ACID SULFATE DATA

Description	Dates	Number of Measurements
Advection by streamflow from Sulphur Works, Lassen Volcanic National Park	1984-1993	16
Advection by streamflow from Little Hot Springs Valley, Lassen VNP	1987-1994	9
Advection by streamflow from Bumpass Hell, Lassen VNP	1983-1993	21
Heat loss from open-water surfaces at Bumpass Hell, Lassen VNP	1986-1988	4
Advection by streamflow from Devils Kitchen, Lassen VNP	1922-1996	15
Heat advected from a fumarole on Mammoth Mountain, CA	1990-1998	20

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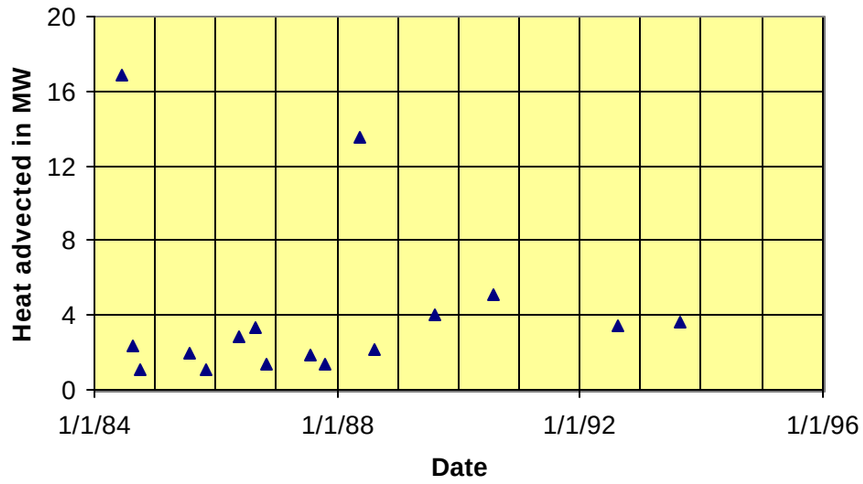
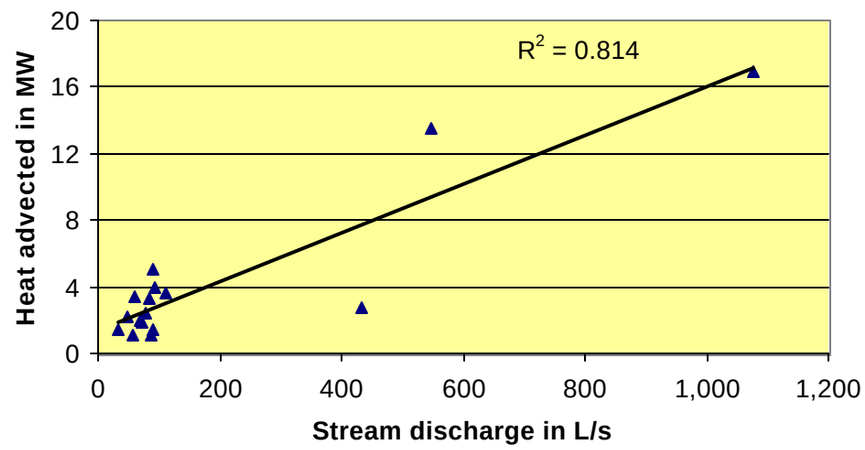
Sulphur Works

Heat advected by streamflow from the **"Sulphur Works"** steam-heated area, Lassen Volcanic National Park. Streamflow and temperature measured in West Sulphur Creek at three culverts passing under the Lassen Park road at lat. 40 deg. 26 min. 55 sec. N, long. 121 deg. 32 min. 08 sec. W; lat. 40 deg. 26 min. 57 sec. N, long. 121 deg. 32 min. 02 sec. W; and lat. 40 deg. 26 min. 59 sec. N, long. 121 deg 31 min. 56 sec. W. Reported streamflow is total of these three sites; reported downstream temperatur is discharge-weighted average of the three sites. Upstream temperature is assumed to be 4 degrees Celsius. Under baseflow conditions advection via streamflow accounts for about 25% of the heat loss from Sulphur Works, and heat loss from bare ground is the dominant mode (Sorey and Colvard, 1994) The data compiled here are from the USGS archives in Menlo Park, California.

DATE	STREAMFLOW	UPSTREAM TEMPERATURE	DOWNSTREAM TEMPERATURE	HEAT ADVECTED
mo/da/yr	L/s	Degrees Celsius	Degrees Celsius	MW
6/19/84	1,076	4.0	7.7	16.9
8/16/84	78	4.0	11.3	2.4
10/3/84	56	4.0	8.7	1.1
7/31/85	68	4.0	11.0	2.0
10/30/85	88	4.0	7.0	1.1
5/22/86	433	4.0	5.5	2.8
8/27/86	85	4.0	13.3	3.3
10/30/86	91	4.0	7.7	1.4
7/22/87	71	4.0	10.4	1.9
10/20/87	33	4.0	14.1	1.4
5/20/88	546	4.0	9.9	13.5
8/17/88	49	4.0	14.7	2.2
8/14/89	93	4.0	14.3	4.0
8/1/90	90	4.0	17.5	5.1
8/11/92	60	4.0	17.5	3.4
8/25/93	112	4.0	11.7	3.6
			Mean	4.1
			Std. Deviation	4.5
			No. Samples	16

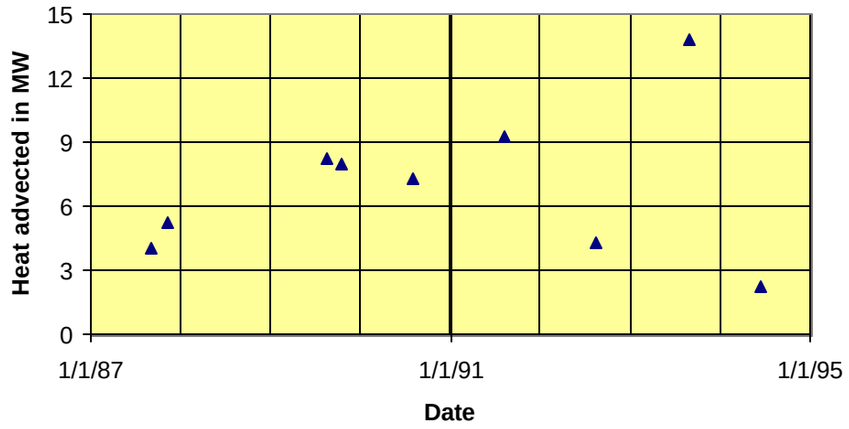


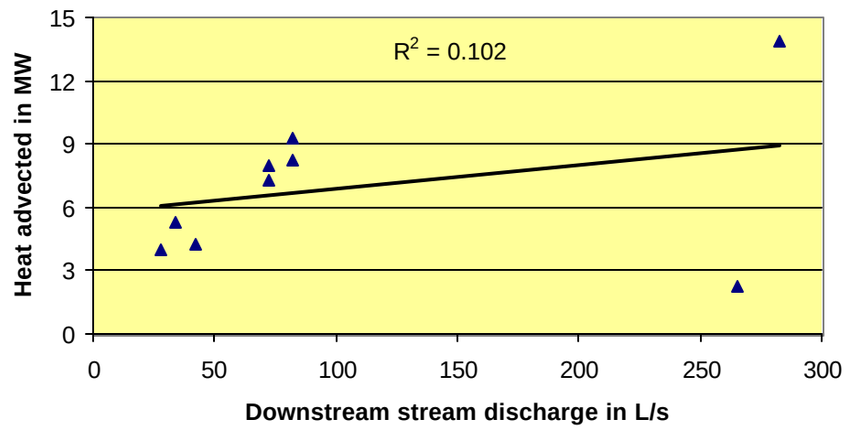


Little Hot Springs Valley

Heat advected by streamflow from the **"Little Hot Springs Valley"** steam-heated area, Lassen Volcanic National Park. Streamflow and temperature measured in East Sulphur Creek at lat. 40 deg. 27 min. 12 sec. N, long. 121 deg. 31 min. 00 sec. W (upstream) and lat. 40 deg. 27 min. 05 sec. N, long. 121 deg. 30 min. 56 sec. W (downstream). Heat advected is based on the difference between the product of downstream temperature and streamflow and the product of upstream temperature and streamflow. Under baseflow conditions advection via streamflow accounts for about 40-50% of the heat loss from Little Hot Springs Valley and is the dominant mode of heat loss (Sorey and Colvard, 1994). The data compiled here are from the USGS archives in Menlo Park, California.

DATE mo/da/yr	UPSTREAM STREAMFLOW L/s	UPSTREAM TEMPERATURE Degrees Celsius	DOWNSTREAM STREAMFLOW L/s	DOWNSTREAM TEMPERATURE Degrees Celsius	HEAT ADVECTED MW
9/4/87	nd	17	28	51	4
11/6/87	26	12	34	46	5.2
8/15/89	68	17	82	38	8.2
10/18/89	47	13	72	35	8.0
8/1/90	49	19	72	37	7.3
8/12/91	44	13	82	34	9.3
8/11/92	47	14	42	40	4.3
8/25/93	165	10	283	17.5	14
6/15/94	323	9	265	13	2.3
				Mean	6.9
				Std. Deviation	3.5
				No. Samples	9

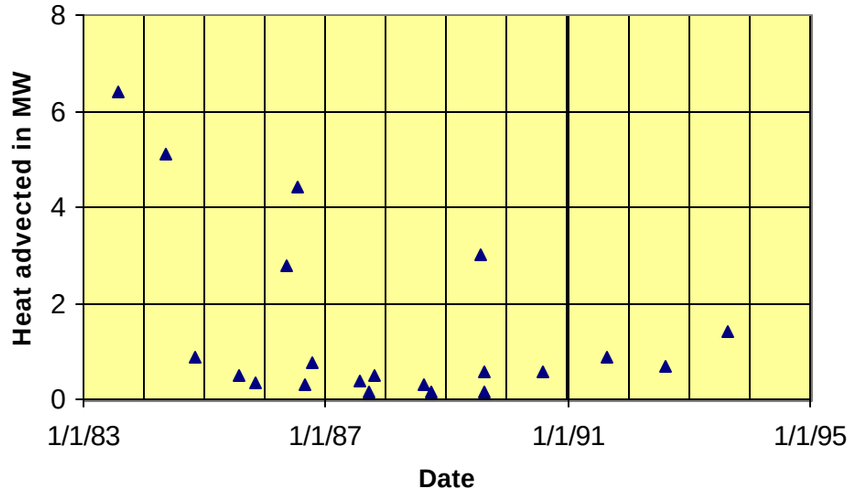


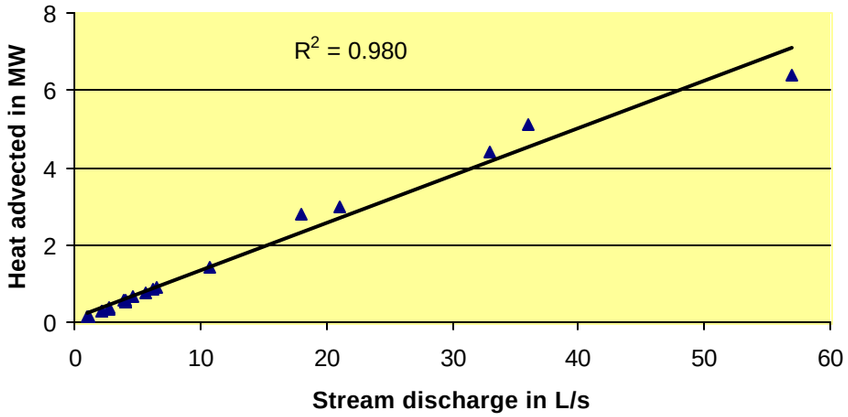


Streamflow from the "Bumpass Hell"

Heat advected by streamflow from the **"Bumpass Hell"** steam-heated area, Lassen Volcanic National Park. Streamflow and temperature measured in the flume in Bumpass Creek at lat. 40 deg. 27 min. 24 sec. N., long. 121 deg. 30 min. 05 sec. W. Upstream temperature is assumed to be 4 degrees Celsius. Under baseflow conditions advection via streamflow accounts for only about 2% of the heat loss from Bumpass Hell, and heat loss from water surfaces (pools) is the dominant mode (Sorey and Colvard, 1994). The data compiled here are from the USGS archives in Menlo Park, California.

DATE	STREAMFLOW	UPSTREAM TEMPERATURE	DOWNSTREAM TEMPERATURE	HEAT ADVECTED
mo/da/yr	L/s	Degrees Celsius	Degrees Celsius	MW
8/3/83	57	4.0	31	6.4
5/8/84	36	4.0	38	5.1
10/31/84	6.2	4.0	37	0.86
7/31/85	4.0	4.0	34	0.50
11/5/85	2.8	4.0	32	0.33
5/9/86	18	4.0	18	2.8
7/14/86	33	4.0	36	4.4
8/27/86	2.2	4.0	37	0.30
10/8/86	5.6	4.0	36	0.75
7/22/87	2.8	4.0	37	0.39
9/22/87	1.0	4.0	38	0.14
10/20/87	4.0	4.0	34	0.50
8/16/88	2.2	4.0	35	0.29
9/29/88	1.2	4.0	35	0.16
7/24/89	21	4.0	38	3.0
8/14/89	1.2	4.0	34	0.15
8/16/89	4.0	4.0	38	0.57
8/2/90	3.9	4.0	40	0.59
8/22/91	6.6	4.0	36	0.88
8/10/92	4.7	4.0	38	0.67
8/25/93	10.8	4.0	35	1.4
			Mean	1.4
			Std. Deviation	1.8
			No. Samples	21



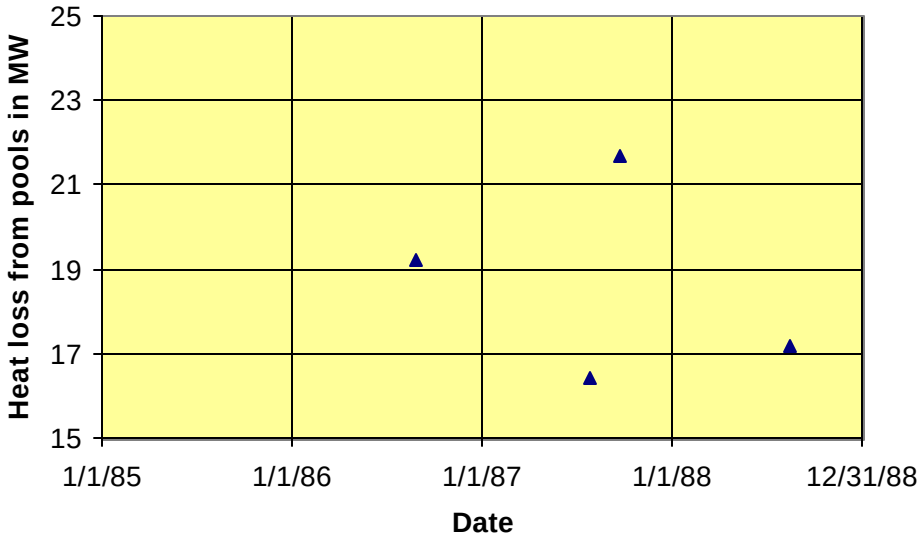


Open-water surfaces at the "Bumpass Hell" steam-heated area

Heat loss from open-water surfaces at the "Bumpass Hell" steam-heated area, Lassen Volcanic National Park, based on areas and temperatures of five large, hot (50-90 degrees Celsius) pools near lat. 40 deg. 27 min. 24 sec. N., long. 121 deg. 30 min. 03 sec. W. Heat-loss calculation assumes 90% of heat is lost by evaporation, 8% by conduction, and 2% by radiation; see Sorey and Colvard (1994) for additional details of the method. Under baseflow conditions heat loss from water surfaces (pools) accounts for about 70% of the heat loss from Bumpass Hell (Sorey and Colvard, 1994). The data compiled here are from the USGS archives in Menlo Park, California.

DATE mo/da/yr	TOTAL POOL AREA square meters	AVERAGE POOL TEMPERATURE degrees Celsius	AREA-WEIGHTED TEMPERATURE degrees Celsius	HEAT LOSS MW
8/27/86	1,400	67	61	19.2
7/27/87	1,420	73	56	16.4
9/22/87	1,420	78	65	21.7
8/16/88	1,410	67	56	17.2

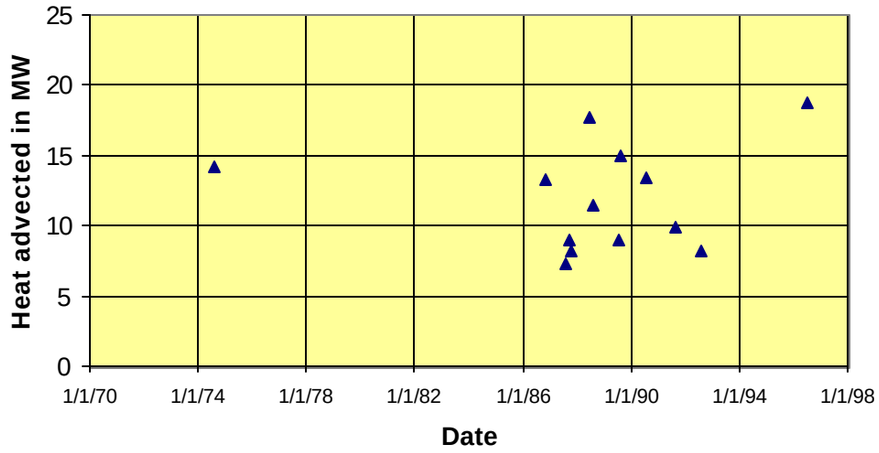
Mean	18.6
Std. Deviation	2.4
No. Samples	4

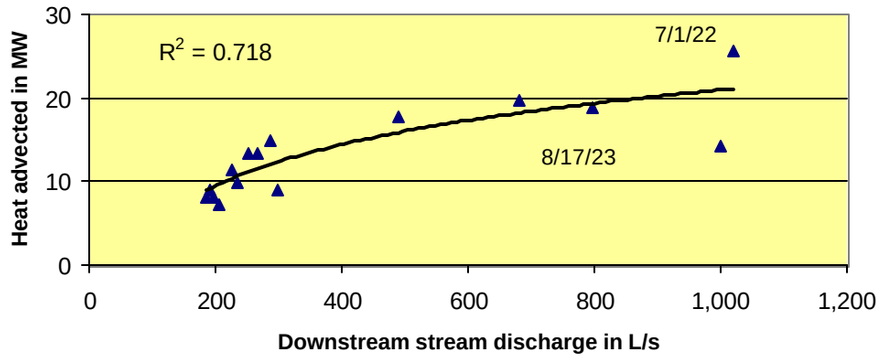


Devils Kitchen

Heat advected by streamflow from the **"Devils Kitchen"** steam-heated area, Lassen Volcanic National Park. From 1986 on streamflow and temperature measured in Hot Springs Creek at lat. 40 deg. 26 min. 31 sec. N, long. 121 deg. 26 min. 07 sec. W (upstream) and lat. 40 deg. 26 min. 28 sec. N, long. 121 deg. 25 min. 51 sec. W (downstream, near the lower bridge). The pre-1986 measurement sites are not precisely known but are believed to be similar. Heat advected is based on the temperature difference between the upstream and downstream sites and the downstream streamflow; there is no good streamgaging site upstream of Devils Kitchen and the streamflow measurements there are regarded as inaccurate, but included here for the sake of completeness. Under baseflow conditions advection via streamflow accounts for about 50% of the heat loss from Devils Kitchen and is the dominant mode of heat loss (Sorey and Colvard, 1994). The data compiled here are from Day and Allen (1925), Friedman and Frank (1978), and the USGS archives in Menlo Park, California.

DATE	UPSTREAM STREAMFLOW	UPSTREAM TEMPERATURE	DOWNSTREAM STREAMFLOW	DOWNSTREAM TEMPERATURE	HEAT ADVECTED
mo/da/yr	L/s	Degrees Celsius	L/s	Degrees Celsius	MW
7/1/22	850	10	1,020	16	26
8/17/23	708	11.8	680	19.2	20
7/28/74	1200	10.5	1000	16.0	14
11/1/86	193	7	266	17	13
8/7/87	230	12	205	22	7.3
9/23/87	189	10	192	21	9.0
10/21/87	164	9	185	18.5	8.2
6/8/88	375	9	490	15.5	18
8/18/88	195	11	227	21.5	11
7/27/89	350	11	300	20	9
8/18/89	216	10	286	20	15
7/31/90	233	11	251	23	13
8/13/91	230	9	234	19	10
8/12/92	221	10	198	21	8
6/26/96	793	8	796	13.6	19
				Mean	13.4
				Std. Deviation	5.3
				No. Samples	15





Fumarole on Mammoth Mountain

Heat advected from a fumarole on **Mammoth Mountain**, a dacitic volcano on the southwestern rim of Long Valley caldera. A plastic tube was installed in the main vent at lat. 37 deg. 38 min. 14 sec. N, long. 119 deg. 01 min. 47 sec. W to facilitate velocity (mass discharge) measurement with a pitot tube or anemometer. The temperature-measurement point is about 0.3 m below land surface. Peak temperatures of about 90 degrees Celsius were recorded in late 1989, prior to the time series reported here. Heat advected is based on the product of mass discharge and temperature. The data compiled here are from the USGS archives in Menlo Park, California.

DATE	MASS DISCHARGE	TEMPERATURE	HEAT ADVECTED
mo/da/yr	kg/s	Degrees Celsius	MW
7/11/90	0.008	84.0	0.0028
11/1/90	0.015	83.6	0.0053
1/18/91	0.015	83.1	0.0052
6/13/91	0.022	81.4	0.0075
8/27/91	0.020	82.6	0.0069
9/26/91	0.019	82.7	0.0066
1/14/92	0.015	83.0	0.0052
5/27/92	0.019	81.6	0.0065
9/25/92	0.015	82.5	0.0052
12/4/92	0.012	83.2	0.0042
3/31/93	0.012	83.0	0.0042
9/15/93	0.014	82.7	0.0049
12/15/93	0.012	83.6	0.0042
2/22/94	0.011	85.2	0.0039
9/26/95	0.007	83.0	0.0024
8/1/96	0.008	81.2	0.0027
5/8/97	0.006	82.7	0.0021
6/17/97	0.006	78.4	0.0020
8/23/97	0.006	84.0	0.0021
1/7/98	0.005	83.1	0.0017
		Mean	0.0043
		Std. Deviation	0.0018
		No. Samples	20