

DR2005037**Table DR1.** ATMOSPHERIC SO₂ CONCENTRATION DATA

SO₂ data ($\pm 5.5\%$) obtained from Harwell Scientifics passive samplers during a three-week exposure in August - September 2003. An altitude flux correction (Larson and Vong, 1990) was made to the mass concentration lab data ($\mu\text{g}/\text{m}^3$), thereby considering the effects of changes in pressure and temperature on the tube diffusivity at each sample site. The estimated relative error was + 8% to 11% to the criterion instrument (U.S. National Park Service, 2004).

SO ₂ Diffusion Tube Data		Altitude meters	Temp k	Lab $\mu\text{g}/\text{m}^3$	Diffusivity corrected $\mu\text{g}/\text{m}^3$	ppbv altitude adjusted
Park SO ₂ monitor (3.88 ppb)		1215	289.28	11.3	10.26	4.42
HVO SO ₂ monitor (7.69 ppb)		1123	290.00	21.8	19.95	8.51
Summit plume - Halemaumau		1110	290.12	1833.0	1679.08	715.67
Eruption plume - Chain of Craters Rd.		518	294.86	354.0	339.42	136.43
Mauna Iki's summit		924	291.61	58.4	54.30	22.71
<i>Exposed cohort</i>						
Kapapala trend		981	291.15	20.1	18.60	7.83
Kapapala trend		668	293.66	29.3	27.78	11.33
Kapapala trend		509	294.93	41.3	39.63	15.91
Wood Valley		750	293.00	25.5	24.03	9.88
Pahala/Wood Valley		549	294.61	32.0	30.61	12.34
Pahala trend		792	292.66	21.6	20.29	8.37
Pahala trend		500	295.00	47.7	45.80	18.38
Pahala trend house		366	296.07	32.9	31.89	12.64
Pahala trend school		287	296.70	37.1	36.16	14.23
Pahala trend house		274	296.81	42.9	41.85	16.45
Pahala trend house		274	296.81	36.7	35.81	14.07
Pahala trend hospital		250	297.00	46.7	45.64	17.89
Pahala trend hospital		244	297.05	52.0	50.84	19.92
Pahala trend		229	297.17	51.9	50.79	19.88
Pahala trend		144	297.85	41.9	41.25	16.02
Pahala/Puna		396	295.83	34.3	33.18	13.18
Pahala/Puna		122	298.02	40.3	39.73	15.40
Punalu'u trend		549	294.61	36.5	34.92	14.08
Punalu'u trend		396	295.83	35.1	33.95	13.49
Punalu'u trend		90	298.28	49.1	48.51	18.75
Punalu'u trend		42	298.66	46.6	46.19	17.78
Punalu'u area		390	295.88	49.6	48.00	19.06
Honu'apo area		443	295.46	50.1	48.30	19.28
Honu'apo		60	298.52	57.6	57.03	21.98
Na'alehu trend		572	294.42	49.7	47.46	19.18
Na'alehu trend house		232	297.14	70.8	69.28	27.12
Na'alehu trend house		213	297.30	51.0	49.97	19.53

SO₂ Data continued Location	Altitude meters	Temp k	Lab µg/m³	Diffusivity corrected µg/m³	ppbv altitude adjusted
Na'alehu trend house	207	297.34	60.9	59.69	23.31
Na'alehu trend school	195	297.44	63.3	62.10	24.23
Na'alehu trend school	195	297.44	54.0	52.97	20.67
Na'alehu trend clinic	195	297.44	55.2	54.15	21.13
Na'alehu trend clinic	195	297.44	59.4	58.27	22.73
Na'alehu trend	183	297.54	76.2	74.81	29.16
Na'alehu trend	152	297.78	88.0	86.58	33.65
Waiohinu Village	305	296.56	84.6	82.36	32.46
Kipuka Nahuaopala	238	297.10	56.2	54.97	21.53
South point trend	742	293.06	31.4	29.61	12.16
South point trend	506	294.95	45.7	43.86	17.61
South point trend	378	295.98	54.0	52.30	20.75
South point trend	277	296.78	59.3	57.84	22.74
South point trend	15	298.88	46.9	46.57	17.88
Ocean View	1244	289.05	18.4	16.67	7.21
Ocean View	866	292.07	14.8	13.82	5.75
Exposed cohort Average			46.48	45.21	17.84

SO₂ Data Location	Altitude meters	Temp k	Lab µg/m³	Diffusivity corrected µg/m³	ppbv altitude adjusted
<i>Control cohort</i>					
Hawi - north	146	297.83	<1.2		
Hawi - west	195	297.44	1.8	1.77	0.69
Hawi - south	268	296.86	1.2	1.17	0.46
Hawi - downtown	183	297.54	3.0	2.95	1.15
Hawi - east, pair	158	297.74	1.2	1.18	0.46
Hawi - east, pair	158	297.74	<1.2		
Control cohort Average			1.8	1.77	0.69

Larson, T.V., and Vong, R.J., 1990, A theoretical investigation of the pressure and temperature dependence of atmospheric ozone deposition to trees: Environmental Pollution, v. 67, p. 179–189.

U.S. National Park Service, 2004, Air quality data for national parks: SO₂ for September 2003, from monitors in Hawai'i Volcanoes National Park: <http://12.45.109.6/> (accessed February 2004).

Data Repository Item**Table DR2.** ATMOSPHERIC FINE AEROSOL DATA ($\pm 1 \mu\text{g}/\text{m}^3$), September 2003.

Aerosol Sample location & altitude	Date /time	Conditions (wind, speed, climate, visual)	Count total	$0.8 \mu\text{m}$	$0.3 \mu\text{m}$	$0.1 \mu\text{m}$	$\leq 0.3 \mu\text{m}$	Adjusted $\leq 0.3 \mu\text{m}$
Exposed Cohort Area			$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$
Kapapala	981 m 9/15/03, 1645	trades 5 swirls, overcast, pre-rain, haze	5.87	0.69	3.52	1.66	5.18	4.87
Kapapala	792 m 9/15/03, 1445	trades <5, overcast, pre-rain, haze	4.55	0.75	2.56	1.24	3.80	3.49
Kapapala	668 m 9/15/03, 1400	trades 5-10, overcast	2.78	0.63	1.75	0.38	2.13	1.82
Wood Valley	750 m 9/11/03, 0737	trades <5, clear sun	1.64	0.73	0.49	0.42	0.91	0.60
Pahala Trend	144 m 9/20/03, 1520	trades 5, overcast	1.42	0.69	0.57	0.14	0.71	0.40
Pahala Trend	229 m 9/20/03, 1422	trades <5, overcast	1.70	1.04	0.41	0.24	0.65	0.34
Pahala Trend Hospital	244 m 9/12/03, 2037	trades <5, partial clouds, dark	13.61	0.94	8.81	3.86	12.67	12.36
Pahala Trend Base	274 m 9/9/03, 0600	trades <5, sunrise, clear	1.61	0.47	1.10	0.03	1.13	0.82
	0815	trades <5, sun, clear	1.97	0.66	0.70	0.60	1.30	0.99
	1005	trades <5, partial clouds	1.46	0.58	0.32	0.56	0.88	0.57
	1400	trades 5-10, overcast, pre-rain	1.61	0.92	0.47	0.20	0.67	0.36
	1600	trades 5, overcast, post-rain	3.30	2.12	0.85	0.32	1.17	0.86
	1800	trades 5, overcast, spotty sun, pre-rain	2.17	1.23	0.61	0.32	0.93	0.62
	2000	trades <5, overcast, dark, no rain	1.11	0.46	0.42	0.22	0.64	0.33
	2200	trades 5, overcast, dark, no rain	4.67	0.75	3.44	0.47	3.91	3.60
	2300	trades <5, overcast, dark, no rain	2.15	0.00	1.45	0.70	2.15	1.84
	0300	trades <5, overcast, dark, no rain	1.95	1.19	0.51	0.24	0.75	0.44
Average for 24-hour sample		low trades with rain	2.20	0.84	0.99	0.37	1.35	1.04
	9/10/03, 2008	trades calm, overcast, dark, post-rain	5.41	0.92	3.34	1.14	4.48	4.17
	9/10/03, 2210	trades calm, moonbeams, partial cloud	1.87	0.71	1.00	0.16	1.16	0.85
	9/12/03, 1530	trades 5-10, overcast, pre-rain	1.53	0.78	0.57	0.17	0.74	0.43
	9/12/03, 1838	trades 5-10, overcast, sunset, post-rain	6.41	1.75	3.43	1.22	4.65	4.34
	9/12/03, 2002	trades <5, partial clouds, dark	6.71	0.92	3.56	2.21	5.77	5.46
	9/13/03, 2308	trades <5, moon & stars, clear night	4.27	1.72	2.21	0.34	2.55	2.24
	9/14/03, 1830	trades 5-10, overcast, sunset, no rain	0.95	0.25	0.40	0.30	0.70	0.39

Aerosol Sample Location	Date /time	Conditions (wind, speed, climate, visual)	Count total	0.8 µm	0.3 µm	0.1 µm	≤ 0.3 µm	Adjusted ≤ 0.3 µm
<i>Exposed Cohort Area</i>			µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3
Pahala (continued) 274 m	9/14/03, 2030	trades <5, overcast, dark, no rain	2.69	1.58	0.76	0.34	1.10	0.79
	9/15/03, 2030	trades calm, stars clear, dark	1.96	0.56	0.96	0.44	1.40	1.09
	9/16/03, 1800	trades <5, overcast, no rain	1.34	0.65	0.51	0.18	0.69	0.38
	9/17/03, 1949	trades <5, clear night	3.11	1.05	1.21	0.84	2.05	1.74
Average of evening samples		trades, some rain, typical evenings	3.30	0.99	1.63	0.67	2.30	1.99
Pahala Trend 500 m	9/11/03, 0837	trades 5, sun, haze	3.25	0.58	1.25	1.42	2.67	2.36
	9/11/03, 1345	trades 5-10, overcast, clear	1.35	0.11	1.11	0.11	1.22	0.91
Pahala Trend Upper 792 m	9/18/03, 1007	trades, <5, overcast, pre-rain, haze	5.41	1.30	2.40	1.71	4.11	3.80
Pahala/Punalu'u 396 m	9/11/03, 1157	trades <5, overcast	1.04	0.20	0.51	0.32	0.83	0.52
Punalu'u Trend 42 m	9/10/03, 0950	trades <5, partial clouds	<.01	0.00	0.00	0.00	0.00	0.00
Punalu'u Trend 90 m	9/10/03, 1025	trades 5-10, sun, clouds area	0.50	0.23	0.06	0.21	0.27	0.00
Punalu'u Trend 396 m	9/11/03, 0944	trades 5-10, partial sun, haze	4.48	0.75	1.79	1.93	3.72	3.41
Punalu'u area 390 m	9/11/03, 1132	trades <5, partial clouds, pre-rain, haze	1.29	0.57	0.41	0.29	0.70	0.39
Honu'apo area 443 m	9/11/03, 1029	trades 10, clear sun	1.61	0.52	0.63	0.44	1.07	0.76
Na'alehu Trend 152 m	9/18/03, 1236	trades 10, overcast	1.69	1.04	0.41	0.23	0.64	0.33
Na'alehu Trend school 195 m	9/12/03, 1708	trades <5, overcast	3.31	1.95	0.59	0.76	1.35	1.04
Na'alehu (end of town) 259 m	9/12/03, 1637	trades 5, overcast	2.75	1.45	0.70	0.60	1.30	0.99
	9/22/03, 1515	trades <5, partial clouds	1.05	0.95	0.06	0.02	0.08	0.00
Na'alehu Trend Upper 572 m	9/11/03, 1053	trades 10, sun, partial clouds	1.64	0.52	0.67	0.44	1.11	0.80
South point Trend 277 m	9/10/03, 1526	trades 15, partial clouds, clear	1.75	0.79	0.48	0.47	0.95	0.64
South point Trend 378 m	9/10/03, 1452	trades 10, partial clouds, clear	1.25	0.63	0.29	0.32	0.61	0.30
South point Trend 506 m	9/10/03, 1426	trades 5-10, sun, partial clouds, clear	1.09	0.48	0.21	0.40	0.61	0.30
South point Trend 742 m	9/17/03, 1739	trades 5-10, overcast, haze	9.31	0.31	8.09	0.89	8.98	8.67
	9/20/03, 1041	trades 5, partial clouds, haze	9.16	0.72	4.03	4.40	8.43	8.12
Ocean View 634 m	9/10/03, 1645	trades 5-10, pre-rain, clear	2.12	0.68	1.07	0.37	1.44	1.13
	9/12/03, 1017	trades 5-10, partial clouds, clear	3.79	0.40	1.66	1.72	3.38	3.07

Aerosol Sample Location	Date /time	Conditions (wind, speed, climate, visual)	Count total	0.8 µm	0.3 µm	0.1 µm	≤ 0.3 µm	Adjusted ≤ 0.3 µm
<i>Exposed Cohort Area</i>			µg/m3	µg/m3	µg/m3	µg/m3	µg/m3	µg/m3
Ocean View	930 m	9/10/03, 1720	trades 5-10, pre-rain	4.93	2.00	2.33	0.59	2.92
		9/12/03, 1045	trades 5, partial clouds, clear	5.71	0.58	3.07	2.06	5.13
Ocean View	1302 m	9/10/03, 1805	trades 5-10, overcast, pre-rain, haze	8.54	6.37	1.95	0.20	2.15
		9/12/03, 1115	trades 5-10, partial clouds, haze	6.88	0.30	2.88	3.70	6.58
Ocean View	1393 m	9/12/03, 1140	trades 5 circular, partial clouds, haze	10.70	1.23	5.63	3.84	9.47
<i>Exposed Cohort Area samples during variable winds</i>								
Ocean View	1487 m	9/23/03, 1524	variables 5, upslope, sun, haze	13.04	1.21	10.75	1.07	11.82
Ocean View	1244 m	9/23/03, 1502	variables 5, trade-like, overcast, haze	10.39	1.04	8.06	1.28	9.34
Ocean View	1243 m	9/23/03, 1347	variables 5, upslope, sun, clouds, haze	10.35	1.36	7.58	1.40	8.98
Ocean View	1049 m	9/23/03, 1607	variables 5, upslope, sun, clouds	12.33	1.07	9.72	1.53	11.25
Ocean View	866 m	9/23/03, 1658	variables <5, sun, distal haze	12.81	1.39	10.4	1.02	11.42
Ocean View	698 m	9/23/03, 1632	variables <5, upslope, sun, wispy, haze	7.32	1.07	5.47	0.77	6.24
		9/23/03, 1807	variables calm, sun, haze & sunset color	10.50	1.59	8.09	0.81	8.90
Ocean View	561 m	9/23/03, 1720	variables 5, trade-like to west, sun, haze	12.95	1.39	10.71	0.83	11.54
Ocean View	305 m	9/23/03, 1742	variables 5-10, trade-like, sun, haze	4.62	0.69	3.32	0.59	3.91
Kapapala Highway	762 m	9/24/03, 1306	variables 5 inland, overcast	5.43	0.94	3.39	1.10	4.49
Kapapala trend Hwy	549 m	9/24/03, 1240	variables 5 inland upslope, overcast	5.03	0.79	3.58	0.66	4.24
North of Pahala Hwy	305 m	9/24/03, 1341	variables 5-10 inland, overcast	3.03	0.52	1.87	0.64	2.51
Pahala Trend Hwy	244 m	9/24/03, 1408	variables <5 upslope & northerly, traffic	3.57	1.15	1.27	1.13	2.40
Pahala Trend (Base)	274 m	9/24/03, 1152	variables 5 inland, overcast, haze	2.79	0.52	1.79	0.48	2.27
<i>Control Cohort</i>								
Hawi – downtown	183 m	9/19/03, 1107	trades 10-15, clear sun	1.10	0.69	0.25	0.15	0.40
Hawi - end of town	195 m	9/19/03, 1419	trades 10-15, clear sun	1.02	0.63	0.20	0.18	0.38
Hawi - north street	146 m	9/19/03, 1155	trades 10-15, clear sun	0.77	0.46	0.14	0.16	0.30
Hawi - south high elev.	268 m	9/19/03, 1232	trades 10-15, patchy clouds	0.70	0.56	0.02	0.12	0.14
Average for Control site				0.90	0.59	0.15	0.15	0.31

Kona Area	Date /time	Conditions (wind, speed, climate, visual)	Count total	0.8 µm	0.3 µm	0.1 µm	≤ 0.3 µm	Adjusted ≤ 0.3 µm
Captain Cook	561 m 9/17/03, 1547	trades <5, overcast, pre-rain, haze	3.55	0.63	2.13	0.78	2.91	2.60
Kipahoehoe reserve	9/17/03, 1656	trades <5, overcast, pre-rain, haze	7.62	1.04	5.50	1.07	6.57	6.26

Data Repository Item**Table DR3** INDOOR/OUTDOOR SO₂ RATIOS

Data from Indoor-outdoor testing in the Kau district of the Big Island, Hawai'i, U.S.A. Sulfur Dioxide was measured by Harwell Scientifics passive diffusion tube samplers exposed for three weeks in August-September, 2003.

I/O Ratio	Indoor $\mu\text{g}/\text{m}^3$	Outdoor $\mu\text{g}/\text{m}^3$	Indoor ppbv	Location Description
0.69	43.0	62.1	16.8	School cafeteria
0.59	31.4	53.0	12.3	School classroom
0.56	33.6	59.7	13.1	Plantation house
0.68	34.0	50.0	13.3	Plantation house
0.15	8.1	55.0	3.2	House
0.71	36.1	50.8	14.1	Hospital dayroom
0.65	29.8	45.6	11.7	Hospital clinic
0.69	24.9	36.2	9.8	School classroom
0.23	7.2	31.9	2.8	House
No data				2 tubes disturbed

Data Repository Item

Appendix DR1 Unpublished SO₂ Emission Data from Kilauea volcano provided by United States Geological Society-Hawaiian Volcano Observatory, 2004.

Andrew J Sutton

02/18/2004 01:10 PM

To: blongo1969@aol.com
cc: Tamar Elias/GD/USGS/DOI@USGS
Subject: SO₂ emissions and concentrations.

Attached is the Kilauea summit and east rift (Pu'u 'O'o) SO₂ emission rate data you requested. I included data bracketing the period you requested, as we have just a few datapoints during your study period. For what it's worth, east rift emissions have averaged 1440 tonnes/day +- 470 for the past 2 years. Summit emissions have averaged 110 tonnes/day +- 30 for the same period.

Regarding the ambient SO₂ concentrations at the observatory and behind the visitor center-- you can obtain those data on the web at:

<http://12.45.109.6/>

You'll be looking for data from longterm sites HAVO-OB and HAVO-VC. As you will see, there is lot's of useful data on this site, including windspeed and direction, precip and humidity. Please be sure to cite the National Park Service for these data as they request.

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