

Kansas City PM Characterization Study

Final Report

Appendix X

Remote Sensing Data Second-by-Second Round 2 Model Year Vehicle Specific Power

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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United States
Environmental Protection
Agency

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April 2008

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mean	rvsp_mean	rvsp_var	svsp_mean	svsp_var	rspeed_mean	rspeed_var	sspeed_mean	sspeed_var	rhc_ppm_n
81	0	1	21	373.1905	-1.527332		-4.715548	0.660976	23.13056	25.95821	20.11067	11.0935	1045.768
81	3	3	18	390.5556	1.283851	1.150296	0.699619	0.018132	22.13333	71.72143	12.27779	11.24258	1276.443
81	306	6	18	155.9444	4.899546	1.191585	4.503636	0.006318	20.68333	5.897227	30.07207	3.122031	1617.3
81	609	17	18	140.8333	7.710454	0.670514	7.429501	0.007346	21.87824	22.66485	33.98836	2.947428	1109.719
81	912	13	18	117.8333	10.47864	0.784022	10.49398	0.012538	23.54385	14.72211	39.0872	6.438454	828.04
81	1218	12	18	132.9444	14.46185	4.471173	14.36139	0.068194	25.96417	16.84839	44.62183	4.030871	368.1933
81	1824	7	18	33.16667	19.2379	2.026268	20.58043	0.076383	29.43143	9.923581	49.44821	6.82985	437.6286
1994	0	16	15	296.4667	-3.419584	13.37687	-5.407024	0.129418	23.89904	22.51983	20.88384	7.949563	310.9973
1994	3	15	11	389.7273	2.099845	0.983407	0.676438	0.002184	21.69933	12.81595	11.28779	0.741155	154.7573
1994	306	64	11	168.8182	4.633369	0.855014	4.491464	0.002372	21.34875	21.71075	29.76748	1.62445	279.3092
1994	609	135	11	157	7.514248	0.718354	7.445187	0.008587	21.52689	14.05484	34.21896	1.581776	242.5829
1994	912	237	11	128	10.53814	0.772852	10.49757	0.006588	24.05616	12.28016	38.63022	1.478115	346.3289
1994	1218	411	11	148.1818	14.62979	2.876267	14.35249	0.021721	26.1427	12.74685	44.90782	0.83921	165.8645
1994	1824	126	11	26.54545	20.18699	1.994978	20.26868	0.088637	29.305	10.36652	50.96035	13.65781	115.789
1994	2430	21	11	8.636364	25.51932	0.961244	26.48944	0.811991	31.62857	17.00513	47.75294	23.67096	95.15
1994	3099	3	9	3.444444	49.08816	816.1179	32.42509	2.577063	27.28667	12.20263	47.10354	60.90887	100.49
1995	0	20	26	324.0769	-2.547153	5.85995	-5.332924	0.069627	23.77744	30.12979	19.49411	21.09975	186.5995
1995	3	26	22	438.2727	1.766588	0.976773	0.646454	0.022126	21.67615	18.7866	10.44999	6.088345	215.9342
1995	306	59	21	169.9048	4.953424	0.740333	4.518793	0.004872	21.27915	20.8739	29.12104	4.07241	146.9708
1995	609	157	21	152.7143	7.62683	0.666336	7.448626	0.006387	22.37561	13.75159	34.20242	2.966303	135.5749
1995	912	284	21	124.2381	10.48709	0.806382	10.45986	0.00974	24.1044	13.73215	39.50619	3.793909	261.248
1995	1218	555	21	153.3333	14.58593	2.830265	14.45296	0.019272	26.32686	12.2346	44.78545	1.712168	142.8504
1995	1824	157	21	29.71429	20.27553	2.929895	20.24257	0.148717	28.72962	12.40991	50.27474	10.26915	153.5579
1995	2430	27	21	9	26.80193	4.87458	26.66891	0.303156	30.69296	10.46423	46.45029	11.11452	241.5426
1995	3099	9	20	3.15	37.7157	101.2295	32.28926	1.302869	31.95111	19.36556	43.41522	16.84519	189.5778
1996	0	24	10	361.9	-2.125355	2.690569	-5.313372	0.03161	23.63643	19.65725	19.70311	3.694019	299.3293
1996	3	28	9	390.2222	1.624016	0.711194	0.679262	0.001867	22.39893	31.27495	10.793	0.362754	115.0239
1996	306	68	9	161.1111	4.780002	0.631777	4.499233	0.005535	19.55368	26.37189	29.15559	2.685358	78.35647
1996	609	170	9	155.4444	7.671953	0.654507	7.460514	0.008851	22.23653	13.72843	33.58876	2.197348	110.1704
1996	912	266	9	124.2222	10.51947	0.772864	10.40491	0.005478	23.73342	12.62334	38.79568	1.571931	131.7648
1996	1218	543	9	153.8889	14.72521	2.642666	14.39302	0.031069	26.39908	11.39159	45.00997	1.261427	111.7719
1996	1824	181	9	32.66667	20.30365	2.806935	20.18747	0.192965	29.12757	13.28625	47.96061	7.55146	106.369
1996	2430	22	9	9.444444	26.68324	3.42488	26.77122	0.220743	30.26182	5.865073	51.8602	11.18925	465.4818
1996	3099	10	9	4.888889	1286.182	1218499	35.21851	14.78608	27.521	27.89959	47.29289	34.21006	140.869
1997	0	17	8	206.5	-1.812319	0.949416	-5.145516	0.059501	24.15343	33.48144	22.01514	10.25069	127.9529
1997	3	35	4	385.5	1.917083	0.756655	0.702444	0.000782	20.034	37.38364	11.69275	0.132246	140.31
1997	306	73	4	169.75	4.652673	0.732289	4.544449	0.007639	20.76973	29.29749	28.65658	0.231947	152.9792
1997	609	203	4	155.25	7.797892	0.697851	7.468226	0.014194	21.75537	18.52433	33.89918	1.863682	111.9017

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mear	rvsp_mean	rvsp_var	svsp_mear	svsp_var	rspeed_mear	rspeed_var	sspeed_mear	sspeed_var	rhc_ppm_n
1997	912	358	4	125.75	10.56331	0.78569	10.43648	0.009809	23.60159	12.71235	38.69845	3.033839	81.92844
1997	1218	793	4	148	14.81011	2.849774	14.52298	0.065728	26.376	12.02259	45.04538	5.177349	109.443
1997	1824	237	4	25.75	20.04879	2.513527	19.91976	0.103859	29.13236	11.46656	50.56903	7.284962	87.03291
1997	2430	42	4	8.75	25.61566	1.853203	26.52751	0.400642	30.50548	7.408523	47.47034	16.10399	102.4652
1997	3099	14	4	2.25	52.71465	1352.228	34.30023	12.87631	31.28429	75.08056	47.88974	0.491881	606.3043
1998	0	31	18	351.7778	-2.260419	3.000616	-5.356153	0.057537	23.21739	30.19838	19.89821	4.255627	80.27087
1998	3	29	16	392.375	1.775817	0.581131	0.642912	0.001991	20.2769	30.09287	10.89413	0.704071	175.0852
1998	306	67	16	164.5625	4.863981	0.526962	4.501219	0.000985	21.15791	17.09529	28.74032	1.525988	178.5246
1998	609	255	16	151.875	7.752419	0.599443	7.476148	0.00419	21.82349	15.31893	32.78953	2.361738	68.11439
1998	912	406	16	127.5	10.57003	0.705345	10.45042	0.006588	24.03182	13.44989	38.08647	4.469098	116.0467
1998	1218	807	16	156.3125	14.7872	2.90652	14.42682	0.036852	26.27103	11.56921	45.47622	0.839512	73.06612
1998	1824	281	16	33.125	20.25872	2.800803	20.1584	0.157745	28.86206	10.75675	51.36148	8.867716	43.63441
1998	2430	39	16	9	26.11519	3.483072	26.73363	0.38495	31.49564	13.13146	48.78514	14.69765	41.27923
1998	3099	14	13	4.307692	47.27867	445.5303	33.1178	2.579933	32.72429	30.44575	43.1269	27.96766	243.5536
1999	0	24	10	233.3	-1.891631	3.737335	-5.328732	0.049855	23.30253	20.7993	20.47558	99.08977	81.99671
1999	3	33	8	482.75	1.703628	1.02576	0.582224	0.055688	19.85576	24.96446	11.426	45.40822	179.0461
1999	306	90	7	147.1429	4.755283	0.749588	4.416588	0.006643	21.52589	23.20012	30.20013	38.54234	88.38271
1999	609	230	7	131.7143	7.752986	0.716575	7.485516	0.016001	21.79652	18.64104	36.89394	65.27608	84.04697
1999	912	402	7	111.5714	10.64313	0.739819	10.51337	0.002486	23.59851	14.07349	39.86362	24.48344	60.22292
1999	1218	937	7	138.8571	14.81499	2.937359	14.43354	0.011561	26.34867	11.9313	45.60877	11.96125	71.06322
1999	1824	377	7	34.14286	20.15602	2.612208	20.23934	0.106741	28.95668	11.18992	52.45985	7.255908	67.48414
1999	2430	52	7	9.142857	26.20765	2.793701	26.61478	0.613034	31.04712	8.89975	41.91124	98.2762	71.85481
1999	3099	19	5	5.8	561.6014	1610489	33.81523	13.05847	33.23632	21.53028	45.05491	29.65827	62.87053
2000	0	30	10	311	-2.712952	13.77028	-5.419784	0.026004	24.48453	21.4286	17.60702	42.39711	47.76039
2000	3	37	9	505	1.848292	0.82859	0.588091	0.051143	20.51297	34.37732	9.543084	13.26232	109.2914
2000	306	103	8	171.625	4.84171	0.748017	4.518812	0.003589	19.95854	24.65797	29.21102	2.973004	104.4829
2000	609	277	8	148.125	7.681441	0.702038	7.427445	0.006735	22.18816	18.84901	33.75136	4.79109	59.39949
2000	912	435	8	129.875	10.58435	0.762198	10.49483	0.011169	23.8986	13.78597	39.15606	1.54017	78.2517
2000	1218	959	8	154.25	14.83074	2.781434	14.48695	0.020477	26.40575	12.24377	44.57966	0.4344	47.34372
2000	1824	385	8	34.5	20.13719	2.305939	20.47918	0.109316	28.91766	10.45947	51.42863	12.05087	35.45894
2000	2430	65	8	13.25	26.26594	2.704573	26.40138	0.388733	31.78862	13.86948	47.81146	19.11294	16.918
2000	3099	24	7	2	954.1808	1646756	31.63868	1.94287	30.5525	25.17289	46.6652	86.40442	137.2838
2001	0	28	13	338	-2.436174	6.77346	-5.419617	0.038261	24.73165	19.81184	20.2517	4.752798	25.17079
2001	3	38	11	391.2727	1.61845	0.663068	0.640255	0.001459	20.92079	45.70315	10.76145	1.502639	13.65658
2001	306	99	11	167.3636	4.794409	0.668832	4.513796	0.003816	21.20798	31.67237	29.53146	3.531637	46.22273
2001	609	227	11	157.8182	7.60776	0.828967	7.452596	0.003549	22.10286	15.52323	33.97293	0.916792	61.12573
2001	912	415	11	127.0909	10.59528	0.731955	10.48232	0.005803	23.68728	11.90746	38.74205	3.814095	38.21995
2001	1218	1042	11	150.9091	14.79126	2.865727	14.4325	0.012111	26.32647	11.14898	44.93513	1.916402	49.94402

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mear	rvsp_mean	rvsp_var	svsp_mear	svsp_var	rspeed_mear	rspeed_var	sspeed_mear	sspeed_var	rhc_ppm_n
2001	1824	291	11	29.45455	20.0853	2.585912	20.48825	0.164577	29.14124	10.36936	50.44098	3.329231	10.89351
2001	2430	56	11	7.636364	25.92548	2.625161	26.4932	0.395208	31.09929	10.13732	46.42572	20.82969	38.68089
2001	3099	26	10	3.3	784.9174	1176164	33.7569	26.44271	28.73462	28.15391	46.66263	34.23824	158.0081
2002	0	13	9	316.5556	-2.626634	10.84118	-5.219978	0.196965	25.21479	24.55668	20.22195	8.26773	44.26581
2002	3	28	7	385	1.578083	0.620644	0.656805	0.003758	21.915	42.26519	11.30398	1.260919	76.57464
2002	306	72	7	162.7143	4.905316	0.754108	4.490593	0.007637	20.46889	21.76837	29.1411	2.225425	24.96722
2002	609	193	7	151.8571	7.694551	0.634803	7.479114	0.004332	22.3887	16.39439	34.08164	1.914648	75.59803
2002	912	277	7	134.1429	10.6143	0.73823	10.48978	0.014568	23.73437	12.50662	39.63049	2.017474	22.47996
2002	1218	764	7	151.7143	14.90854	2.806993	14.2434	0.031618	26.46576	11.54218	44.16501	2.090391	39.12393
2002	1824	304	7	29.28571	20.23838	2.660581	20.64523	0.102338	29.42911	10.20261	51.25837	2.503852	27.41658
2002	2430	50	7	10.14286	25.99596	2.808825	26.80453	0.596586	31.7374	9.233122	48.67632	30.74107	-5.401
2002	3099	30	5	3	1701.659	2225127	33.49085	10.50324	27.17267	35.97349	44.97213	119.1211	102.4957
2003	0	0	8	291.75	.	.	-5.256376	0.069251	25.51722	21.97342	20.38243	10.13288	20.7915
2004	0	0	3	390	.	.	-5.38275	0.060372	27.19895	19.64483	19.25844	0.098732	15.77444
2005	0	0	2	0	30.86	.	24.37063	0.017965	11.02
8182	3	3	3	347	1.175898	0.194991	0.740508	7.46E-05	18.63667	90.26243	11.06044	1.293153	1692.033
8182	306	4	3	165.6667	4.837035	1.319814	4.49925	0.008715	24.7225	9.170825	29.1763	0.882263	2356.99
8182	609	5	3	165.6667	7.053107	0.168899	7.486248	0.00209	22.132	8.60992	33.52201	0.279365	314.57
8182	912	9	3	133	10.36275	1.135696	10.55684	0.004379	24.36667	13.11985	41.6606	1.834926	289.64
8182	1218	11	3	147	14.89558	1.595557	14.16627	0.021637	25.76091	16.30871	44.14546	1.442148	538.0145
8182	1824	4	3	23.66667	20.75396	4.620804	20.52694	0.047427	26.3575	15.80243	48.28404	6.40737	106.45
8385	0	3	8	260.625	-1.092865	0.616366	-4.996263	0.147357	23.56077	130.5632	21.19037	9.831897	295.3815
8385	3	7	5	370	1.460336	0.975619	0.650162	0.00176	22.63857	6.931848	10.75431	1.11318	1695.93
8385	306	12	5	160.4	4.988299	0.646878	4.50672	0.014793	20.705	17.67134	28.16893	1.846787	452.605
8385	609	31	5	152	7.81559	0.705057	7.431364	0.003695	22.72935	13.96438	32.85448	1.088816	448.7171
8385	912	38	5	131.6	10.36533	0.802358	10.54358	0.014982	23.88947	8.869113	39.78868	0.809183	590.9213
8385	1218	48	5	161.4	14.26282	2.457395	14.2882	0.090449	26.78479	9.279532	45.60009	0.450753	264.1223
8385	1824	19	5	29.4	20.3445	2.920947	20.2838	0.182634	29.30579	18.60455	49.12155	6.819293	662.4168
8385	2430	6	5	9.2	26.41782	2.498523	25.80189	0.868555	31.08333	16.33295	50.55332	28.97926	324.0883
8385	3099	1	3	5	58.6695	.	33.29075	0.833669	37.77	.	43.91038	15.85633	648.93
8689	0	19	32	366.125	-2.235589	1.493885	-6.435223	52.04111	23.165	20.0505	19.92609	5.239747	952.0079
8689	3	20	28	373.9286	1.93278	0.72902	0.685933	0.013942	23.395	53.32522	10.84989	4.490038	849.655
8689	306	57	28	154.4643	4.625112	0.742747	4.526111	0.004382	20.14912	29.56994	29.2978	10.39931	490.4361
8689	609	126	28	142	7.633157	0.726063	7.437132	0.008397	22.76651	15.41485	33.43054	13.52535	400.089
8689	912	193	28	123.0714	10.58286	0.743651	10.50968	0.007158	24.40114	13.0383	38.48415	9.7987	466.6713
8689	1218	271	28	146	14.40888	2.775097	14.40847	0.043537	26.76779	10.0498	44.56068	9.55397	402.5314
8689	1824	67	28	32.75	20.18809	3.160933	20.37922	0.171605	28.59239	12.39212	49.65544	36.21896	365.2396
8689	2430	16	28	9.142857	26.25841	2.777365	26.48719	0.606237	31.19563	12.41951	46.35397	41.01401	324.8138

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mean	rvsp_mean	rvsp_var	svsp_mean	svsp_var	rspeed_mean	rspeed_var	sspeed_mean	sspeed_var	rhc_ppm_n
8689	3099	5	21	29.2381	90.09284	9872.392	40.41934	1276.473	41.45	110.5418	47.8767	45.45667	468.122
9093	0	40	44	347.5	-2.166914	4.078052	-5.822161	15.10297	24.49405	22.67033	20.38648	6.251563	917.8663
9093	3	57	36	376.5	1.820344	0.811863	0.693149	0.002652	19.3107	47.83088	11.12019	1.141603	698.6342
9093	306	134	36	163.3056	4.779215	0.720214	4.484145	0.006919	21.31739	24.731	28.93587	3.470606	432.6163
9093	609	294	36	141.2222	7.744669	0.766223	7.454408	0.005683	22.3169	15.42174	33.95444	4.297017	253.5351
9093	912	485	36	125.8611	10.57465	0.736783	10.47829	0.007358	24.06452	12.74142	38.71065	2.219594	304.8019
9093	1218	915	36	148.3333	14.72651	2.801895	14.41274	0.041059	26.56356	11.56228	43.94968	5.919125	198.1138
9093	1824	243	36	28.27778	20.17843	2.522177	20.19045	0.1619	29.09346	11.30463	50.40444	24.83395	228.1288
9093	2430	42	35	10.62857	26.15999	2.171236	26.41523	0.440536	30.66667	12.33786	47.84308	22.24537	322.3993
9093	3099	20	26	20.15385	47.14563	551.5787	37.50195	626.028	29.656	25.60204	44.48812	26.95427	795.548

Part B: RSD vs. PEMS results for site 21

date	RSD Speed	Veh ID #	RSD HC (ppm)	RSD CO (%)	RSD CO2 (%)	RSD NOx (ppb)	RSD Accel	PEMS HC	PEMS CO	PEMS CO2	PEMS NOx	PEMS VI S	PEMS GP S
2/22/2005	25.2	729	14.94	0.26	14.85	230.16	1.71	262.66	0.04	13.01	903.74	24.6	23.1
								274.84	0.04	13.05	745.56	26.1	23.6
								286.07	0.04	13.07	1063.07	27.8	25.4
								295.76	0.03	13.08	1580.85	29.6	26.1
Avg	25.2		14.94	0.26	14.85	230.16		279.83	0.03	13.05	1073.3	27.03	24.55
Median	25.2		14.94	0.26	14.85	230.16		280.46	0.04	13.06	983.4	26.95	24.5
StdDev	N/A		N/A	N/A	N/A	N/A		14.29	0	0.03	362.34	2.16	1.43
N	1		1	1	1	1		4	4	4	4	4	4
2/22/2005	25.2	728	-32.31	0.07	14.96	1065.43	2.27	80.33	0.02	12.99	404.26		29.1
2/22/2005	29.6		-102.39	0.05	15.01	95.12		68.58	0.01	13.14	309.13		29.2
								65.81	0.01	13.17	306.62		29.2
								68.61	0.03	13.16	310.49		30
								136.71	0.02	12.72	850.42		21.5
								142.82	0.09	12.78	459.91		23.5
								157.23	0.11	12.86	592.01		25.7
								128.14	0.08	12.89	837.78		28
Avg			-67.35	0.06	14.99	580.28		106.03	0.05	12.96	508.83		27.03
Median			-67.35	0.06	14.99	580.28		104.23	0.03	12.94	432.09		28.55
StdDev			49.55	0.01	0.04	686.11		38.7	0.04	0.18	228.43		3.12
N			2	2	2	2		8	8	8	8		8

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mear	rvsp_mean	rvsp_var	svsp_mear	svsp_var	rspeed_me	rspeed_var	sspeed_me	sspeed_var	rhc_ppm_n
2/23/2005	29.7	731	-25.32	0.16	14.9	894.32	1.09	112.37	0.23	12.98	856.19		26.6
2/23/2005	29.2		-60.06	0.49	14.68	506.28	-0.27	107.55	0.18	13.01	808.93		27.2
2/23/2005	29.2		-18.73	0.16	14.91	685.49	1.12	103.35	0.19	13.03	759.53		28.6
								100.39	0.22	13.03	853.8		29.7
Avg			-34.7	0.27	14.83	695.36		105.92	0.21	13.01	819.61		28.03
Median			-25.32	0.16	14.9	685.49		105.45	0.21	13.02	831.36		27.9
StdDev			22.21	0.19	0.13	194.21		5.21	0.02	0.02	45.57		1.4
N			3	3	3	3		4	4	4	4		4
2/24/2005	31.1	737	123.1	1.02	14.29	496.48	0.81	863.66	1.24	12.2	270.49		30.2
								1120.88	3.33	11.14	246.13		30
								1427.21	6.09	9.48	128.84		29.9
								1662.31	7.41	8.39	136.4		30.2
Avg			123.1	1.02	14.29	496.48		1268.51	4.52	10.3	195.46		30.08
Median			123.1	1.02	14.29	496.48		1274.04	4.71	10.31	191.26		30.1
StdDev			N/A	N/A	N/A	N/A		349.27	2.77	1.7	73.31		0.15
N			1	1	1	1		4	4	4	4		4
2/25/2005	33.2	747	-16.25	0.3	14.8	1083.18	1.4	187.93	0.12	13.07	600.58	N/A	30.6
2/25/2005	30		5.54	0.13	14.91	1109.65	0.66	179.87	0.17	13.07	1198.47	N/A	31.2
2/25/2005	20.1		-45.95	0.12	14.96	109.56	3.09	172.03	0.13	13.09	1116.21	N/A	32.1
2/25/2005	29.9		-61	0.13	14.95	141.28	1.28	164.96	0.1	13.11	955.87	N/A	33.7
Avg			-29.42	0.17	14.91	610.92		176.2	0.13	13.09	967.78		31.9
Median			-31.1	0.13	14.93	612.23		175.95	0.12	13.08	1036.04		31.65
StdDev			29.81	0.09	0.07	560.86		9.91	0.03	0.02	264.72		1.35
N			4	4	4	4		4	4	4	4		4
2/25/2005	31.5	744	15.84	0.19	14.91	5.26	0.74	32.73	0.12	9.37	50.23	29.9	28.6
2/25/2005	36.4		-61.53	0.18	14.91	264.73	1.17	32.77	0.09	9.37	73.71	30.6	29.6
2/25/2005	36.9		-28.48	1.96	13.64	9.92	3.49	30.03	0.08	9.37	81.64	31.3	30.6
2/25/2005	33.8		-48.1	0.1	14.97	94.76	1.38	34.95	0.12	9.36	104.42	32.4	31.4
Avg			-30.57	0.61	14.61	93.67		32.62	0.1	9.37	77.5	31.05	30.05
Median			-38.29	0.19	14.91	52.34		32.75	0.11	9.37	77.68	30.95	30.1
StdDev			33.78	0.9	0.65	121.23		2.02	0.02	0.01	22.36	1.07	1.22

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mean	rvsp_mean	rvsp_var	svsp_mean	svsp_var	rspeed_mean	rspeed_var	sspeed_mean	sspeed_var	rhc_ppm_n
N				4	4	4	4		4	4	4	4	4

rhc_ppm_v	shc_ppm_r	shc_ppm_v	rco_perc	nrco_perc_v	sco_perc_r	sco_perc_v	rco2_perc	rco2_perc_v	sco2_perc	sco2_perc_v	rnx_ppm_n	rnx_ppm_v	snx_ppm_r	snx_ppm_var
7283726	5555.87	49946258	1.839058	7.891367	2.391323	4.536237	13.655	4.219466	10.74709	9.103693	1140.118	1261749	191.4523	27193.52
2197741	5171.675	54303523	3.463333	17.53083	2.243822	3.441938	12.49333	8.728133	10.6279	8.750008	868.9267	683249	250.1131	39708.74
4204069	5234.507	82938615	0.898333	3.248137	1.742685	2.359434	14.31333	1.829867	12.32137	3.978808	1247.363	466891.2	524.3462	220325.6
6984190	5119.979	82071230	1.460847	11.82009	1.63853	2.422388	13.90647	6.368699	12.54408	3.107217	1658.53	2155935	649.0622	290019.3
1347002	4853.419	65268995	0.726923	0.726673	1.713821	2.535983	14.42231	0.366019	12.66957	2.256094	2173.779	821669.6	754.0951	414939.2
304106.9	4560.337	58670336	1.482725	2.622561	1.803886	2.515354	13.93333	1.37977	12.78451	1.809119	1101.057	551247.1	857.549	469391.1
655116.2	5002.08	61204979	2.165714	9.109395	2.867449	2.376683	13.44857	4.736714	12.43072	1.244675	845.8471	1139817	808.2133	281535.4
787936.8	826.2264	1869473	0.554517	1.257845	0.446094	0.228682	14.61058	0.686296	13.79199	0.845235	769.9731	649498.1	141.554	19129.16
52237.23	668.2447	895659.4	0.646	0.534569	0.348928	0.111291	14.56267	0.271935	13.79795	0.685766	401.8673	198323.9	133.3387	8314.517
894086.5	462.4377	523347.6	0.546286	1.000659	0.289519	0.086395	14.62359	0.541963	14.54799	0.187508	608.6134	338529.1	223.1831	38935.17
343402.8	451.3313	506736.6	0.507051	0.804449	0.284844	0.079281	14.64289	0.429734	14.66273	0.16334	893.7001	764600.1	230.9459	39001.88
2058244	428.9406	488630.6	0.56634	1.91304	0.262551	0.088898	14.59211	1.026401	14.73567	0.161378	1022.265	822872.7	248.3221	36470.5
234434.8	407.3392	424990.5	0.469779	0.678375	0.209256	0.050761	14.66908	0.358921	14.79985	0.143407	963.8967	888372.3	299.6578	48690.51
41569.47	369.6176	354466.1	0.640162	1.378643	0.203086	0.046641	14.54254	0.70995	14.82974	0.135244	1130.705	1245631	443.1574	78357.21
25013.54	419.8439	399147.2	1.558095	4.357056	0.518343	0.743075	13.89381	2.245655	14.66055	0.428045	863.9271	383100	586.3059	107252.6
6970.867	591.6584	570231.4	0.236667	0.046433	1.131225	3.750141	14.81667	0.010233	14.20146	1.903673	1676.337	2320328	645.3544	125200.2
144321.6	290.3509	164854.7	0.377593	0.530753	0.193897	0.027009	14.73302	0.280964	13.70809	2.853634	1007.448	1294197	125.5153	33537.47
123408.4	396.3049	260331.2	0.690331	0.735208	0.301365	0.097912	14.52462	0.389298	13.99968	1.140714	572.6708	389718.6	117.8901	4149.065
45808.47	240.1711	58832.46	0.508417	1.110101	0.218564	0.014335	14.65085	0.570732	14.50393	0.78816	702.8297	410186.3	187.2954	7995.069
82224.6	222.9722	33727.2	0.478925	1.017079	0.196305	0.011839	14.6658	0.529348	14.58035	0.605957	890.3486	730591	198.8145	10885.71
3601233	219.4416	39747.8	0.385563	0.778806	0.171564	0.007541	14.73268	0.430553	14.64686	0.490386	802.9688	801432.3	232.5092	18568.22
135708.7	211.6507	9445.674	0.475979	0.83644	0.170481	0.008211	14.66503	0.438943	14.69259	0.380611	991.8504	798637.2	275.2778	28340.58
100642.4	272.8842	14857.75	0.798143	2.145648	0.280188	0.052454	14.43121	1.105086	14.65685	0.294837	1064.389	1003371	389.3107	30891.44
215084.5	482.7672	183089.1	1.167722	2.75887	0.68246	0.684351	14.16889	1.424687	14.45074	0.319348	943.3833	666857.4	600.5211	73263.17
21436.57	526.3867	197342.8	2.191111	4.539236	0.869549	1.12099	13.42	2.33385	14.33677	0.448283	1393.021	751229.4	619.9098	110031.8
451357.4	147.485	21546.47	0.847857	1.172768	0.10428	0.007495	14.39881	0.613591	11.67943	19.20763	810.3279	899254.1	62.31416	1527.825
43473.31	244.0849	50366.89	0.598243	1.284719	0.167155	0.021475	14.6025	0.671242	11.76706	17.28828	289.8704	219996.1	73.77175	2027.756
41429.69	194.5792	41355.37	0.225478	0.120889	0.192808	0.041126	14.86397	0.069194	12.42749	19.17712	487.2022	454907.5	116.0459	5184.93
116108.1	200.1409	37328.69	0.301597	0.232091	0.186318	0.04299	14.80524	0.126167	12.52805	18.89392	587.2423	507601.5	146.8399	12096.99
135709.3	213.0161	38754.38	0.291659	0.602834	0.198582	0.047321	14.80883	0.319178	12.79588	15.16621	664.17	646248.6	170.1779	20150.6
127011.8	243.3745	40582.32	0.349678	0.436316	0.224331	0.056817	14.76464	0.232059	12.90544	13.77469	751.3129	596377.9	218.5758	36079.34
66828.89	297.4688	59961.93	0.398509	0.685999	0.339659	0.123589	14.72685	0.357146	12.3413	20.38556	828.2862	657949.2	302.4322	81470.66
1460951	458.5838	218403.7	1.549032	4.274762	0.67917	0.579375	13.89409	2.182082	11.75724	28.70347	790.7623	706097.6	369.8777	124426.8
82260.77	922.7967	2112884	1.11503	2.889019	1.410372	2.969568	14.216	1.478071	10.92299	30.84107	699.798	523416.5	383.3766	166982.8
193058.4	208.2874	69223.16	0.428571	0.314113	0.167393	0.014064	14.70771	0.156165	13.91386	0.7891	732.828	1021962	124.6595	15451.45
116876.8	149.6348	3896.443	0.839389	4.625579	0.169807	0.0001	14.42657	2.4048	13.94759	0.559005	387.07	238004.1	92.36469	2947.275
226732.9	86.04334	263.6942	0.315216	0.272532	0.176065	0.001706	14.79822	0.144248	14.67647	0.04188	481.3256	426768	166.8733	16566.06
70237.59	81.58495	174.2338	0.282069	0.456142	0.18259	0.003507	14.82069	0.239325	14.74892	0.024431	538.0645	377679.3	188.5726	24478.2

rhc_ppm_v	shc_ppm_r	shc_ppm_v	rco_perc	nrc_perc	vco_perc	rco_perc	vco_perc	rco2_perc	rco2_perc	sco2_perc	sco2_perc	rn_x_ppm	rn_x_ppm_v	sn_x_ppm_r	sn_x_ppm_var
73428.31	87.12024	314.3343	0.199959	0.091279	0.179323	0.007386	14.87793	0.051013	14.79508	0.013953	612.309	532481.5	236.1516	28092.57	
184229.9	93.94795	324.8639	0.244499	0.264672	0.163746	0.006653	14.8432	0.143747	14.85118	0.005231	669.2073	550633.5	277.9089	38298.07	
67780.55	108.791	501.0012	0.333161	0.544301	0.246473	0.010578	14.77688	0.285713	14.80451	0.006283	763.5222	754332.3	317.2115	33384.28	
25771.56	250.6537	19255.67	1.279574	3.428117	1.00191	0.315923	14.10286	1.771367	14.40794	0.103466	609.8498	289084.7	497.9748	57426.11	
705193.4	425.6928	64840.21	1.070371	2.658599	2.051258	1.017874	14.22357	1.333425	13.70846	0.484405	1004.983	517795.2	535.325	45990.86	
25405.48	118.0453	10254.66	0.321328	0.15316	0.114285	0.009816	14.79804	0.085727	13.94021	0.573419	439.0033	464855.9	88.28426	3808.351	
426290.2	169.5279	14563.21	0.196507	0.117471	0.16654	0.009751	14.89517	0.063369	14.19853	0.232794	108.7807	22458.05	127.6472	10800.1	
641758.9	128.5417	17574.47	0.218615	0.161025	0.171965	0.020548	14.87239	0.09007	14.72349	0.038929	325.4504	331509.4	204.0269	31370.8	
90553.72	131.6319	16110.42	0.168034	0.048375	0.175817	0.023275	14.91055	0.028683	14.78318	0.037354	358.3296	270485.5	237.3147	38322.64	
488231.8	141.734	14406.71	0.242731	0.698487	0.19367	0.031648	14.85283	0.37062	14.827	0.024404	444.6568	419721.5	293.5784	48695.69	
71742	165.3147	17198.39	0.237594	0.311327	0.226931	0.044443	14.85439	0.163855	14.83844	0.024898	527.3235	513398.4	379.5934	70372.79	
42467.71	237.429	52091.21	0.302558	0.459342	0.426392	0.220837	14.80712	0.240882	14.73496	0.083176	573.7037	511400.8	500.2965	92758.17	
24533.82	353.2132	189293.7	0.588518	0.854435	0.967706	1.596786	14.60641	0.449003	14.44198	0.517935	449.279	245014.1	715.5789	239911.4	
125410.6	655.6165	561214.1	1.939936	4.341237	1.436866	3.081112	13.62929	2.245038	14.06164	1.198172	530.7736	390139.7	655.4761	261434.2	
36588.31	150.5849	7868.115	0.255491	0.437808	0.121305	0.010868	14.8362	0.225703	13.74673	4.342399	686.5977	436228.3	86.48599	8327.473	
201526.9	175.8503	2819.135	0.228409	0.319145	0.183469	0.013057	14.87242	0.165025	14.19223	0.398353	140.9642	72915.62	77.056	4059.516	
127774.4	123.5481	4021.411	0.189524	0.149491	0.157802	0.024286	14.896	0.08557	14.8175	0.008173	328.7012	359498.7	182.6936	18456.61	
111240.7	115.0092	2462.771	0.186301	0.23927	0.157094	0.025132	14.89957	0.12872	14.86401	0.008521	294.6772	226886.9	187.1124	13054.84	
55872.78	125.4581	3562.235	0.16151	0.201312	0.157956	0.025773	14.9149	0.106762	14.88148	0.00948	370.7655	295323.5	216.0469	24637.51	
94167.15	141.8165	3631.735	0.191512	0.232538	0.155149	0.024937	14.89239	0.123917	14.91046	0.009916	393.3002	299217.6	211.7683	16644.84	
122270.3	149.4797	5394.053	0.245732	0.34495	0.199313	0.043609	14.85042	0.181642	14.90363	0.012172	487.7666	421592.2	295.9898	47500.79	
34538.16	237.5779	44058.75	0.472512	0.65111	0.356459	0.168367	14.68308	0.34123	14.79815	0.05123	623.1927	251241.9	425.465	101609.2	
26277.16	144.3597	8445.658	0.831579	1.55827	0.204717	0.045588	14.42526	0.807915	14.84507	0.015687	642.4989	367866.9	374.3075	60793.41	
52060.89	108.4899	7592.782	0.140315	0.090842	0.058793	0.006708	14.92617	0.048676	13.65077	6.16222	500.9305	509473.2	45.52812	969.08	
154866.7	150.198	23286.12	0.133954	0.041884	0.093711	0.005625	14.94216	0.022217	14.26491	0.046888	140.6024	119057.8	62.40468	1317.78	
162334.1	131.2766	14278.41	0.112549	0.034532	0.08258	0.008294	14.95932	0.019244	14.85297	0.012902	93.32029	72076.77	97.99902	3542.252	
72814.99	138.3667	14558.08	0.13466	0.05882	0.075603	0.003615	14.94159	0.031737	14.90966	0.010547	182.4235	126950.5	100.6018	3890.445	
105655.7	162.716	23285.31	0.159855	0.252711	0.079796	0.003092	14.91894	0.132326	14.92308	0.009953	283.4733	380809.8	127.6448	4288.503	
46957.94	182.3124	30770.42	0.141153	0.197674	0.084533	0.003385	14.93325	0.103698	14.94391	0.01141	284.0552	243695.1	139.3059	4190.589	
34074.96	173.3086	23991.83	0.220298	0.574327	0.114952	0.005405	14.8761	0.298792	14.94101	0.009895	301.1733	132219.3	200.2187	4787.765	
6322.379	170.4296	17702.2	0.562951	1.311755	0.128329	0.008151	14.62354	0.675954	14.92097	0.012607	518.728	487661.6	265.7017	14582.82	
63623.75	190.3797	20372.97	0.745596	1.055574	0.170707	0.048537	14.48792	0.548287	14.89019	0.024676	510.7971	487377.5	349.2255	43701.95	
13652.9	44.68462	827.9054	0.115654	0.04469	0.04304	0.001151	14.945	0.02434	13.81393	5.913064	478.8556	388136.3	31.15883	380.6652	
9405.71	69.69483	4427.797	0.134884	0.109999	0.053747	0.003799	14.94605	0.056938	13.79898	5.672813	105.6821	60356.31	43.1192	657.6221	
111328.4	54.42042	1558.242	0.117725	0.093191	0.05495	0.003266	14.95758	0.048984	14.16564	5.889203	111.0395	89640.95	65.77934	2017.7	
162137.7	58.09659	1803.449	0.071922	0.016402	0.053917	0.00169	14.98885	0.010849	14.13301	7.047381	117.1325	119802.6	65.22565	2580.187	
43359.53	72.97186	3155.541	0.085679	0.022933	0.055079	0.001276	14.97793	0.013273	14.33755	4.079129	168.6588	118505.6	62.82561	2070.9	
110271.3	94.42055	5803.281	0.110062	0.088185	0.082005	0.004435	14.95968	0.046803	14.33568	4.062811	178.6627	112340.8	75.13318	3456.944	

rhc_ppm_v	shc_ppm_r	shc_ppm_v	rco_perc	nrc_perc	vco_perc	rco_perc	vco2_perc	rco2_perc	sco2_perc	sco2_perc	rnx_ppm_r	rnx_ppm_v	snx_ppm_r	snx_ppm_var
15742.9	92.91373	4869.528	0.157401	0.187146	0.168502	0.03674	14.92526	0.096762	14.25296	4.555373	212.5176	100889.9	128.7165	13641.73
26408.42	105.0475	8589.376	0.351059	0.81178	0.2497	0.091345	14.78643	0.419318	14.18538	4.635861	203.245	141918.7	255.7597	35970.19
194780.8	137.2847	39442.22	0.89795	3.584806	0.542482	1.169433	14.38846	1.857918	13.93345	5.333494	251.7342	287797.9	270.1137	100374.5
74413.86	530.2909	2196807	0.102246	0.159886	0.31957	0.667659	14.96389	0.084197	13.8535	3.329044	218.8782	264855.7	27.02559	148.9192
102727.6	531.2707	1463934	0.098379	0.025536	0.378064	0.62144	14.9725	0.013797	13.71798	3.458203	47.25357	71408.97	44.71364	1161.286
37521.99	609.7768	2253843	0.186676	0.61683	0.578868	1.777998	14.90778	0.325781	14.34591	1.922052	127.6456	99091.59	66.7723	2757.22
130215.5	617.5695	2339887	0.067918	0.023844	0.580986	2.012838	14.99181	0.012884	14.45147	1.640774	111.6163	141526.7	90.29875	8793.382
25525.47	555.85	1814706	0.06506	0.019847	0.712178	3.116372	14.99466	0.011096	14.48456	1.577566	127.7314	75039.5	94.54752	6499.88
51182.25	473.5649	1256927	0.097606	0.126229	0.632653	2.493142	14.96987	0.066023	14.58926	1.129797	144.602	78321.53	107.4667	21413.74
46841.88	374.9978	691609.9	0.153966	0.204233	0.462823	1.196481	14.92766	0.105312	14.71027	0.615716	187.3581	117147.2	218.6738	129741.9
1262.507	343.4598	572201.8	0.403736	0.909139	0.472787	1.241093	14.7504	0.465392	14.7129	0.588048	176.6376	82236.95	256.623	104462.5
89396.43	408.4758	662691.7	0.20243	0.283283	0.620865	1.447578	14.89	0.146359	14.56109	0.751263	205.7547	438496.4	368.309	189008.1
28305.81	19.76221	139.2798	0.083428	0.087179	0.015565	0.000404	14.98246	0.045718	14.22241	0.190524	109.426	103371.7	42.2583	173.9754
23959.92	9.086707	62.15024	0.078328	0.031042	0.008156	1.35E-06	14.98611	0.016625	14.82191	0.032735	111.4195	129250	4.132698	21.78658
.	35.197	55.72351	0.03	.	0.045457	0.000841	15.02	.	14.7203	0.011172	37.18	.	7.687626	4.608685
1328437	14865.24	3.77E+08	1.443333	5.258533	3.150022	8.298869	13.90333	2.747233	9.255489	2.943238	1545.45	1194628	159.3922	14376.51
11490853	14808.42	4.78E+08	1.498875	3.033572	2.777558	9.802837	13.8325	1.502825	9.881828	3.347081	1948.775	4154453	208.8383	20886.16
63556.15	14617.16	4.68E+08	0.644	0.31573	2.685632	6.97857	14.5	0.1555	10.50917	3.633986	2071.498	3846027	297.0593	76464.08
39192.43	14780.25	5.1E+08	2.363333	5.19525	2.478305	8.850819	13.29667	2.59565	11.01839	6.014845	1239.251	1294362	389.4155	150531.5
211757	14749.7	5.01E+08	2.376364	5.097605	2.713272	9.280945	13.27455	2.590947	11.17651	7.563043	1452.465	1102614	461.5929	227702.1
46676.3	14919.71	4.96E+08	1.213125	5.019139	3.563859	10.84797	14.1375	2.675825	10.96455	10.67424	1061.858	1596600	541.5522	324824.3
71303.83	1121.489	2357228	1.312308	10.63657	0.92421	2.141343	14.07308	5.459523	11.9259	4.104156	634.5015	269273.9	181.8608	8601.243
6255235	421.9223	62687.43	1.608571	1.422914	0.183255	0.01884	13.82714	0.830224	12.3587	3.976824	411.6443	341416.8	254.1945	13698.54
289015	438.2132	132000.7	1.595	13.73665	0.226957	0.027034	13.8525	7.103657	13.12036	1.695042	981.0367	671048.6	459.8259	111729.6
167320.9	429.1634	91485.94	1.747742	5.801785	0.279106	0.044643	13.72677	2.959969	13.39749	1.075932	1445.791	1724610	582.0027	239547.3
1029775	529.9631	163662.4	2.222105	8.858044	0.373746	0.085544	13.37579	4.477425	13.63396	0.723915	1654.693	2565435	660.4044	301432.8
99982.89	701.147	260422	1.108306	3.307203	0.536742	0.128759	14.18271	1.69182	13.87639	0.430689	1659.85	2102648	752.1598	337076.2
2018296	1249.35	805055.9	2.323684	7.513791	1.658012	0.93953	13.30684	3.830678	13.53969	0.070231	1483.968	1694915	714.4257	158059.8
83190.43	1773.386	969652.7	1.461667	2.758777	3.280271	4.868963	13.915	1.31527	12.7941	0.96516	2103.553	3533945	602.318	90530.53
.	5699.745	31689893	7.41	.	3.250847	6.821629	9.7	.	12.0674	3.882956	459.99	.	830.3023	22973.02
2150039	1620.269	4667752	1.716779	5.323246	0.818773	2.131669	13.74625	2.749633	12.27881	3.036387	1135.46	1179049	202.5505	25853.06
6813215	1555.593	3003756	1.352	2.389501	0.853356	2.115738	14.027	1.233643	12.08629	5.105096	681.181	325771.4	270.3795	18942.58
888879.4	1376.729	2557044	0.698691	1.55904	0.983861	2.475973	14.4907	0.825892	13.12812	2.283175	1098.877	1144675	556.2049	65521.03
1326736	1360.272	2329778	0.914733	3.8949	1.031896	2.921856	14.32754	2.030369	13.26413	2.443474	1406.145	1555205	650.59	85313.12
1208488	1325.488	1873602	1.113285	3.285219	1.134075	3.129881	14.18466	1.683675	13.40986	2.132798	1359.107	1332345	752.2322	123218
1971809	1355.442	1666708	1.246483	4.057381	1.255008	3.30073	14.08723	2.117847	13.50529	1.944375	1467.105	1490086	869.407	184102.4
644385.7	1544.129	1911584	1.27483	3.559086	1.851903	4.841897	14.06	1.836442	13.1655	2.610531	1685.258	1413768	949.7464	328329.4
256376.3	1731.207	2452264	1.635813	4.870009	2.546586	5.64658	13.82375	2.521185	12.74327	3.450002	1067.599	746942.2	900.3043	371103.3

rhc_ppm_v	shc_ppm_r	shc_ppm_v	rco_perc	nrco_perc_v	sco_perc_r	sco_perc_v	rco2_perc	rco2_perc	sco2_perc	sco2_perc	rnx_ppm_n	rnx_ppm_v	snx_ppm_r	snx_ppm_var
59738.4	2904.947	10330125	3.872	11.39777	3.441082	7.246123	12.198	5.69747	12.06341	3.814633	1582.424	1819894	850.4385	392746.1
18617446	977.0111	2444207	0.979899	1.846837	0.730035	1.799902	14.28139	1.041053	13.27044	2.782544	947.1775	1217901	206.0274	41113.11
2215789	772.4141	494655.6	1.305425	6.325433	0.535912	0.258867	14.07158	3.377417	13.46458	1.913943	477.2744	292096.1	236.4489	25188.38
680893.8	517.0442	281543.1	0.91734	3.217151	0.423394	0.182023	14.33903	1.65888	14.18016	0.886518	996.7759	1024647	486.1789	99459.62
332798.1	503.0699	296612.4	0.649967	1.780939	0.404537	0.209578	14.53167	0.925383	14.31817	0.677458	1127.28	1056013	573.2175	127309.3
776720.6	491.1243	301267.6	0.662644	2.01674	0.414958	0.233337	14.51769	1.058388	14.40214	0.549094	1221.722	1204777	613.67	122007.3
222725.1	507.6322	281721.8	0.658977	1.319309	0.437986	0.310669	14.52049	0.684553	14.46468	0.449606	1301.963	1180028	677.5437	133061.9
128499.6	577.634	301538.2	1.148498	3.029501	0.716966	1.320981	14.16786	1.560006	14.36821	0.667808	1319.55	1084413	785.5241	138859.7
266047.2	624.2346	308128.4	2.317381	6.041805	1.056221	1.888012	13.33524	3.093987	14.19321	0.851521	1078.538	770544.6	915.7403	210989.3
2222407	839.9128	379593.6	3.719	11.87191	1.661682	2.920355	12.301	6.064294	13.76658	1.041569	1532.178	931347.8	907.9068	211137.6

PEMS Latit PEMS Longitude (deg)

39.10017 -94.73025
39.10011 -94.73034
39.10005 -94.73044
39.09999 -94.73057

39.10018 -94.73024
39.1001 -94.73034
39.10003 -94.73047
39.09997 -94.73061
39.10016 -94.73021
39.1001 -94.7303
39.10004 -94.7304
39.09998 -94.73053

rhc_ppm_v shc_ppm_r shc_ppm_\rco_perc_nrco_perc_v sco_perc_r sco_perc_\rco2_perc_rco2_perc_sco2_perc_sco2_perc_rnx_ppm_nrnx_ppm_v snx_ppm_r snx_ppm_var
39.10018 -94.73022
39.1001 -94.73033
39.10003 -94.73045
39.09997 -94.73059

39.10017 -94.73026
39.10009 -94.73037
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39.10022 -94.73022
39.10012 -94.73032
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39.09997 -94.73062

39.10022 -94.73023
39.10013 -94.73034
39.10005 -94.73047
39.09999 -94.73062

rhc_ppm_v shc_ppm_r shc_ppm_\ rco_perc_n rco_perc_v sco_perc_r sco_perc_\ rco2_perc_ rco2_perc_ sco2_perc_ sco2_perc_ rnx_ppm_n rnx_ppm_v snx_ppm_r snx_ppm_var