

Table S1 Hydrologic modeling of modern and paleo-lake systems, Lake Victoria end-member

Lake systems

Paleolake:
Darfur Fezzan Chad

modern Lake:
Chad Kutzbach Victoria Victoria Hastenrath

reference

<i>measured physical parameters</i>	symbol	units							
lake area	A_w	km ²	32288	126500	344724	344724	68800	68800	(1)
land area	A_L	km ²	91912	203000	1185802	1185802	110,000	110,000	(1)
lake area ratio	a_w	-	0.26	0.38	0.23	0.23	0.47	0.47	(1)
land area ratio	a_b	-	0.74	0.62	0.77	0.77	0.53	0.53	
lake highstand elevation	masl	m	573	521	325	325	1135	1135	
pressure	P	kPa	94.78	95.37	97.59	97.59	88.65	88.65	
mean annual air temperature	MAT	°C	NA	NA	NA	NA	22.3	19.7	(2)
mean annual lake temperature	MALT	°C	NA	NA	NA	NA	25.4	22.3	(2)
wind speed	U	m sec ⁻¹	NA	NA	NA	NA	1.95	1.95	(2)

Lake Victoria end-member

Radiation

fractional cloud cover	c	-	0.65	0.65	0.65	0.65	0.65	0.50	
clear sky radiation (with clouds)	R_{sw}	MJ m ⁻² day ⁻¹	19.28	18.55	19.41	18.40	19.04	19.63	(3)
surface albedo	α	-	0.07	0.07	0.07	0.06	0.07	0.06	(4)
net shortwave absorbed at surface	$R_{sw}(1-\alpha)$	MJ m ⁻² day ⁻¹	17.93	17.25	18.05	17.30	17.70	18.45	
surface emissivity	ϵ	-	0.96	0.96	0.96	0.96	0.96	0.96	(5)
net longwave emitted from surface	R_{LW}	MJ m ⁻² day ⁻¹	3.8	3.8	3.8	3.8	3.8	4.2	(6)
net radiation at surface	$R_n=R_{sw}(1-\alpha)-R_{LW}$	MJ m ⁻² day ⁻¹	14.1	13.5	14.3	13.5	13.9	14.2	

assumed physical parameters

surface air temperature	T	°C	22.3	22.3	22.3	22.3	22.3	22.3	(2)
surface water temperature	T	°C	25.4	25.4	25.4	25.4	25.4	25.4	(2)
wind speed assumed	U	m sec ⁻¹	1.95	1.95	1.95	1.95	1.95	1.95	(2)

Models

Hastenrath and Kutzbach

Bowen ratio	B	-	0.2			0.20	0.21	0.21	(7)
evaporation (latent heat equiv.)	$LE=R/(1+B)$	W m ⁻²	12			11	11	12	(7)
evaporation rate	E	mm yr ⁻¹	1932			1846	1886	1927	(7)

Priestly-Taylor

slope of sat vapor curve	Δ	kPa °C ⁻¹	0.16	0.16	0.16	0.16	0.16	0.16	(7)
T-P constant	$\alpha(P-T)$	-	1.26	1.26	1.26	1.26	1.26	1.26	(7)
psychrometric constant	γ	kPa °C ⁻¹	0.06	0.06	0.06	0.06	0.06	0.06	(7)
latent heat of vaporization	λ	MJ kg ⁻¹	2.45	2.45	2.45	2.45	2.45	2.45	(7)
evaporation rate	E	mm yr ⁻¹	1909	1815	1910	1809	1913	1955	(7)

Penman combination

sat. vapor pressure	e_s	kPa	2.69	2.69	2.69	2.69	2.69	2.69	(7)
vapor pressure measured	e_a	kPa	2.00	2.00	2.00	2.00	2.00	2.00	(7)
wind speed	U	m sec ⁻¹	1.95	1.95	1.95	1.95	1.95		(7)
psychrometric constant	γ	kPa °C ⁻¹	0.07	0.07	0.07	0.07	0.06	0.06	(7)
evaporation due to wind	E_a	mm day ⁻¹	0.37	0.37	0.37	0.37	0.37		(7)
slope of saturation vs T de/dT	Δ	kPa °C ⁻¹	0.16	0.16	0.16	0.16	0.16	0.16	(7)
Evaporation rate	E	mm day ⁻¹	4.16	3.96	4.17	3.95	4.17	4.16	(7)
Evaporation rate	E	mm yr ⁻¹	1520	1447	1521	1443	1523	1517	(7)

Results

lake area ratio observed	a_w observed		0.260	0.384	0.225	0.225	0.470		
lake area ratio calculated	a_w calculated		0.259	0.384	0.225	0.225	0.470	w:	2.53
calculated evapotranspiration	E_b	mm yr ⁻¹	941	968	915	868	1055		
calculated run-off coefficient	k		0.14	0.16	0.13	0.13	0.17		
iterated Precipitation	P	mm yr⁻¹	1090	1152	1051	997	1275	iterated P	

References

- (1) DEM this study
- (2) Yin & Nicholson (1998)
- (3) Ba et al. (2001)
- (4) Abtew&Malesse (2013)
- (5) Sellars (1965)
- (6) Budyko (1974)
- (7) Supplemental text