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

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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 February-2018

According to the National Meteorological data of February-2018 report; **total amount of monthly rainfall 80 mm and above, monthly mean relative humidity 60% and above were NOT recorded over** the most parts of the country. Similarly the distribution of rainfall was not recorded highest to normal wholly over most parts of the country.

Regarding **rainfall, humidity and rainfall deciles** outputs, normal and above rainfall amount was not recorded over most parts of the country.

As per Grover-Kopek et al. 2006, the favorable climatic conditions 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 February-2018 collected from some **representative meteorological stations of Ethiopia** in order to demarcate all the possible malaria expected areas of the country (fig. 4).

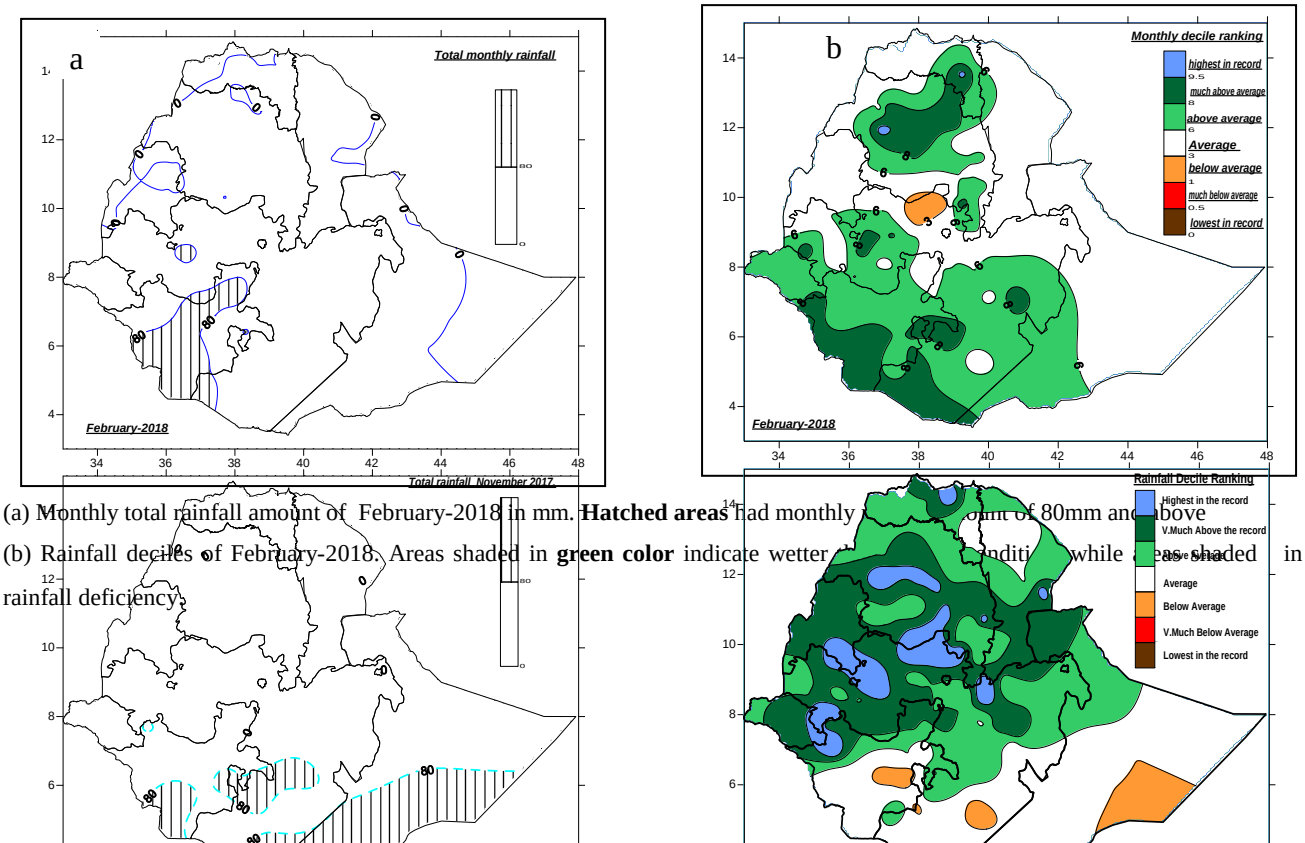
On the basis of the above principle and other related output like the deciles map (fig. 1b), assessments of February-2018 rainfall, temperature and humidity with respect to the distribution of malaria, **values of monthly mean temperature 18^{0}C to 32^{o}C** was observed over most areas (2a). At the same time some parts of the country except southwestern areas of the country were not recorded 80 mm and above of monthly total rainfall (fig. 1a). Additionally, **60% and above monthly mean relative humidity** was not recorded over most parts of the country . Based on the above explained assessment, the monthly rainfall, humidity and temperature; **Therefore** climatic conditions were not favorable for the survival and distribution of malaria over most parts of the country lowland areas of Benishangulgumz, North-western, North-eastern and eastern Oromia, and adjoining parts of area and a few lowland portion of western Amhara and entire portions of the country during February-2018 (fig.4).

For furthermore and detailed information with respect malaria, the monthly mean minimum and maximum temperatures summary maps of February-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;

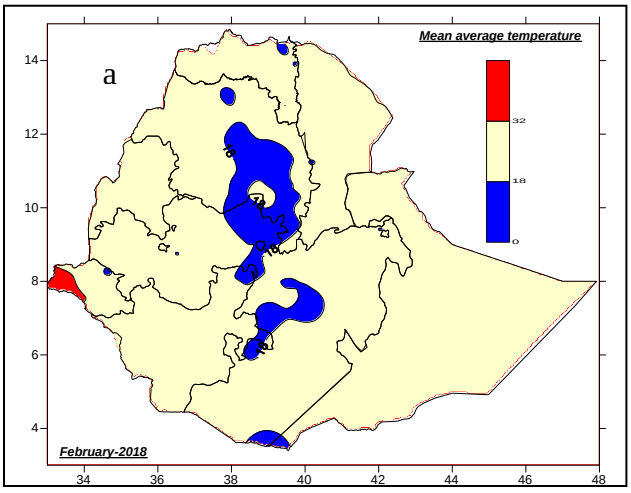
if there is an area which satisfies the above three stated conditions with respect to the current monthly rainfall, temperature and humidity data; that specific portion of the area will be clearly marked in light yellowish background which is superimposed with red square pattern (fig.4).

Rainfall, Temperature and Humidity Assessment during the month of February-2018



(a) Monthly total rainfall amount of February-2018 in mm. **Hatched areas** had monthly [illegible] amount of 80mm and above

(b) Rainfall deciles of February-2018. Areas shaded in **green color** indicate wetter [illegible] conditi[illegible] while areas shaded in **red color** indicate rainfall deficiency.



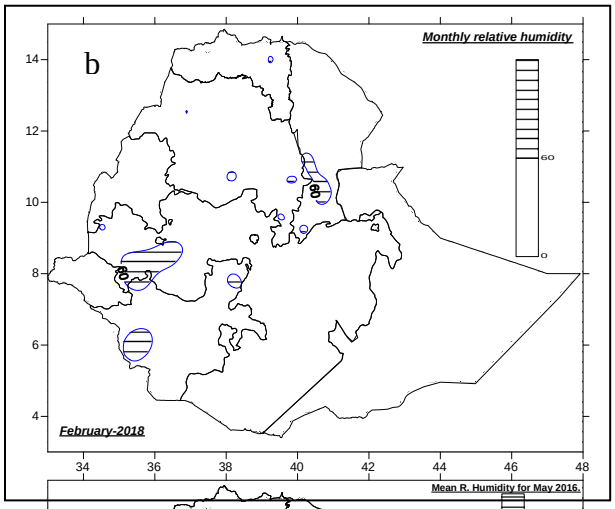
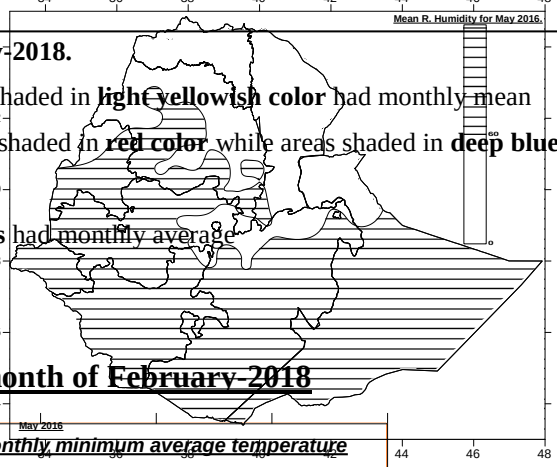


Fig. 2:- Temperature and relative humidity assessment of February-2018.

(a) Monthly mean temperature in degree centigrade of February-2018. Areas shaded in **light yellowish color** had monthly mean temperature of **18 to 32 ºC** 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 February-2018. **Hatched areas** had monthly average **Relative humidity of 60% and above**.



Average temperatures for the month of February-2018

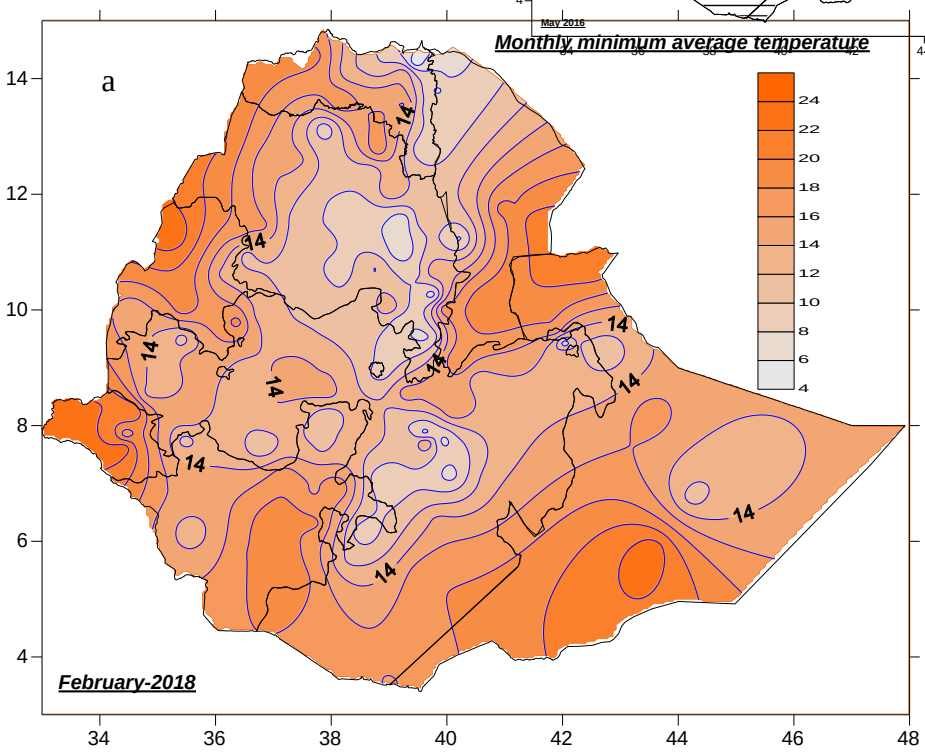


Fig 3:- (a). Mean minimum temperature in degree Celsius during February-2018.

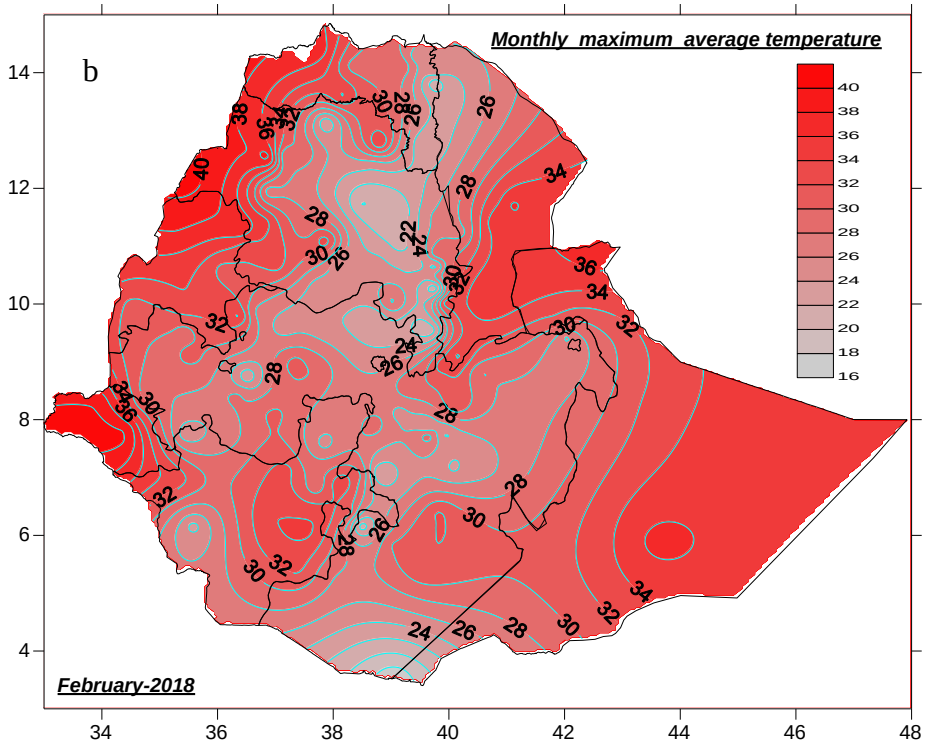


Fig 3:- (b). Mean maximum Temperature in degree Celsius for the month of February-2018.

Malaria prone areas during the month of February-2018

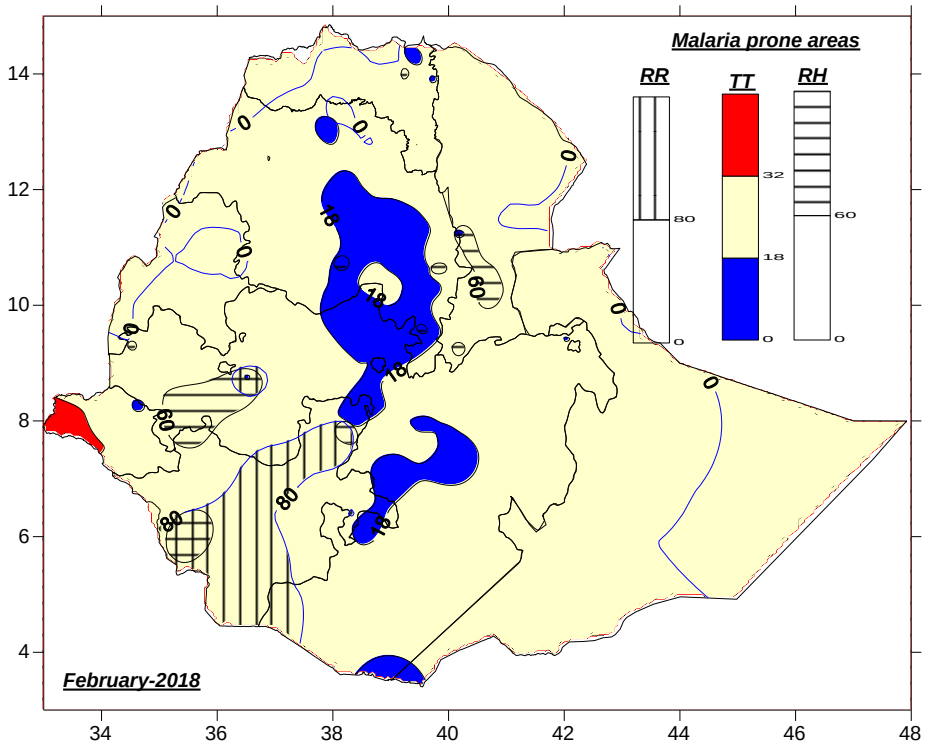


Fig 4:- Combined temperature, rainfall and relative humidity analysis for February-2018. Areas under square patterns with yellowish background color are assumed to satisfy favorable climatic conditions for malaria.

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 February-2018.** Regarding to this issue; Areas under **red squared patterns** with **light yellowish background colors** are **assumed to satisfy suitable climatological 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 was not observed over most parts of the country ; ***Therefore climatic conditions were not favorable for the survival and distribution of malaria over most portions of the country and some lowland areas of Benishangulgumz , southern and Southern Oromiya ,SNNPR, Southern eastern Somali parts as well with in entire portion of the country during February-2018 except some southwestern parts of the country.*** (fig. 4)**.**

In general, the rainfall, temperature and humidity 'RTH' values with respect to survivable and distribution malaria; **if the current monthly** assessment of temperature, rainfall and humidity **satisfy the above conditions**, the climate condition over that specific area automatically considered as **favorable for the survival and distribution of malaria and that portion of the country** will be marked in **light yellowish background color superimposed with red square pattern.**

2. Temperature Humidity Index (THI) Conditions during February-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 May2016. 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.

Based on the "THI" values of the next table, the degree of human comfort with respect heat stress can be **abridged** as; uncomfortable was registered over **2 synoptic stations of** 17 synoptic stations for about **8 and 11 days** with **Diredawa** and **Arbaminch** respectively ; yet comfortable and moderate conditions were **dominating** over some parts of the country during the **month of February-2018** areas like **Balerobe**, **Debremarkos**, **Addis ababa**, **and Mekele**, **,**were **stayed comfortable** for more than 81% of the observation days; moreover the places which were **moderately comfortable** were **Nekemte,Awassa, Gondar, Bahirdar, Debrezeit, Combolcha, Metehara, Jimma, Negele,Arbaminch, Diredawa and Gore**. 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 **February-2018** (table 1).

Frequency of temperature-humidity Index (THI) during the month of February-2018

No	*Station*	*Number Of Days With THI Values*			TOTAL
No	FEB.2018	<21(Comfortable)	21-26(Moderate)	>26(Uncomfotable)	TOTAL
1	*Debremarkos*	28	0	0	28
2	*Addisababa*	28	0	0	28
3	*Balerobe*	27	0	0	27
4	*Mekele*	25	3	0	28
5	*Combolcha*	11	17	0	28
6	*Debrezeit A.F*	7	17	0	24
7	*Nekemte*	6	22	0	28
8	*Gondar*	4	24	0	28
9	*Gore*	4	24	0	28
10	*Jimma*	4	22	0	26
11	*Bahirdar*	3	25	0	28
12	*Negele*	2	25	0	27
13	*Metehara*	1	13	9	23
14	*Awassa*	0	28	0	28
15	*Diredawa*	0	20	8	28
16	*Arbminch*	0	16	11	27
17	*Gode*	0	0	0	0

Table 1:- Temperature Humidity Index (THI) values for some selected stations during the month of February-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