

Draft Report

**Preliminary Description of Results
from Niwot Ridge Tracer Experiments,
July 2001**

prepared by

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July 9, 2002

Data Presentation

During July, 2001, a series of SF₆ tracer experiments were conducted at the Niwot Ridge Ameriflux site to investigate dispersion within the forest canopy during nighttime drainage flow conditions. Due to difficulties with the SF₆ line source system, the experiments were conducted using a single point source located 50 m upslope from the primary USGS tower and 200 m upslope from the primary CU tower. The automated profiler gas sampling system was used with a continuous SF₆ analyzer to measure SF₆ concentrations at multiple heights on the USGS tower, the CU tower, and the satellite USGS tower. Results from these measurements are presented here in terms of 30 min average concentrations from the primary USGS and CU towers for days 204 through the morning of day 208 (July 23 through July 27, 2001).

This report includes a brief overview of the data and an analysis of vertical diffusion rates obtained during one night when the drainage flow was very steady for a number of hours and both towers were impacted by the SF₆ plume. SF₆ release rate information is summarized in Table 1. The release was initiated during the evening of day 203 and continued through the morning of day 208. The release was at a height of approximately 0.2 m above the surface.

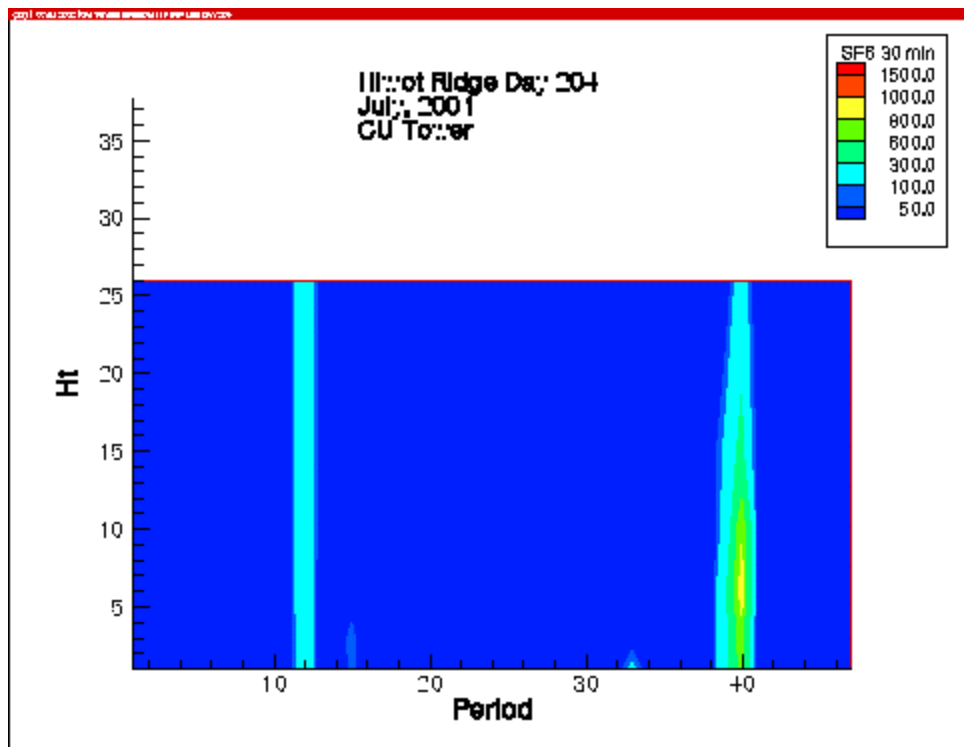
Table 1. Summary of SF6 point source release rates.

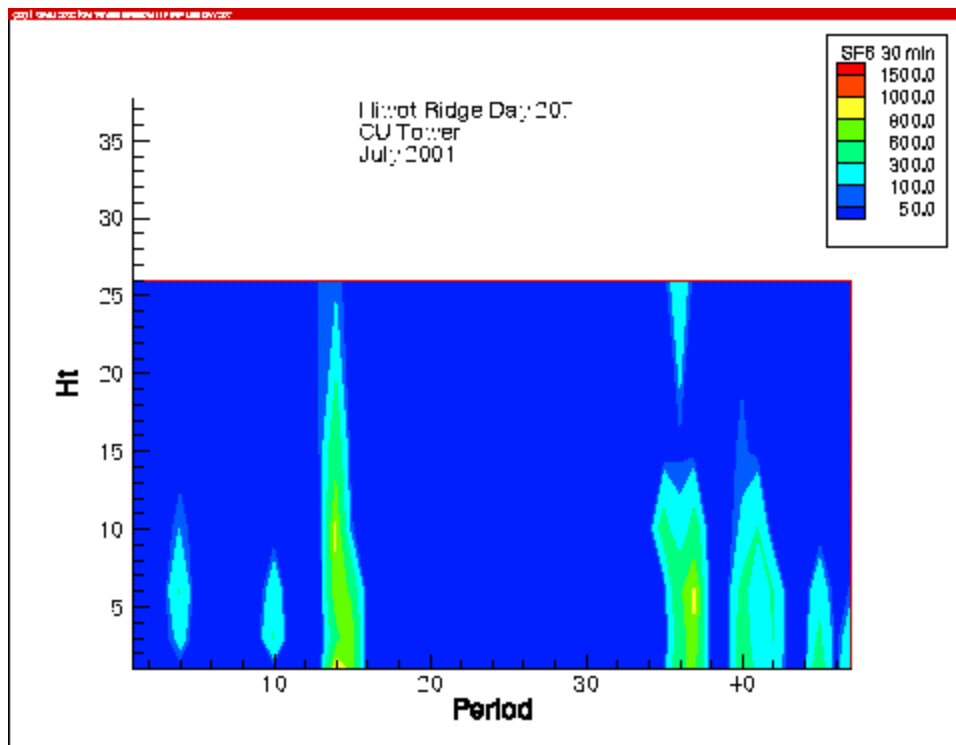
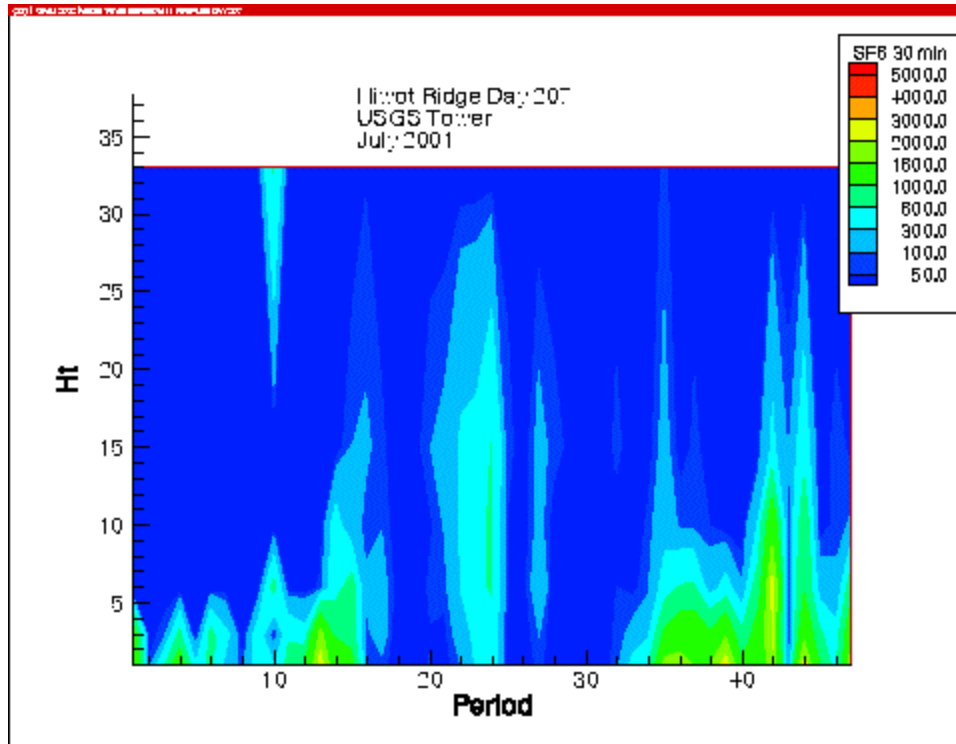
Date	Day	Time MDT	SF6 %	SF6 sccm		
7/22/01	203	1751	3.7	4.81		
7/23/01	204	710	4.4	5.72		
		801	4.2	5.46		SF6 sccm
		1432	3.8	4.94	mean	5.23
		1514	10	13	std	0.43
		1819	10.6	13.78	% std	8.21
7/24/01	205	720	11.2	14.56		
		1024	9.9	12.87		
		1245	9.4	12.22		
		1245	10	13		
		1951	11.8	15.34		
		2018	11.9	15.47	mean	13.91
		2018	8	10.4	std	1.39
		2137	8.1	10.53	% std	10.00
7/25/01	206	719	7.8	10.14		
		719	9	11.7		
		845	8.5	11.05		
		1920	9	11.7		
		2010	8.6	11.18		
		2010	9	11.7		
7/26/01	207	625	9	11.7		
		625	8.8	11.44		
		1659	8.5	11.05		
7/26/01	207	1930	8.3	10.79		
		1931	8.5	11.05		
		2010	8.6	11.18		
7/27/01	208	955	8.1	10.53	mean	11.08
		956	off		std	0.52
					% std	4.66

*SF6 released through Tylan mass flow meter (0 to 500 sccm)

Time-height cross sections of SF6 concentrations measured at the two towers are presented in the following figures for days 204 through 208. The primary features of these graphs include:

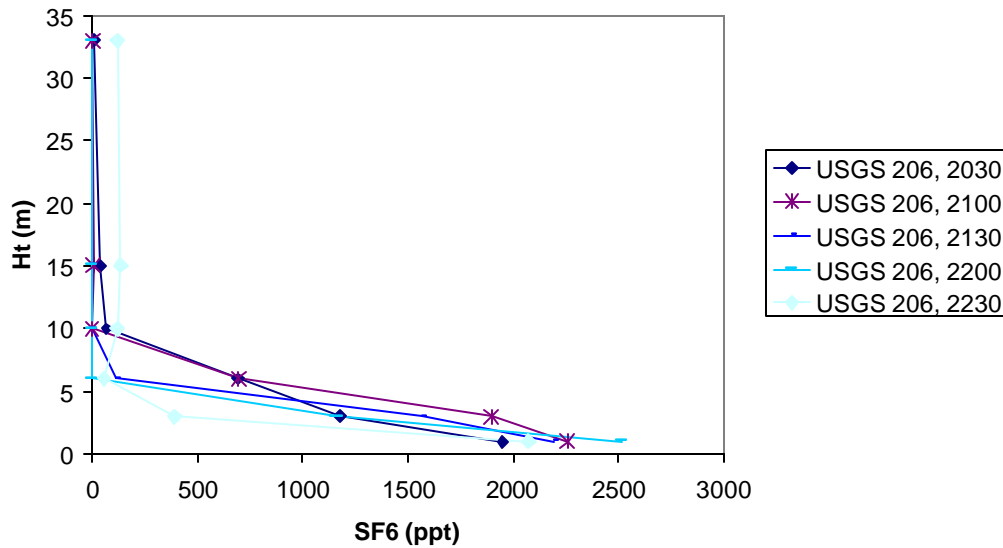
- Due to the use of the point source, the impact is intermittent, particularly during daylight hours when the flow tended to be mostly upslope. There is more intermittency at the CU tower compared to the USGS tower due to the greater downwind distance from the source;
- During some of the nights, the plume impact at both towers was quite steady and maximum concentrations occurred at the lowest levels and decreased relatively rapidly with height.
- Occasionally, there was SF6 measured at higher levels and not near the surface, but this probably an artifact of the point source plume meandering across the tower during a 30 min averaging period



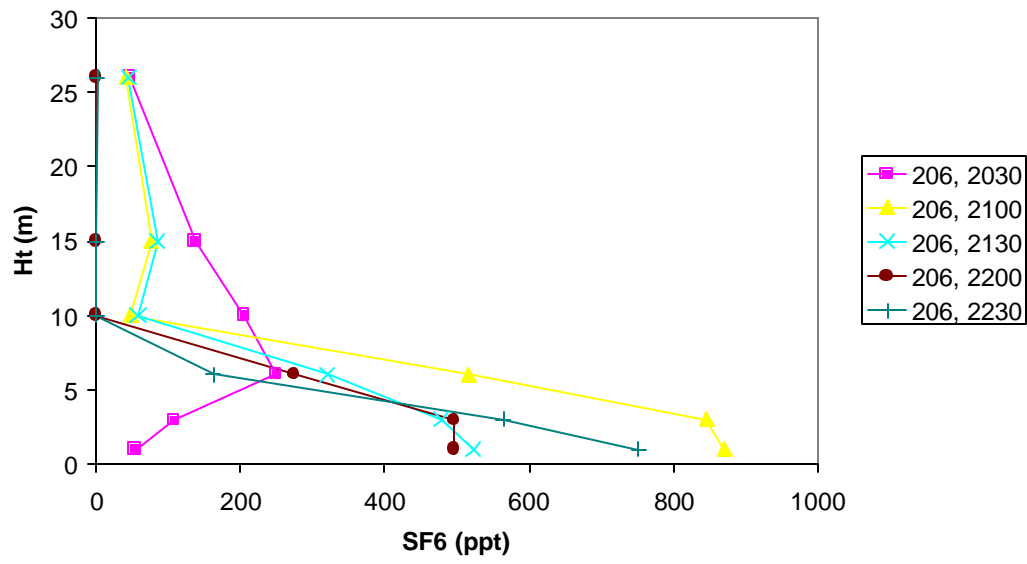


To illustrate the nature of nighttime dispersion conditions, results from night 206 are presented. This was a period when the flow was quite steady downslope and the plume impacted both towers continuously for a period of hours. Vertical profiles of SF6 are shown for the USGS and CU towers in the following figures. At the USGS towers, the profiles are all quite similar and show a dramatic decrease in concentration from approximately 2000 ppt at the surface to less than 100 ppt at 10 to 15 m. At the CU tower, 200 m downwind, the profiles exhibited greater variability compared to the USGS tower. Maximum concentrations near the surface varied between 400 and 800 ppt, but still decreased rapidly to less than 100 ppt at 10 to 15 m height.

SF6 Vertical Profiles Niwot Ridge USGS Tower, July 2001



SF6 Vertical Profiles Niwot Ridge CU Tower, July 2001



Results from these profiles were used to estimate Gaussian vertical diffusion coefficients for each tower and each half hour period. These are shown in the following figure; the plume diffusion coefficients are quite small and vary from 2 to 4 m at 50 m downwind to 3 to 6 m at 200 m downwind.

**Vertical Diffusion Coefficient
Niwt Ridge, Day 206 2030 - 2230, July 2001**

