water

Supplementary materials

Water balance for a tropical lake in the volcanic highlands: Lake Tana, Ethiopia

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Table-S1: Length of record and spatial coordinates of the data for 13 rainfall stations in and near the Lake Tana basin; locations are plotted in Figure 1

No	Name of Stations	Records	X	Y
1	Adet	1986 - 2009	335182	1247364
2	Addis Zemen	1974 - 2014	366153	1340125
3	Bahir Dar	1961 - 2014	327373	1282803
4	Dangela	1969 - 2011	263966	1244823
5	Debre Tabor	1992 - 2013	391084	1312374
6	Delgi	1993 - 2014	284194	1345775
7	Gasay	1987 - 2014	407399	1304579
8	Gonder	1952 - 2014	309683	1360347
9	Gorgora	1987 - 2014	306441	1363687
10	Maksegnit	1987 - 2014	343457	1370102
11	MekaneEyesus	1987 - 2014	396868	1283335
12	Merawi	1987 - 2014	299679	1262059
13	Zege	1987 - 2014	316880	1291713
14	Gurer	2013 - 2014	309286	1314548
15	Jigrfa	2013 - 2014	338010	1316687

Table S2: Percentage weights based on Thiessen polygon method for the rainfall station for calculating the Lake Tana rainfall

Stations	Land-based stations (%)	Lake+land-based stations (%)
Bahir Dar	1.4	1.3
Addis Zemen	6.4	-
Gorgora	34.9	19.6
Maksegnit	4.5	1.8
Delgi	22.9	13.8
Zege	29.8	6.7
Gurer	-	30.6
Jigrfa	-	17.5
Total	100.0	100.0

Table S3: Slope intercept and R^2 for the linear regression of monthly gauged discharge and the inflow to and water loss from Lake Tana

			land-based			Lake+land-based		
Evaporation (mm a^{-1})			1426	1650	1789	1426	1650	1789
1990 1995	a	$km^3\ month^{-1}$	1.78	1.76	1.75	1.75	1.73	1.72
	b		-0.11	-0.05	-0.01	-0.12	-0.06	-0.02
	R^2		0.91	0.91	0.91	0.92	0.91	0.91
1996-2002	a	$km^3\ month^{-1}$	1.90	1.89	1.88	1.84	1.82	1.81
	b		-0.16	-0.09	-0.06	-0.16	-0.10	-0.06
	R^2		0.88	0.88	0.88	0.89	0.88	0.88
2003-2007	a	$km^3\ month^{-1}$	2.19	2.17	2.16	2.15	2.13	2.12
	b		-0.25	-0.19	-0.15	-0.25	-0.19	-0.15
	R^2		0.94	0.94	0.94	0.95	0.94	0.94

Table S4: Performance evaluation results with three parameters for the land-based and lake+land-based precipitation and evaporations 1426 mm a^{-1}, 1650 mm a^{-1} and 1789 mm a^{-1}.

	Land-based			**Lake+land-based**		
Evaporation (mm a^{-1})	**1426**	**1650**	**1789**	**1426**	**1650**	**1789**
NSE	0.76	0.69	0.84	0.98	0.98	0.98
R^2	0.89	0.86	0.92	1.00	1.00	1.00
RMSE	0.44	0.56	0.33	0.09	0.09	0.09

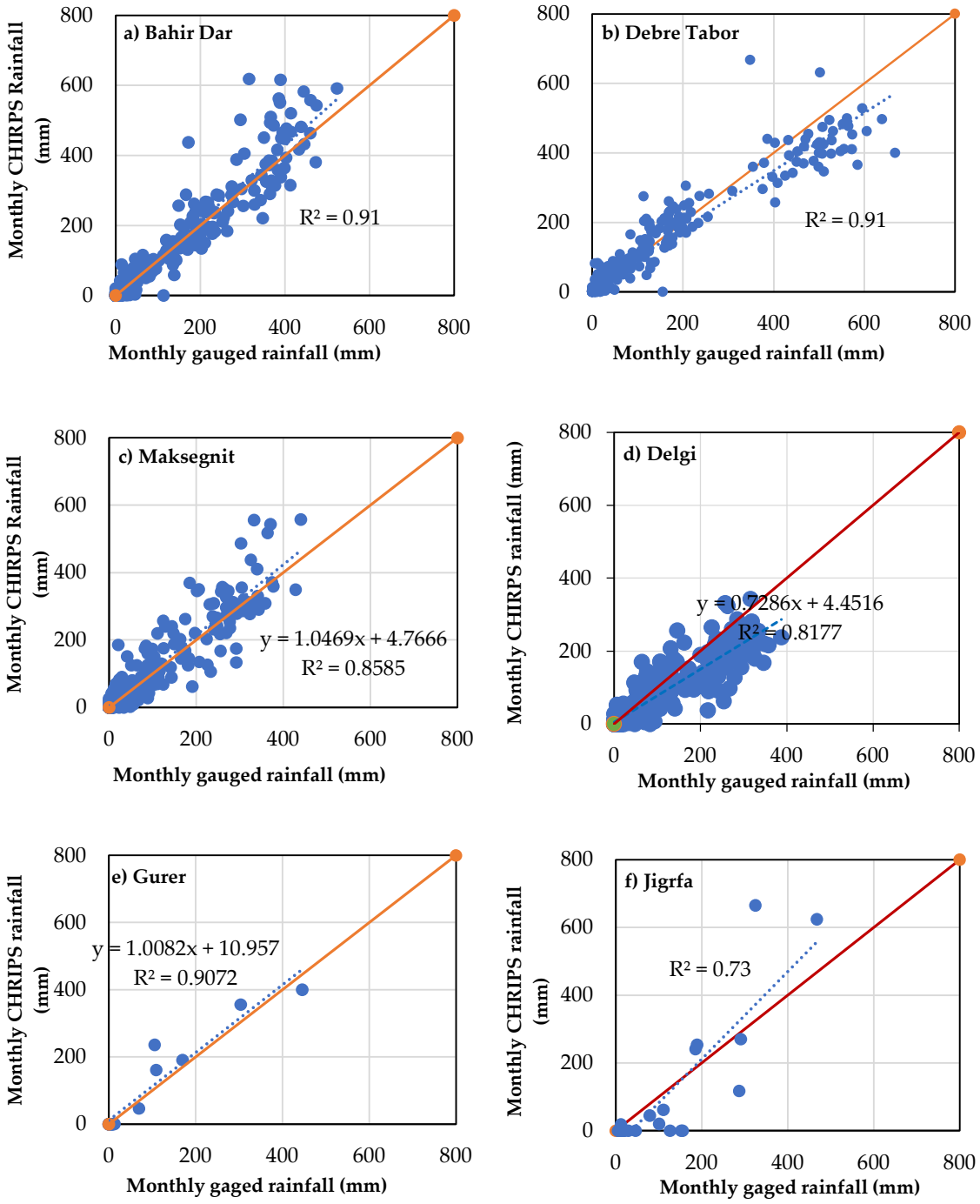

Figure S1: Correlation between gauged and CHIRPS rainfall data: a) Bahir Dar gauged rainfall vs. CHIRPS, b) Debre Tabor gauged rainfall vs. CHIRPS rainfall estimate, c) Maksegnit gauged rainfall vs. CHIRPS rainfall d) Delgi gauged rainfall vs. CHIRPS rainfall estimate, e) Gurer gauged rainfall vs. CHIRPS rainfall estimate, f) Jigrfa gauged rainfall vs. CHIRPS rainfall estimate.

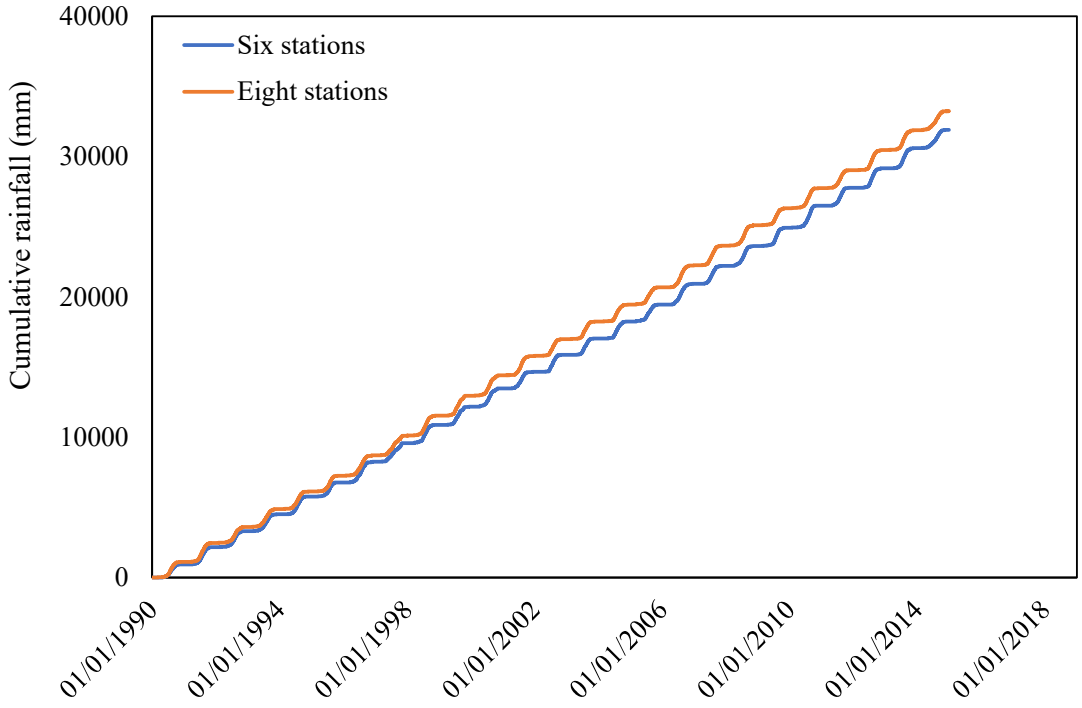

Figure-S2: Cumulative areal rainfall estimated using the land-based stations and previous station land and lake-based stations

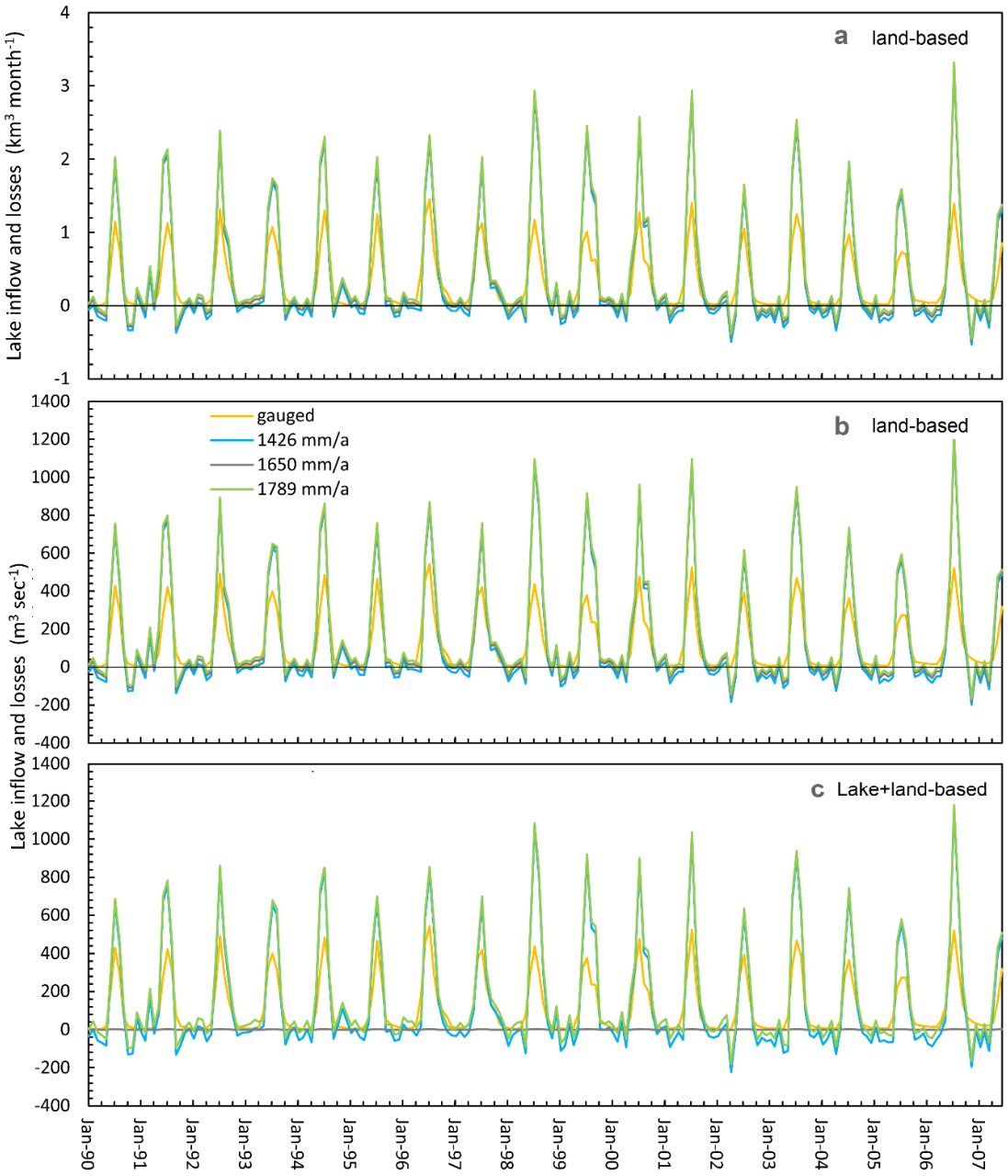

Figure S3: Comparison of Lake inflow and losses based on land-based (a & b) and lake + land-based (c) rainfall corresponding to three evaporation values

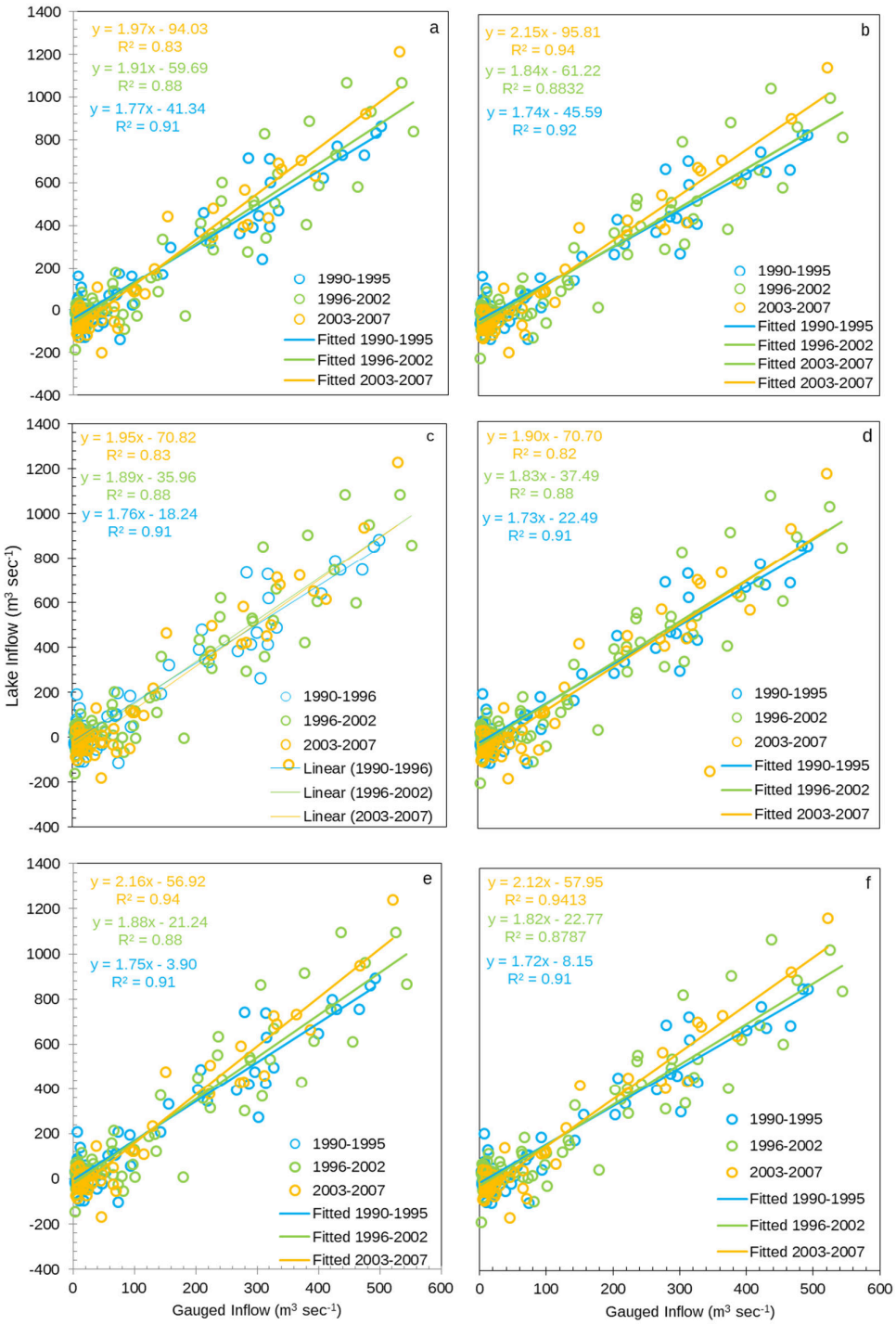

Figure S4: Regression of lake inflow and losses with the discharge (m^3 Sec^{-1}) of the four gauged watersheds - Gilgel Abay, Gumara, Rib and Megech for precipitation based on land-based rain gauges (a, c, e), lake+land-based rain gauges (b, d, f) and lake evaporation rates of 1426 mm a^{-1} (a, b); 1650 mm a^{-1} (c, d) and 1789 mm a^{-1} (e, f)

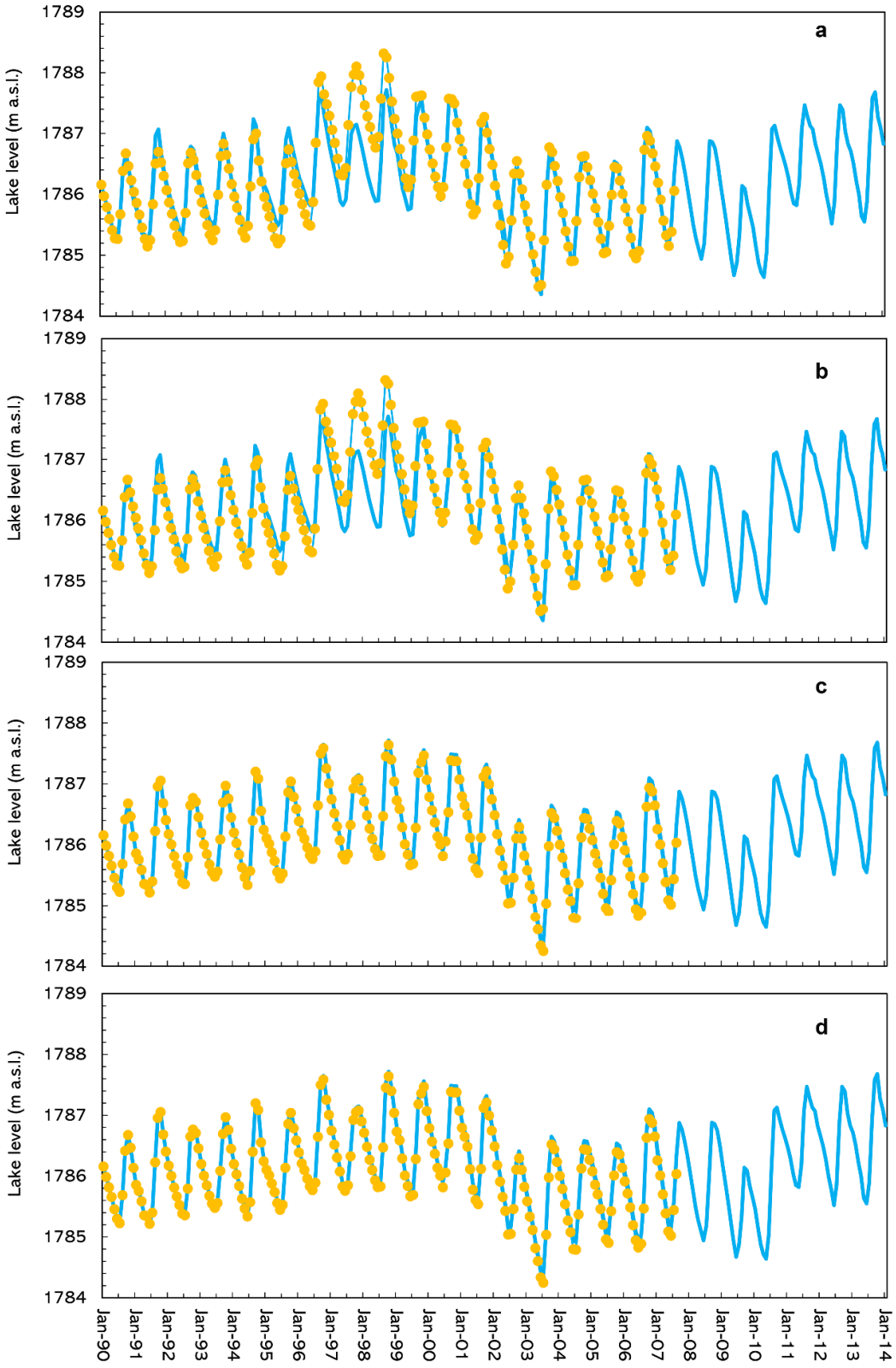

Figure S5: Water level predictions (yellow dots) of Lake Tana with rainfall based on land-based stations (a,b), lake + land-based stations (c,d) corresponding to evaporations 1426 mm a^{-1} (a,c), and 1789 mm a^{-1} (b,d). The blue line is the observed lake water level