Supporting Information for "Climate drivers of malaria seasonality and their relative importance in Sub-Saharan Africa"

Edmund I. Yamba[1], Andreas H. Fink[2], Kingsley Badu[3], Ernest O. Asare[4],

Adrian M. Tompkins[5]and Leonard K. Amekudzi[1]

[1]Department of Meteorology and Climate Science, Kwame Nkrumah University of Science and Technology (KNUST),

Kumasi-Ghana

[2]Institute of Meteorology and Climate Research, Karlsruhe Institute of Technology, Karlsruhe, Germany

[3]Theoretical and Applied Biology, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

[4]Department of Epidemiology of Microbial Diseases, Yale School of Public Health, Yale University, New Haven, CT, USA

[5]International Centre for Theoretical Physics, Earth System Physics, Trieste, Italy

1. Introduction

The tables provide detailed information on the study locations where mosquitoes have been collected and estimated for EIR. Geographical information for each location include: country and village where the survey took place; the longitude (lon), latitude (lat) and the elevation of the place; whether the location is rural (R) or periurban (PU) and had no permanent water body or irrigation activities. Other important information include: the year the data collection started (SY) and ended (EY), the month the data collection started (SM) and end (EM).

———

Corresponding author: E. I. Yamba, Department of Meteorology and Climate Science, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. Email: eiyamba@knust.edu.gh

July 27, 2022, 8:30am

Figure S1 shows the climate characteristics Sahel, Guinea, WCA and EA. It depicts the distinct seasonal profile of rainfall, minimum and maximum temperature for each zone.
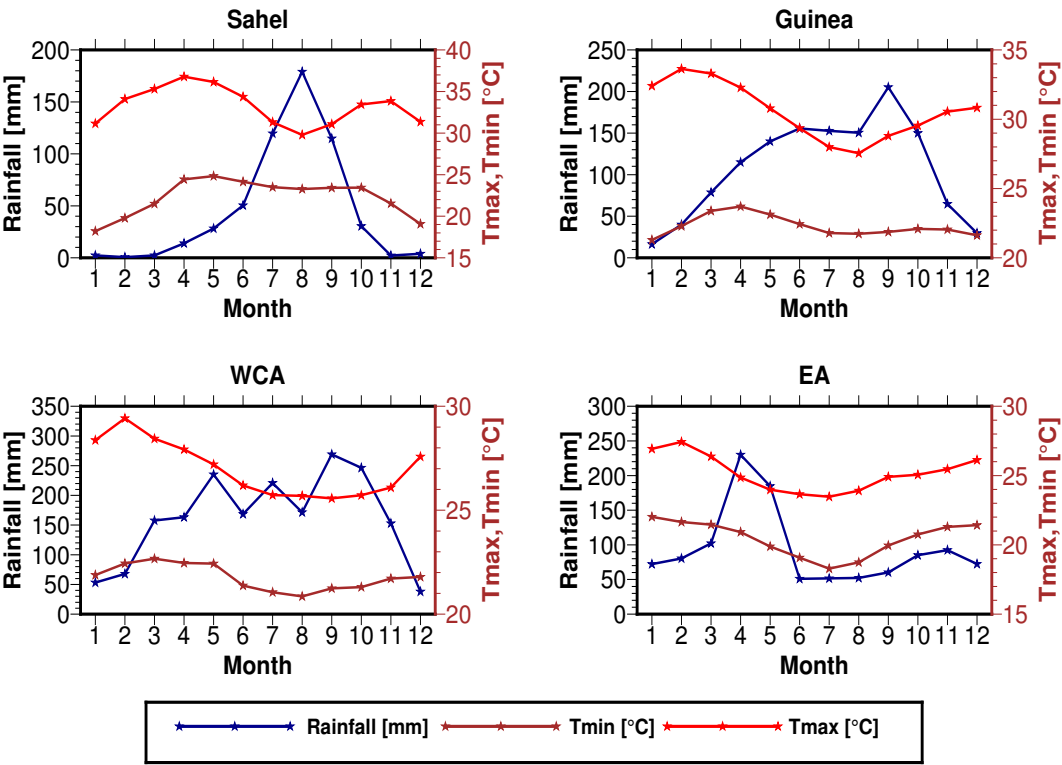

Figure S1. The monthly timeseries of RR, T_n and T_x over the difference climate zones

Table S1. Malaria EIR database locations for Sahel. Pd=population density type, SY=start year of data, EY=End year of data, SM=start month of data, EM= end month of data.

Country	site	lon	lat	elevation	Pd	Hydrology	SY	SM	EY	EM
Burkina Faso	Dande	-4.557	11.582	275	R	N	1983	01	1984	12
Burkina Faso	Koubri	-1.406	12.198	289	R	N	1984	03	1985	02
Burkina Faso	Lena	-3.98	11.28	307	R	N	1999	01	2001	12
Burkina Faso	Pabre	-1.57	12.505	303	R	N	1984	03	1985	02
Burkina Faso	Tago	-2.643	12.932	308	R	N	1983	01	1983	12
Eritrea	Adibosqual	38.39	15.42	1482	R	N	1999	01	1999	12
Eritrea	Anseba Adibosqual	38.39	15.42	894	R	N	1999	10	2000	09
Eritrea	Anseba Hagaz	37.39	15.42	894	R	N	1999	10	2000	09
Eritrea	Dasse	37.29	14.55	916	R	N	1999	01	1999	12
Eritrea	Gash Barka Dasse	37.29	14.55	610	R	N	1999	10	2000	09
Eritrea	Gash Barka Hiletsidi	36.39	15.07	610	R	N	1999	10	2000	09
Eritrea	Hagaz	38.17	15.42	883	R	N	1999	01	1999	12
Eritrea	Hiletsidi	36.39	15.07	586	R	N	1999	01	1999	12
Eritrea	Maiaini	39.09	14.49	1554	R	N	1999	01	1999	12
Ghana	KND Lowland	-1.33	10.84	212	R	N	2001	06	2002	05
Ghana	KND Rocky Highland	-1.33	10.84	212	R	N	2001	06	2002	05
Mali	Ndebougou Sector	-5.96	14.327	280	R	N	1999	04	2000	03
Mali	Molodo Sector	-6.03	14.257	280	R	N	1999	04	2000	03
Mali	Sotuba	-7.91	12.66	323	R	N	1998	01	1998	12
Senegal	Aere Lao	-14.32	16.4	13	R	N	1982	05	1983	04
Senegal	Affiniam Diagobel Tendimane	-16.24	14.28	12	R	N	1985	01	1986	12
Senegal	Barkedji	-14.88	15.28	349	R	N	1994	06	1996	05
Senegal	Boke Dialllobe	-14	16.07	28	R	N	1982	05	1983	04
Senegal	Ndiop	-16.36	15.95	6	R	N	1993	01	1996	12
Senegal	Ngayokheme	-16.43	14.53	11	R	N	1995	01	1995	12
Senegal	Takeme and Ousseuk	-16.24	14.28	21	R	N	1985	01	1986	12
Senegal	Toulde Galle	-14.48	16.53	11	R	N	1990	06	1992	05

Table S2.   Malaria EIR database locations for Guinea. Pd=population density type, SY=start

year of data, EY=End year of data, SM=start month of data, EM= end month of data.

Country	site	lon	lat	elevation	Pd	Hydrology	SY	SM	EY	EM
Ghana	Abotanso	-0.26	6.09	374	R	N	2004	09	2005	08
Ghana	Gyidim	-1.11	6.81	408	R	N	2003	11	2005	10
Ghana	Hwidiem	-2.35	6.93	186	R	N	2003	11	2005	10
Ghana	Kintampo	-1.73	8.05	354	R	N	2003	11	2006	10
Ghana	LowCost	-1.33	6.38	250	R	N	2003	11	2005	10
Ivory Coast	Beoue	-7.87	6.55	268	R	N	1998	04	1999	03
Ivory Coast	Bouake Dar es Salam	-5.04	7.69	325	PU	N	1991	01	1992	12
Ivory Coast	Bouake Kennedy	-5.01	7.69	351	PU	N	1991	01	1992	12
Ivory Coast	Bouake Sokoura	-5.01	7.90	361	PU	N	1991	01	1992	12
Ivory Coast	Danta	-8.16	7.02	272	R	N	1998	04	1999	03
Ivory Coast	Douandrou	-7.92	6.54	237	R	N	1998	04	1999	03
Ivory Coast	Douedy-Guezon	-7.75	6.57	266	R	N	1998	04	2000	03
Ivory Coast	Folofonkaha	-5.21	8.58	328	R	N	1996	12	1997	11
Ivory Coast	Ganse	3.9	8.617	392	R	N	2000	07	2002	06
Ivory Coast	Glopaoudy	-7.63	6.55	234	R	N	1998	04	1999	03
Ivory Coast	Kabolo	-4.99	8.19	268	R	N	1996	12	1997	11
Ivory Coast	Kafine	-5.67	9.27	322	R	N	1995	01	1995	12
Ivory Coast	Kaforo	-5.67	9.29	329	R	N	1996	12	1997	11
Ivory Coast	Kombolokoura	-5.88	9.33	366	R	N	1996	12	1997	11
Ivory Coast	Petionara	-5.12	8.43	277	R	N	1996	12	1997	11
Ivory Coast	Pohan	-7.93	6.54	249	R	N	1998	04	2000	03
Ivory Coast	Seileu	-8.17	7.10	337	R	N	1998	04	1999	03
Ivory Coast	Tai	-7.12	5.75	218	R	N	1995	07	1996	06
Ivory Coast	Tiemelekro	-4.617	6.5	91	R	N	2002	01	2003	12
Ivory Coast	Tioroniaradougou	-5.70	9.36	361	R	N	1996	12	1997	11
Ivory Coast	Zaïpobly and Gahably	-7.0	5.5	180	R	N	1995	07	1997	06
Ivory Coast	Ziglo	-7.80	6.57	256	R	N	1998	04	2000	03
Sierra Leone	Mendewa	-11.48	8.17	325	R	N	1990	01	1990	12
Sierra Leone	Nyandeyama	-11.62	8.12	118	R	N	1990	01	1990	12

Table S3.   Malaria EIR database locations for WCA. Pd=population density type, SY=start

year of data, EY=End year of data, SM=start month of data, EM= end month of data.

Country	site	lon	lat	elevation	Pd	Hydrology	SY	SM	EY	EM
Cameroon	Koundou	12.12	3.90	705	R	N	1997	06	1998	05
Cameroon	Ebogo	11.47	3.40	659	R	N	1991	04	1992	03
Cameroon	Ebolakounou	12.44	3.91	701	R	N	1997	06	1998	05
Cameroon	Esuke camp	9.31	4.10	279	R	N	2004	10	2005	09
Cameroon	Idenau	9.05	4.21	359	R	N	2001	08	2002	07
Cameroon	Likoko	9.31	4.39	1933	R	N	2002	10	2003	09
Cameroon	Limbe	9.18	4.03	185	R	N	2001	08	2002	07
Cameroon	Nkoteng	12.05	4.5	587	R	N	1999	02	2001	01
Cameroon	Ndogpassi	10.13	3.08	72	R	N	2011	01	2011	12
Cameroon	Tiko	9.36	4.08	182	R	N	2001	08	2002	07
Gabon	Benguia	13.52	-1.63	37	R	N	2003	05	2004	04
Gabon	Dienga	12.68	-1.87	772	R	N	2003	05	2004	04

Table S4. Malaria EIR database locations for EA. Pd=population density type, SY=start year of data, EY=End year of data, SM=start month of data, EM= end month of data.

Country	site	lon	lat	elevation	Pd	Hydrology	SY	SM	EY	EM
Burundi	Katumba	29.237	-3.317	776	R	N	1982	01	1982	12
Kenya	Asembo	34.40	-0.18	1148	PU	N	1988	03	1989	02
Kenya	Kameichiri	37.62	-0.82	1188	PU	N	2004	04	2005	03
Kenya	Kilifi	39.85	-3.62	18	PU	N	1990	12	1991	11
Kenya	Mumias	34.49	0.34	1311	PU	N	1995	05	1996	04
Kenya	Murinduko	37.45	-0.57	1311	PU	N	2004	04	2005	03
Kenya	Sokoke	39.88	-3.33	125	R	N	1990	12	1991	11
Mozambique	CdSLCMPC	32.57	-25.92	35	PU	N	1985	01	1985	12
Tanzania	Bagamoyo	38.26	-5.04	1093	R	N	1995	10	1996	09
Tanzania	Balangai	38.28	-4.56	1230	R	N	1995	10	1996	09
Tanzania	Chasimba	38.82	-6.58	36	R	N	1992	01	1992	12
Tanzania	Kisangasangeni	37.39	-3.39	759	PU	N	1994	07	1995	06
Tanzania	Kwameta	38.29	-5.08	671	R	N	1995	10	1996	09
Tanzania	Kwamhanya	38.28	-5.04	596	R	N	1995	10	1996	09
Tanzania	Magundi	38.28	-5.04	671	R	N	1995	10	1996	09
Tanzania	Mapinga	39.07	-6.60	59	R	N	1992	01	1992	12
Tanzania	Milungui	38.23	-4.45	1636	R	N	1995	10	1996	09
Tanzania	Mvuleni	37.33	-3.39	786	PU	N	1994	07	1995	06
Tanzania	Yombo	38.85	-6.59	36	R	N	1992	01	1992	12
Tanzania	Zinga	38.99	-6.52	22	R	N	1992	01	1992	12
Uganda	Apac-Olami	32.56	1.89	1053	R	N	2001	06	2002	05
Uganda	Arua-Cilio	31.02	3.11	976	PU	N	2001	06	2002	05
Uganda	Kabale villages	29.98	-1.22	1888	PU	N	1997	10	1998	09
Uganda	Kanungu Kihihi	29.70	0.59	758	R	N	2001	06	2002	05
Uganda	Kyenjojo Kasiina	30.65	0.62	1361	R	N	2001	06	2002	05
Uganda	Tororo-Namwaya	34.18	0.68	1143	PU	N	2001	06	2002	05
Zambia	Chidakwa	26.791	-16.393	1000	R	N	2005	11	2006	10
Zambia	Lupata	26.791	-16.393	1000	R	N	2005	11	2006	10

Table S5. **Results of the relative importance of the meteorological predictors of**

$\mathbf{EIR_m}$ for locations with elevations between 501–1000 m. Variables with significant contributions

are are boldfaced.

Zone	R^2 [%]	Variable	lmg [%]	First [%]	Coefficient (R)	P-value
Sahel	10.08	RR	3.20	7.07	0.2070	0.0189
		T_{max}	2.73	3.60	-4.3460	0.1300
		T_{min}	2.36	1.22	2.7780	0.2320
		T_{mean}	1.79	0.45	-0.9683	0.7490
Guinea	-	RR	-	-	-	-
		T_{max}	-	-	-	-
		T_{min}	-	-	-	-
		T_{mean}	-	-	-	-
WCA	8.96	RR	0.77	1.79	0.2630	0.1350
		T_{max}	4.89	3.71	-9.5780	0.1060
		T_{min}	0.91	0.18	-5.0120	0.6650
		T_{mean}	2.39	1.63	-9.5740	0.2330
EA	6.74	+ RR	0.68	0.21	-0.0951	0.6070
		T_{max}	3.02	2.34	4.6330	0.0847
		T_{min}	1.14	0.14	1.1540	0.6340
		T_{mean}	1.90	1.04	3.1700	0.2350