	2	29	0	31
5	Kombolcha	2	29	0	31
6	Jimma	4	26	1	30
7	Arbminch	4	26	0	30
8	Gode	5	23	0	28
9	Gondar	8	23	0	31
10	Awassa	8	22	1	31
11	D/Zeit A.F	7	21	0	28
12	Mekele	13	18	0	31
13	Gore	14	17	0	31
14	Negele	15	16	0	31
15	Nekemte	15	16	0	31
16	D/Dawa	2	11	17	30
17	Metehara	1	10	20	31

Table 1:- Temperature Humidity Index (THI) values for some selected Synoptic stations during the month of May 2018.

Reference: - Grover-Kopec et al. 2006 - Web-based climate information resources for malaria control in Africa, Malar J. 2006; 5: 38. Published online 2006 May11. doi: 10.1186/1475-2875-5