Lake Lacawac, Bruce R. Hargreaves, Lehigh University (brh0@lehigh.edu, http://www.lehigh.edu/~brh0) 41° 22.5'N 75° 17.3'W elevation 428m

17 April 2011: platform moved to lake center, 1-2pm

The water level sensor (referenced to dock) settles for several days after moving platform to lake center and thus underestimates water level during this period.

19Sep12: Tw1.0m failed; modeled from Tw0.5 and Tw2.0 until

H310 sensor depth & Lake level are based on differential pressure
sensor with ca 0.1mm resolution & vertical position referenced to bottom of lake.
Sensor PSIG converted to depth using density of water at 4oC (1.43321 psi/m)
Lake level is referenced also to lower frame of dock at SE corner (2003-May2005)
(Actual water level at dock varies seasonally with density of water column and hourly from
precip, runoff, evaporation, seepage & outflow. Outflow also varies with status of beaver dam).

	5280	ft/mile
rain sum (in.) Aug-Sep2011=> 14.27	1609.3	m/mile

Std pressure at sea level =1 atm=760 mm Hg=29.92" Hg=1013.2 mbars
Std pressure at 428m elevation =724 mm Hg, 29.61 in. Hg, (965.2 mbars)

	Tair avg F	Tair max F	Tair min F		Rain-in	WS-mph	WS max mph					Tw 0.1m F	Tw 0.5m F	Tw 1m F	Tw 2m F	Tw 3m F	Tw 4m F	Tw 5m F	Tw 6m F	Tw 8m F	Tw 10m F	Tw 12m F						
	45.0	68.9	26.8		3.55	3.4	25					46.3	46.2	46.3	46.3	45.9	46.1	46.2	46.1	46.1	45.6	44.7						
Month summa avg Tw	Tair avg-C	Tair Hi-C	Tair Min-C	RHair-%	Rain-mm	WS-m/s	WS Max-m/s	WDIR-deg	Barom-mb	Sum Rad W/m2	Sum PAR uM/m2/s	Tw 0.1m	Tw 0.5m	Tw 1m	Tw 2m	Tw 3m	Tw 4m	Tw 5m	Tw 6m	Tw 8m	Tw09.8m	Tw11.1m	H310_z (m)	Lakelevel-mm (4oC)	cumul. rain-mm	Batt min-V	RH% CR10 enc	RH% MUX enc
7.8	7.2	20.5	-2.9	79.2	90.2	1.5	11.2	219.0	965.8	220331117	442	7.9	7.9	7.9	7.9	7.7	7.9	7.9	7.8	7.8	7.6	7.1	5.5	66.2	90.2	12.4	29.5	48.3

month (All)

30.2 mm delayed precip from rain gage from 29Oct 9" snow (16.2mm from lake level rise)

1.19 in. water equiv (0.32" reported at Hamlin on 29Oct; 0.64" from lake level rise)

Data

Location	% records	Date	Day of Yr	Tair avg-C	Tair Hi-C	Tair Min-C	RHair-%	Rain-mm	WS-m/s	WS Max m/s	WDIR-deg	Barom-mb	Sum Rad J/m2	Sum PAR Mol/m2	Tw 0.1m	Tw 0.5m	Tw 1m	Tw 2m	TW3m	TW4m	TW5m	TW6m	TW8m	TW H310-C	TW12m	H310 depth-m (4oC)	Lakelevel-mm (4oC)	cumul. rain-mm	Batt min-V	RH% CR10 enc	RH% MUX enc
LC	100%	11/1/2011	305	3.7	10.4	-1.0	88.8	0.0	0.7	3.7	226	973.3	12611253	25	9.45	9.23	9.15	9.14	8.81	9.02	9.03	8.86	8.86	7.7	6.67	9.8	80.1	0.000	12.6	27.1	52.1
LC	100%	11/2/2011	306	5.9	14.1	-1.0	81.9	0.0	1.0	4.9	255	972.9	13358155	26	9.09	9.07	9.11	9.05	8.66	8.86	8.88	8.75	8.85	7.8	6.55	9.8	76.9	0.000	12.6	27.5	41.5
LC	100%	11/3/2011	307	9.0	15.2	4.5	79.0	0.0	1.2	3.9	249	964.7	8891538	18	9.06	9.11	9.14	9.00	8.62	8.81	8.85	8.74	8.79	7.9	6.52	9.8	73.9	0.000	12.6	26.7	37.6
LC	100%	11/4/2011	308	5.6	8.3	1.0	69.8	0.0	3.5	11.2	107	965.6	13252048	25	8.86	8.94	9.05	9.09	8.75	8.94	8.96	8.84	8.88	8.0	6.44	9.8	70.1	0.000	12.6	27.5	35.0
LC	100%	11/5/2011	309	2.3	9.4	-2.9	67.3	0.0	0.9	4.3	204	974.4	13754535	26	8.84	8.74	8.73	8.71	8.36	8.58	8.59	8.48	8.58	8.2	6.44	9.8	66.8	0.000	12.5	26.0	28.3
LC	100%	11/6/2011	310	4.4	11.4	-2.6	71.5	0.0	1.4	6.2	249	976.7	13298834	26	8.40	8.48	8.54	8.59	8.20	8.36	8.37	8.28	8.38	8.1	6.44	9.8	63.3	0.000	12.5	25.3	25.6
LC	100%	11/7/2011	311	9.4	17.7	2.3	79.7	0.0	1.2	5.5	268	973.3	12326500	25	8.60	8.57	8.52	8.40	8.02	8.23	8.24	8.16	8.27	8.0	6.53	9.8	60.0	0.000	12.5	28.5	28.2
LC	100%	11/8/2011	312	12.5	20.5	6.7	76.9	0.0	0.7	3.5	217	971.5	11418190	23	9.63	8.90	8.80	8.53	8.04	8.23	8.22	8.13	8.25	8.0	6.62	9.8	58.2	0.000	12.6	31.6	30.3
LC	100%	11/9/2011	313	10.9	16.9	3.9	76.2	0.0	1.6	8.5	191	967.0	12656187	25	9.50	9.31	9.14	8.82	8.07	8.23	8.21	8.13	8.25	8.0	6.61	9.8	56.1	0.000	12.6	31.0	28.6
LC	100%	11/10/2011	314	8.8	12.7	4.3	97.4	3.4	1.9	6.2	254	958.5	1480796	3	9.19	9.25	9.47	9.16	8.19	8.28	8.22	8.13	8.26	8.0	6.69	9.8	54.9	3.400	12.5	28.4	34.0
LC	100%	11/11/2011	315	2.7	4.3	0.8	80.3	0.1	3.4	9.2	306	954.7	5606301	11	8.30	8.42	8.52	8.61	8.24	8.36	8.27	8.17	8.27	8.0	6.76	9.8	54.9	3.500	12.5	24.0	54.9
LC	100%	11/12/2011	316	5.7	11.9	0.6	64.7	0.0	2.2	10.0	250	963.2	11643430	23	7.79	7.90	8.00	8.08	7.75	7.95	7.91	7.84	8.00	7.8	7.02	9.8	50.5	3.500	12.5	27.7	41.7
LC	100%	11/13/2011	317	7.9	11.7	2.6	71.1	0.0	1.1	6.0	201	963.0	6416204	13	7.75	7.75	7.82	7.89	7.75	7.84	7.89	7.85	7.90	7.8	7.21	6.2	47.3	3.500	12.6	26.3	37.3
ND	100%	11/14/2011	318	12.5	16.3	9.0	67.9	0.0	1.0	7.6	257	957.7	2116902	5	7.82	7.72	7.82	7.83	7.95	7.81	7.97	7.98	7.87	7.8	7.56	1.7	44.1	3.500	12.5	29.3	44.2
ND	100%	11/15/2011	319	12.1	16.3	9.6	95.2	2.8	0.8	8.5	246	958.4	2696510	6	8.30	8.06	8.12	8.07	8.18	8.16	8.18	8.23	8.11	8.0	7.84	1.7	45.4	6.300	12.5	32.7	49.7
ND	100%	11/16/2011	320	9.6	11.3	8.0	100.0	10.0	0.6	5.8	188	958.2	1447739	3	8.49	8.34	8.43	8.43	8.48	8.50	8.50	8.54	8.47	8.4	8.25	1.7	49.1	16.300	12.4	32.2	54.9
ND	100%	11/17/2011	321	3.0	8.4	-0.4	76.0	0.0	2.6	8.1	320	959.1	3438525	7	7.86	7.94	8.02	8.07	8.23	8.14	8.17	8.29	8.12	8.0	8.00	1.7	54.1	16.300	12.4	28.4	69.2
ND	100%	11/18/2011	322	0.0	3.6	-2.0	72.2	0.0	1.9	7.9	273	970.8	8776816	17	7.18	7.26	7.31	7.32	7.60	7.34	7.42	7.52	7.27	7.3	7.21	1.7	49.3	16.300	12.4	26.3	69.5
ND	100%	11/19/2011	323	4.4	10.4	-0.6	50.6	0.0	1.0	4.9	258	972.4	8278091	16	6.89	6.91	6.98	6.96	7.36	7.06	7.15	7.30	6.91	6.9	6.94	1.7	45.5	16.300	12.5	27.2	58.2
ND	100%	11/20/2011	324	11.3	16.4	5.9	70.1	0.0	1.6	8.9	268	967.3	6082206	13	6.92	6.98	7.07	7.10	7.30	7.12	7.26	7.30	7.12	7.1	7.25	1.8	42.1	16.300	12.6	30.8	53.3
ND	100%	11/21/2011	325	6.9	11.3	2.7	71.3	0.0	1.6	5.7	200	971.6	7221089	15	7.35	7.41	7.49	7.48	7.41	7.43	7.65	7.55	7.53	7.4	7.49	1.9	39.8	16.300	12.5	32.9	52.1
ND	100%	11/22/2011	326	3.2	5.1	1.1	94.7	18.3	1.8	7.6	50	971.3	1338301	3	7.07	7.16	7.27	7.33	7.25	7.57	7.56	7.46	7.42	7.3	7.43	1.9	43.9	34.600	12.4	26.0	51.2
ND	100%	11/23/2011	327	4.3	6.7	1.3	98.4	25.4	2.8	9.3	207	956.5	1619986	4	6.76	6.83	6.93	6.98	6.75	7.15	7.45	7.23	7.06	6.9	6.99	2.0	100.5	60.000	12.4	30.5	65.5
ND	100%	11/24/2011	328	3.8	9.5	-1.0	85.0	0.0	1.7	6.6	279	967.9	8756146	17	6.59	6.68	6.75	6.78	6.76	7.02	7.10	6.94	6.81	6.7	6.84	1.9	101.6	60.000	12.4	31.6	71.1
ND	100%	11/25/2011	329	8.2	14.5	3.5	71.5	0.0	1.6	6.1	157	968.3	8710614	18	6.57	6.65	6.72	6.78	6.68	6.96	6.94	6.78	6.75	6.7	6.98	2.0	96.2	60.000	12.5	31.9	62.8
ND	100%	11/26/2011	330	9.0	15.5	3.6	61.4	0.0	0.6	4.3	44	969.6	7599739	16	6.67	6.68	6.72	6.72	6.40	6.73	6.62	6.54	6.69	6.7	6.86	2.0	91.0	60.000	12.5	31.1	57.0
ND	100%	11/27/2011	331	8.3	15.5	1.3	84.3	0.0	0.6	4.8	150	967.1	6691199	14	6.63	6.59	6.66	6.83	6.59	6.81	6.69	6.63	6.73	6.7	7.00	1.8	85.8	60.000	12.5	30.0	53.1
ND	100%	11/28/2011	332	13.4	17.0	10.6	84.9	0.0	1.2	5.8	259	966.7	3777821	8	7.07	6.83	6.88	7.13	6.84	7.04	6.89	6.87	6.93	6.9	7.33	1.6	81.5	60.000	12.5	35.9	54.5
ND	100%	11/29/2011	333	13.5	15.2	9.4	98.6	29.5	1.2	9.3	161	959.1	2225104	5	8.05	7.36	7.43	7.59	7.30	7.49	7.41	7.35	7.46	7.4	7.82	1.6	89.1	89.500	12.4	37.7	60.3
ND	100%	11/30/2011	334	4.2	8.9	1.5	88.1	0.7	2.0	7.8	274	953.7	2840356	6	7.54	7.53	7.59	7.82	7.64	7.73	7.64	7.60	7.67	7.6	8.13	1.6	115.1	90.200	12.4	34.6	80.4
	0%																														

Lake water & energy budget daily summary from hourly data (negative values: loss from lake; runoff & seepage term is residual after adjusting lake level change for all others)

Ratio of lake watershed to lake area: 2.61767578 Runoff & seepage as % of watershed area precip: 29.3%

Grand sum/avg	7.21	7.94	7.89	7.94	7.94	7.74	7.86	1.3	220331117	-16668	31.6	90.2	69.1	-24.3	-0.3	0.0

SumTerrevap2=AirV PD,mbar*WS,m/s*s

Data

DATE	DayOfYr	AvgTair C	AvgTw 0.1m	AvgTw0.5 m	Avg Tw1m	Avg Tw2m	Avg Tw3m	Avg Tw4m	AvgWS CSI m/s	SumRad J/m2	SumH Evap (*0.9=KJ/m2)	Sum Lk_lvl chg (mm)	SumRain mm	Sum Runoff & seepage, mm	SumLake evap (mm)	Sum Terrevap2
11/1/2011	305	3.71	9.45	9.23	9.15	9.14	8.81	9.02	0.6	12611253	-676	-3.445	0.0	0.8	-1.0	0.0
11/2/2011	306	5.90	9.09	9.07	9.11	9.05	8.66	8.86	1.0	13358155	-659	-2.707	0.0	1.3	-1.0	0.0
11/3/2011	307	9.01	9.06	9.11	9.14	9.00	8.62	8.81	1.1	8891538	-392	-2.953	0.0	0.3	-0.6	0.0
11/4/2011	308	5.58	8.86	8.94	9.05	9.09	8.75	8.94	3.2	13252048	-2097	-4.324	0.0	1.1	-3.1	0.0
11/5/2011	309	2.31	8.84	8.74	8.73	8.71	8.36	8.58	0.8	13754535	-1083	-3.058	0.0	0.7	-1.6	0.0
11/6/2011	310	4.40	8.40	8.48	8.54	8.59	8.20	8.36	1.3	13298834	-1036	-3.726	0.0	-0.2	-1.5	0.0
11/7/2011	311	9.37	8.60	8.57	8.52	8.40	8.02	8.23	1.1	12326500	-286	-2.461	0.0	0.0	-0.4	0.0
11/8/2011	312	12.49	9.63	8.90	8.80	8.53	8.04	8.23	0.7	11418190	-94	-1.758	0.0	0.6	-0.1	-0.3
11/9/2011	313	10.87	9.50	9.31	9.14	8.82	8.07	8.23	1.4	12656187	-480	-2.355	0.0	0.3	-0.7	0.0
11/10/2011	314	8.84	9.19	9.25	9.47	9.16	8.19	8.28	1.7	1480796	-147	2.109	3.4	1.0	-0.2	0.0
11/11/2011	315	2.67	8.30	8.42	8.52	8.61	8.24	8.36	3.1	5606301	-1887	-4.289	0.1	0.4	-2.7	0.0
11/12/2011	316	5.71	7.79	7.90	8.00	8.08	7.75	7.95	2.1	11643430	-1249	-3.902	0.0	0.1	-1.8	0.0
11/13/2011	317	7.89	7.75	7.75	7.82	7.89	7.75	7.84	0.8	6416204	-434	-3.900	0.0	-0.9	-0.6	0.0
11/14/2011	318	12.46	7.82	7.72	7.82	7.83	7.95	7.81	0.7	2116902	-22	-0.914	0.0	1.7	0.0	0.0
11/15/2011	319	12.12	8.30	8.06	8.12	8.07	8.18	8.16	0.7	2696510	244	2.004	2.8	1.4	0.4	0.0
11/16/2011	320	9.58	8.49	8.34	8.43	8.43	8.48	8.50	0.5	1447739	48	10.722	10.0	3.0	0.1	0.0
11/17/2011	321	2.95	7.86	7.94	8.02	8.07	8.23	8.14	2.5	3438525	-1456	-5.273	0.0	-1.1	-2.1	0.0
11/18/2011	322	0.00	7.18	7.26	7.31	7.32	7.60	7.34	1.7	8776816	-1457	-4.183	0.0	0.2	-2.1	0.0
11/19/2011	323	4.41	6.89	6.91	6.98	6.96	7.36	7.06	0.7	8278091	-810	-3.761	0.0	-0.1	-1.2	0.0
11/20/2011	324	11.34	6.92	6.98	7.07	7.10	7.30	7.12	1.3	6082206	64	-2.765	0.0	-0.1	0.1	0.0
11/21/2011	325	6.91	7.35	7.41	7.49	7.48	7.41	7.43	1.4	7221089	-497	-1.670	0.0	1.2	-0.7	0.0
11/22/2011	326	3.23	7.07	7.16	7.27	7.33	7.25	7.57	1.7	1338301	-557	29.612	18.3	12.9	-0.8	0.0
11/23/2011	327	4.31	6.76	6.83	6.93	6.98	6.75	7.15	2.6	1619986	-590	35.517	25.4	19.0	-0.9	0.0
11/24/2011	328	3.77	6.59	6.68	6.75	6.78	6.76	7.02	1.5	8756146	-627	-5.275	0.0	3.6	-0.9	0.0
11/25/2011	329	8.15	6.57	6.65	6.72	6.78	6.68	6.96	1.4	8710614	-368	-5.305	0.0	1.8	-0.5	0.0
11/26/2011	330	8.96	6.67	6.68	6.72	6.72	6.40	6.73	0.5	7599739	-277	-5.115	0.0	0.6	-0.4	0.0
11/27/2011	331	8.25	6.63	6.59	6.66	6.83	6.59	6.81	0.4	6691199	-21	-5.211	0.0	-0.9	0.0	0.0
11/28/2011	332	13.38	7.07	6.83	6.88	7.13	6.84	7.04	0.9	3777821	372	-3.234	0.0	-0.1	0.5	0.0
11/29/2011	333	13.47	8.05	7.36	7.43	7.59	7.30	7.49	0.7	2225104	585	34.064	29.5	9.1	0.9	0.0
11/30/2011	334	4.15	7.54	7.53	7.59	7.82	7.64	7.73	1.7	2840356	-779	-0.844	0.7	11.5	-1.1	0.0
#N/A																

1.000 <=SCALE ADJ (1.0=no adjustment)

4.184 joule/calorie (= joule/degree for 1cm3)

Nominal diffuse %R from water=7%	#N/A	#N/A	8%	8	#N/A	#N/A	#N/A	#N/A

				4.184	<=CONVERT HEAT TO DEGREES				4.184	slope
7%	0.9			6000000	cm3/m2 (for 0-4m integrated depth)				6000000	intercept r2
Solar Heat input (absorbed from solar rad), KJ/m2)	Sum H evap (KJ/m^2)	solar heat absorbed - evap loss (kJ/m^2)	% of absorbed solar heat lost via evap	Solar Heat input (absorbed from solar rad), Tw 0-6m)	starting Tw (0-6m)	ending Tw (0-6m)	actual dTw, 0-6m	RESID1: NON-SOLAR FLUX (Heat flux to offset absorbed solar to match dTw)	evap loss (degC 0-6m)	RESID2: NON-SOLAR FLUX to offset absorbed solar to match dTw LESS EVAP (degC 0-6m)
11728	-609	11120	5.2%	0.47	9.16	8.98	(0.18)	(0.65)	-0.02	(0.62)
12423	-593	11830	4.8%	0.49	8.98	8.94	(0.04)	(0.53)	-0.02	(0.51)
8269	-353	7917	4.3%	0.33	8.94	8.92	(0.02)	(0.35)	-0.01	(0.33)
12324	-1887	10437	15.3%	0.49	8.92	8.79	(0.13)	(0.62)	-0.08	(0.54)
12792	-975	11817	7.6%	0.51	8.79	8.53	(0.26)	(0.77)	-0.04	(0.73)
12368	-932	11436	7.5%	0.49	8.53	8.35	(0.18)	(0.67)	-0.04	(0.64)
11464	-258	11206	2.2%	0.46	8.35	8.37	0.02	(0.43)	-0.01	(0.42)
10619	-84	10535	0.8%	0.42	8.37	8.46	0.08	(0.34)	0.00	(0.33)
11770	-432	11338	3.7%	0.47	8.46	8.70	0.24	(0.23)	-0.02	(0.21)
1377	-132	1245	9.6%	0.05	8.70	8.64	(0.06)	(0.11)	-0.01	(0.11)
5214	-1698	3516	32.6%	0.21	8.64	8.07	(0.57)	(0.78)	-0.07	(0.71)
10828	-1125	9704	10.4%	0.43	8.07	7.90	(0.17)	(0.60)	-0.04	(0.55)
5967	-390	5577	6.5%	0.24	7.90	7.81	(0.09)	(0.33)	-0.02	(0.32)
1969	-20	1949	1.0%	0.08	7.81	7.93	0.12	0.05	0.00	0.05
2508	220	2727	-8.8%	0.10	7.93	8.26	0.33	0.23	0.01	0.22
1346	43	1390	-3.2%	0.05	8.26	8.79	0.53	0.48	0.00	0.47
3198	-1310	1888	41.0%	0.13	8.79	7.54	(1.25)	(1.38)	-0.05	(1.33)
8162	-1311	6852	16.1%	0.33	7.54	7.13	(0.41)	(0.73)	-0.05	(0.68)
7699	-729	6969	9.5%	0.31	7.13	6.95	(0.18)	(0.49)	-0.03	(0.46)
5656	58	5714	-1.0%	0.23	6.95	7.44	0.49	0.27	0.00	0.27
6716	-448	6268	6.7%	0.27	7.44	7.68	0.24	(0.03)	-0.02	(0.01)
1245	-501	744	40.3%	0.05	7.68	7.12	(0.56)	(0.61)	-0.02	(0.59)
1507	-531	976	35.2%	0.06	7.12	6.66	(0.46)	(0.52)	-0.02	(0.50)
8143	-564	7579	6.9%	0.32	6.66	6.90	0.25	(0.08)	-0.02	(0.05)
8101	-331	7769	4.1%	0.32	6.90	6.59	(0.31)	(0.63)	-0.01	(0.62)
7068	-249	6819	3.5%	0.28	6.59	6.73	0.14	(0.14)	-0.01	(0.13)
6223	-19	6204	0.3%	0.25	6.73	6.84	0.11	(0.14)	0.00	(0.14)
3513	334	3848	-9.5%	0.14	6.84	7.24	0.40	0.26	0.01	0.25
2069	527	2596	-25.4%	0.08	7.24	7.83	0.59	0.51	0.02	0.49
2642	-701	1941	26.5%	0.11	7.83	#N/A	#N/A	#N/A	-0.03	#N/A
	#N/A	#N/A		#N/A				#N/A	#N/A	