4. Conclusions Summary

- The major results are re-summarized.
- The results help provide an understanding of the mechanisms that can lead to high PM levels from windblown dust episodes and show that it is possible to characterize the potential of PM generation based on the physical properties of the soil and soil surface.
- Although not a complete simulation of the actual in-situ emissions, the methods developed allow comparisons of the relative emissions potential of different soils when acted upon by winds.
- Finally, the results of this study provide information which characterizes the differing emissions potentials of Owens Lake soils which may prove useful in identifying control strategy measures.

4. Conclusions

The Saltation Wind Tunnel (SWT) at the University of California at Davis was employed to perform a series of experiments aimed at quantifying the conditions for high emissions from Owens Lake soils. Four soils believed to be causal in the fugitive dust storms were targeted and emission rates obtained for varying surface conditions. Though the variables are numerous, the wind tunnel proved to be a significant aid in quantifying conditions for high emissions. Conditions similar to those at Owens Lake were matched and emission rates established for each of the four soils.

The emission rates for PM_{10} were as high as 28000 $\mu g/m^2s$ for loose soil emissions with upwind saltation simulating a Northerly wind (Old Pipe Line Soil and the North Sand). Likewise, the loose soil emissions for $PM_{2.5}$ went as high as 5600 $\mu g/m^2s$ for loose soil emissions. Surprisingly, the Dirty Socks Sand contained high levels of PM_{10} as emission rates were as a high as 2600 $\mu g/m^2s$. The UCD Fence Soil had a maximum average emission rate of 2700 $\mu g/m^2s$ indicating the emissions potential of these two soils is comparable. Both of these soils are potential sources of fugitive dust emissions, with the Dirty Socks Sand potential likely arising from years of Northerly wind fall-out from the blowing UCD Fence Soil. However, when the saltation effect of the Dirty Socks Sand over the UCD Fence Soil is measured simulating a Southerly wind storm, there is a synergistic effect in which the emission rates double to approximately 5600 $\mu g/m^2s$ for the South Sand Sheet simulation. The doubling of emissions is a significant effect arising from saltation of sand particles over the soil-like material. This synergistic effect occurs for the North Sheet as well, as emission rates climb from 15000 $\mu g/m^2s$ to 28000 $\mu g/m^2s$. The ballistic trajectories of the sand and its abrasive properties are instrumental in enhancing the emissions.

Moisture content, on the other hand, has a dramatic effect in suppressing emissions. From the air-dried state, an increase of about 8-10% moisture content significantly reduced emissions for the same shear velocity as an order of magnitude decrease in emission rates was witnessed. For the Pipe Line Soil at a constant friction velocity of 0.60 m/s, the emission rates dropped from 6000 $\mu g/m^2s$ to 500 $\mu g/m^2s$; for the UCD Fence Soil at a constant friction velocity of 0.70 m/s, the emission rates dropped from 3700 $\mu g/m^2s$ to 250 $\mu g/m^2s$. The increased moisture content coalesces the smaller particles into larger clumps preventing them from becoming airborne. Moisture content could thus play a significant role in reducing emissions.

A series of $PM_{2.5}$ studies were done which indicated that the ratio of $PM_{2.5}$ to PM_{10} increases linearly with increased friction velocity. The moving particles of soil and sand abrade each other more frequently at the higher velocities creating smaller and smaller particles, thus, particles of PM_{10} become $PM_{2.5}$ sized particles and the ratio increases. The ratio of $PM_{2.5}$ to PM_{10} can be as high as 30% indicating a likely violation of the new Clean Air Standards on severe to moderate storm days on Owens Lake.

Owens Lake soil crusts were produced and tested in the wind tunnel representing the summer crust cycle or “hard crust” cycle. This “hard crust” produced very little emissions as compared to the loose soil emission studies. Quantitatively, these tests indicated that the crust, until broken, is not a significant factor in emissions. Once broken, tumbling of crust pieces by the wind results in exposure of the “softer” crust-like material which can be abraded by sand into a loose soil. Ultimately as a loose soil, the problem then reverts back to the study on loose soil emissions which are predicted to be quite high.

Lastly, fetch effect studies were conducted to observe the development of emissions along the test bed. In all cases for the soils without upwind saltation, the emissions reached an equilibrium between 2.65 m and 4.38 m for the higher velocities tested. Soil entrainment and fall-out were approximately equal for these cases. Likely, the near surface air has become saturated such that emissions are supressed at the surface even though there is still upward entrainment of existing particles. Concentration profiles for these cases show a decrease in concentration near the surface and slight increases higher up resulting in total concentration equilibrium between 2.65 m and 4.38 m. When upwind saltation is introduced this saturation equilibrium disappeared as the vertical flux is quite active due to ballistic sand impacts enhancing the dynamics of the near surface of the soil. Saltation again plays a dynamic role in enhancing emissions. The equilibrium condition is thus primarily the result of near surface characteristics of the soil in which severe loading near the surface prevents the same increases in emissions seen earlier in the fetch. The fetch effect is critical in estimating emissions at Owens Lake as this study shows that it is unlikely that PM_{10} continually increases across an erodable surface, but instead reaches saturation equilibrium states.

Over all, the Saltation Wind Tunnel-Studies provided critical insights into how various mechanism at Owens Lake can operate to produce high emissions. Through varying parameters such as wind strength and turbulence, sand saltation flux, moisture content, and other soil surface characteristics, imperative quantifiable information for modeling the surface dynamics of dust storms at Owens Lake has been obtained. Although not a complete simulation of the actual in-situ emissions, the methods developed allow comparisons of the relative emissions potential of different soils when acted upon by winds.

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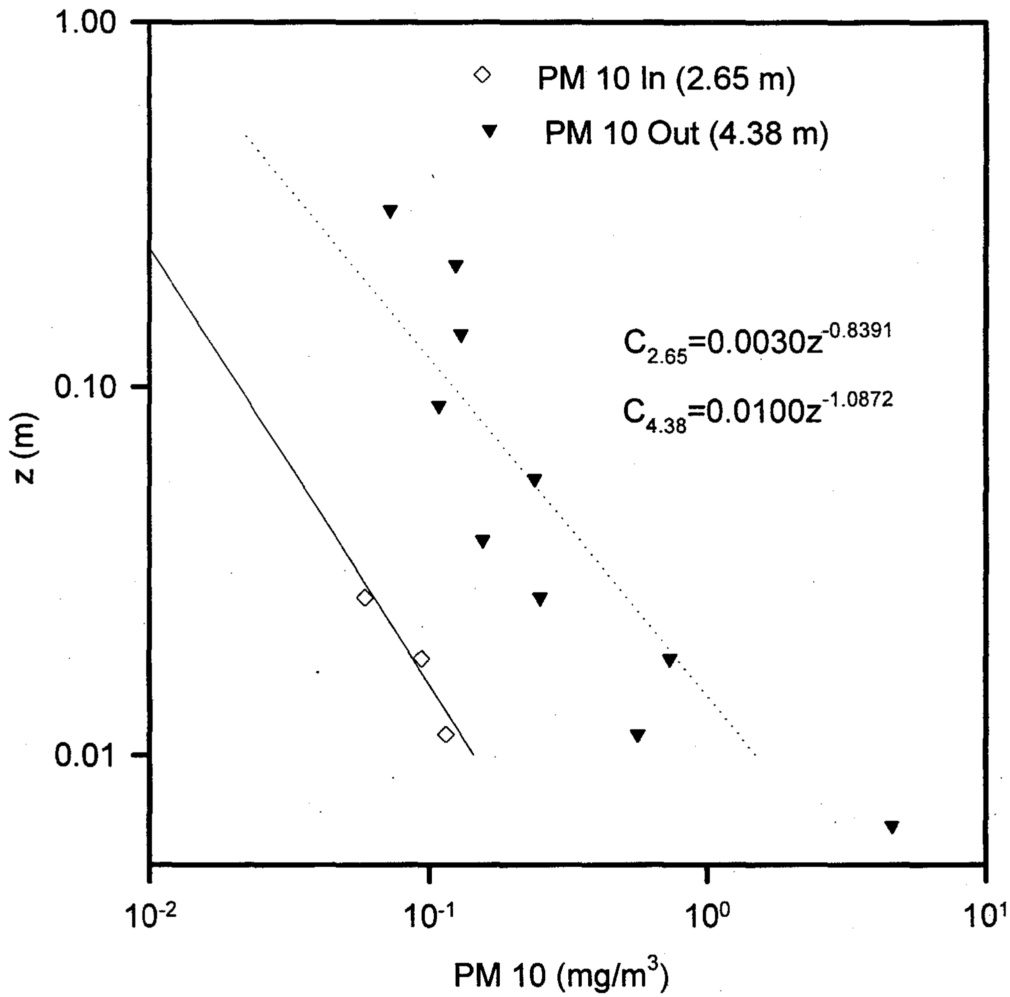
Appendices

Appendix A:

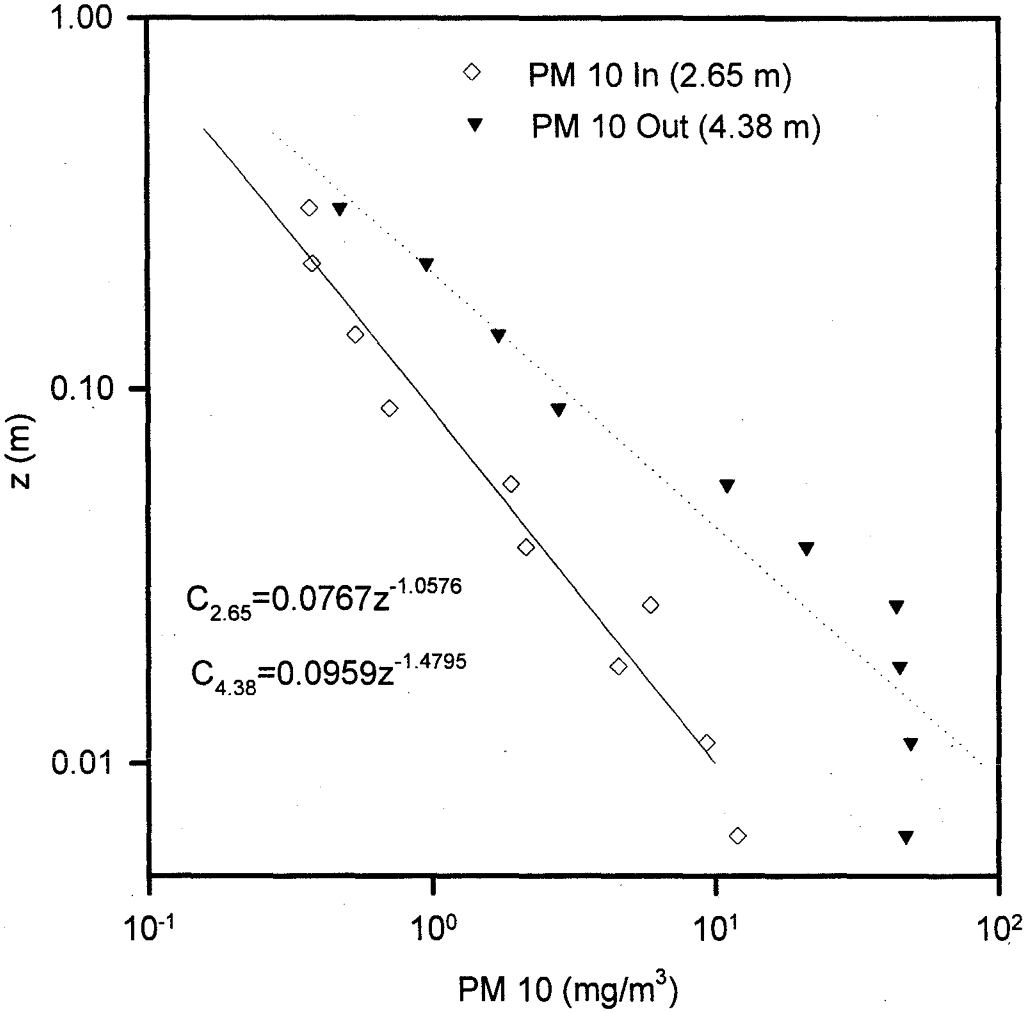
Loose Soil Emissions Concentration Profiles
and
Velocity Profiles (not in text)

Old Pipe Line (Soil #1), uref = 9.0 m/s

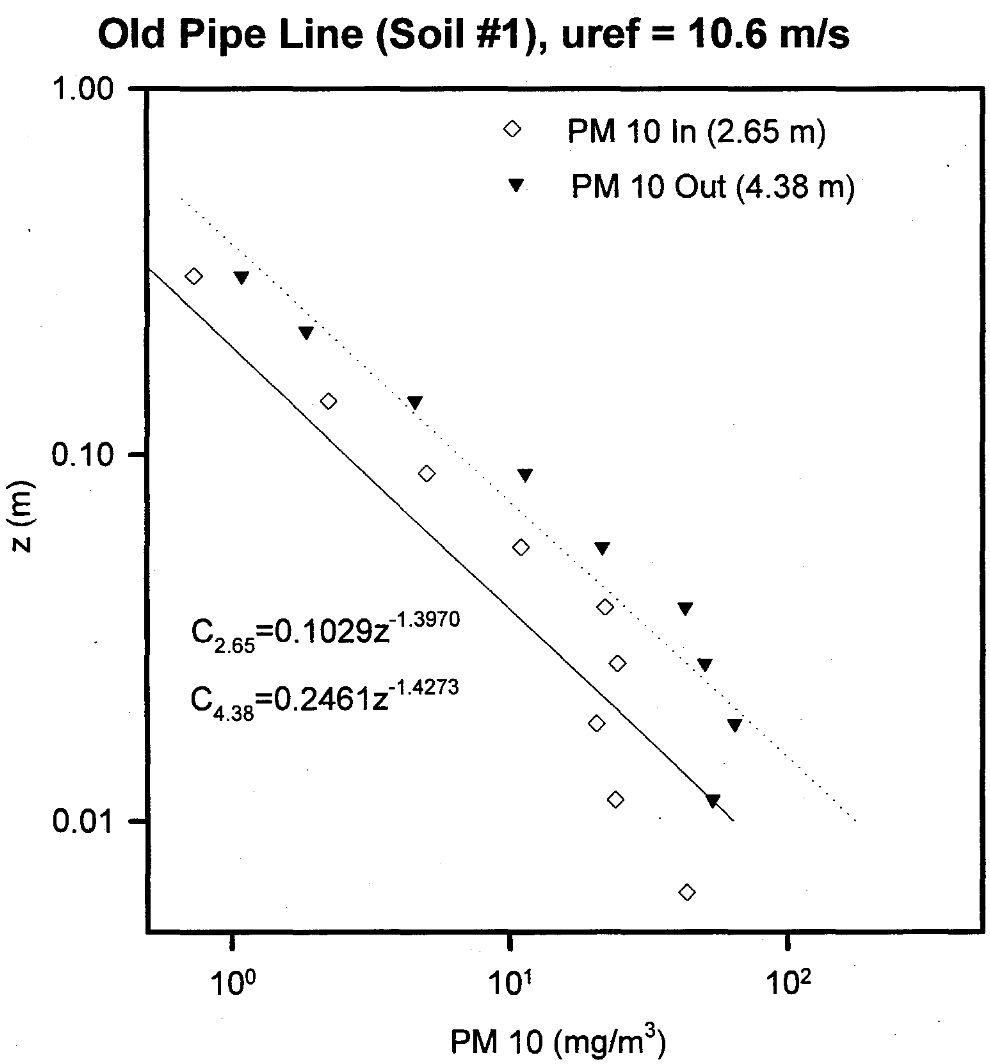


z, Height (m)	IN PM_{10} (mg/m³)	Out PM_{10} (mg/m³)
6.4000e-3		4.6253
0.0114	0.1147	0.5642
0.0183	0.0938	0.7373
0.0267	0.0588	0.2512
0.0381		0.1562
0.0559		0.2393
0.0889		0.1087
0.1397		0.1305
0.2159		0.1248
0.3048		0.0725

Old Pipe Line (Soil #1), uref = 9.8 m/s

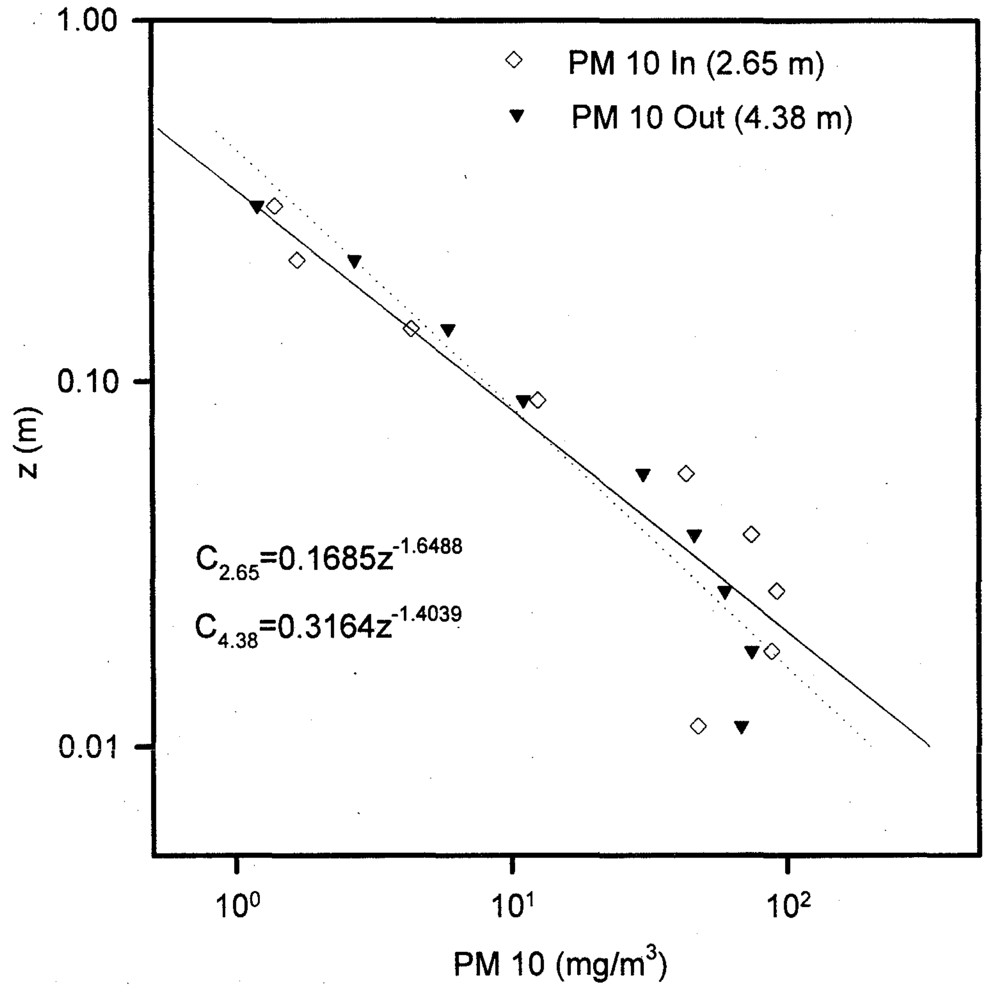


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	11.9408	46.8597
0.0114	9.2903	48.7825
0.0183	4.5315	44.5920
0.0267	5.9083	43.5840
0.0381	2.1420	20.9970
0.0559	1.8955	11.0168
0.0889	0.7072	2.7993
0.1397	0.5378	1.7217
0.2159	0.3808	0.9617
0.3048	0.3725	0.4770

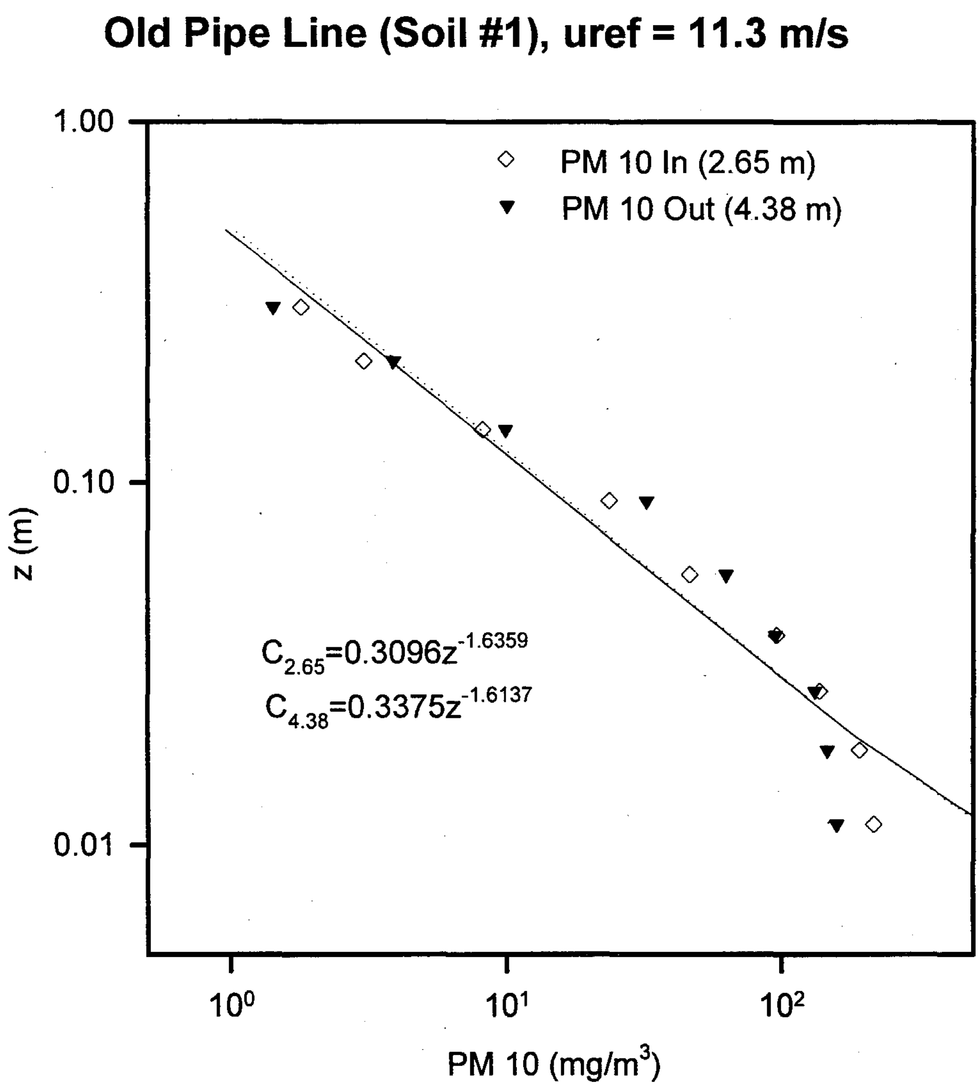


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	43.3812	
0.0114	23.9690	53.8317
0.0183	20.5368	64.6778
0.0267	24.4980	50.5862
0.0381	22.0378	42.8165
0.0559	10.9817	21.6312
0.0889	5.0615	11.4407
0.1397	2.2332	4.5857
0.2159	0.3587	1.8647
0.3048	0.7342	1.0907

Old Pipe Line (Soil #1), uref = 11.3 m/s

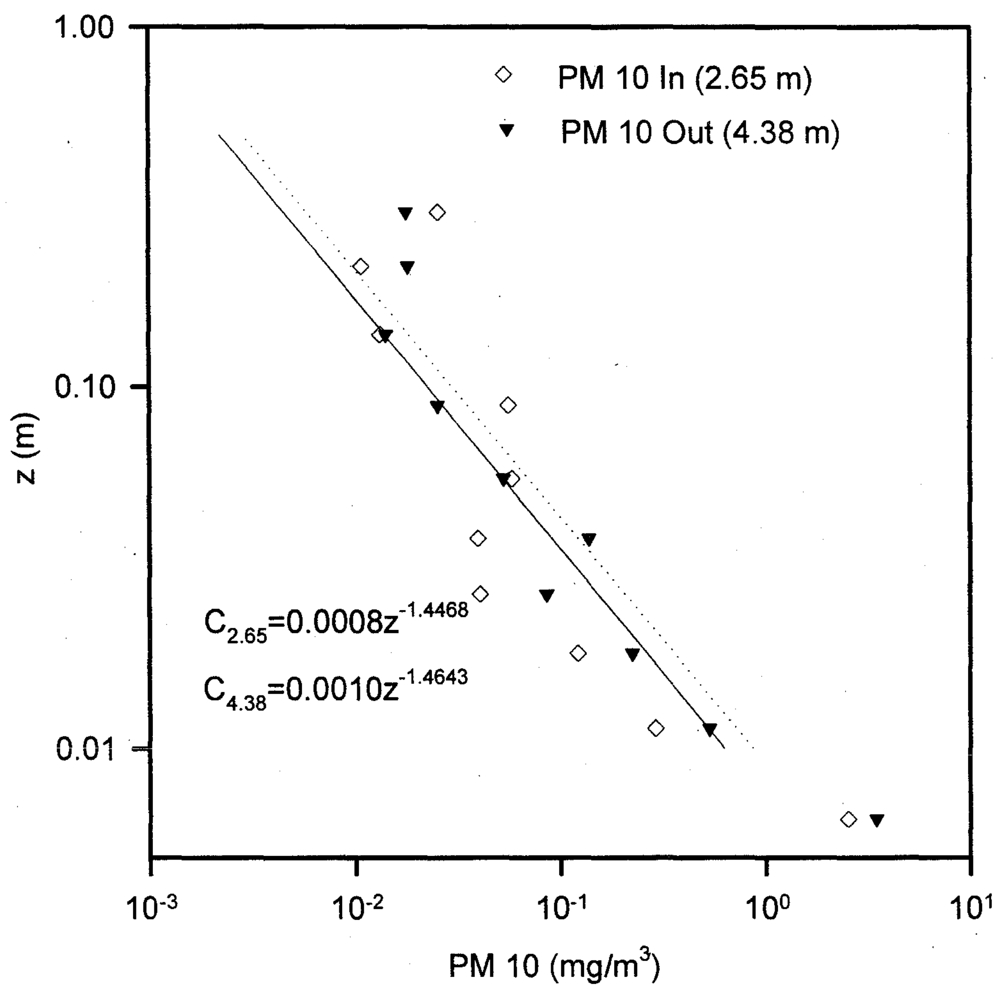


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		
0.0114	47.3338	68.1095
0.0183	88.0385	74.5617
0.0267	92.1075	59.7978
0.0381	74.2575	46.1252
0.0559	43.1090	30.1602
0.0889	12.5063	11.0790
0.1397	4.3608	5.9533
0.2159	1.6895	2.7338
0.3048	1.3988	1.2090



z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		
0.0114	217.1770	159.4843
0.0183	192.7923	147.7998
0.0267	137.7448	132.3758
0.0381	96.1868	95.5130
0.0559	46.4558	63.1333
0.0889	23.5435	32.3395
0.1397	8.1945	9.9610
0.2159	3.0285	3.8860
0.3048	1.7993	1.4287

North Sand (Soil #2), uref = 8.9 m/s



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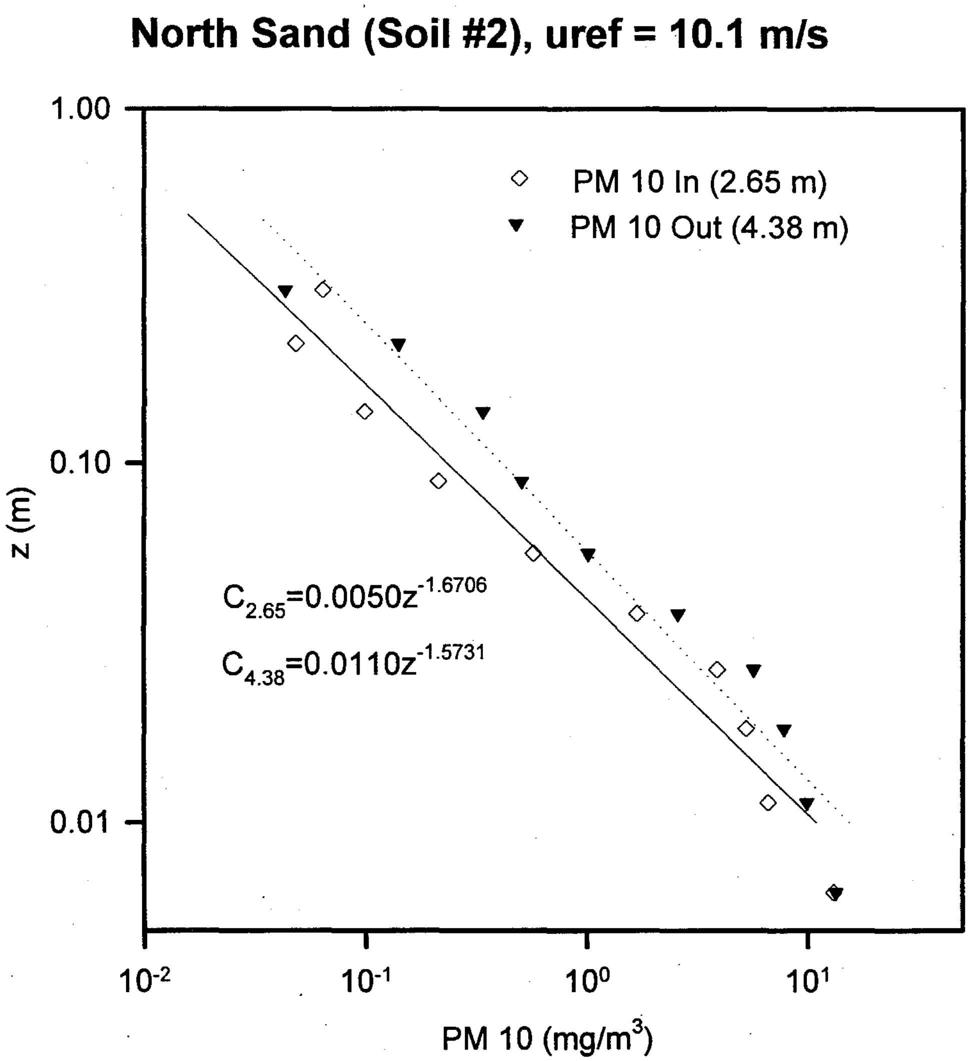
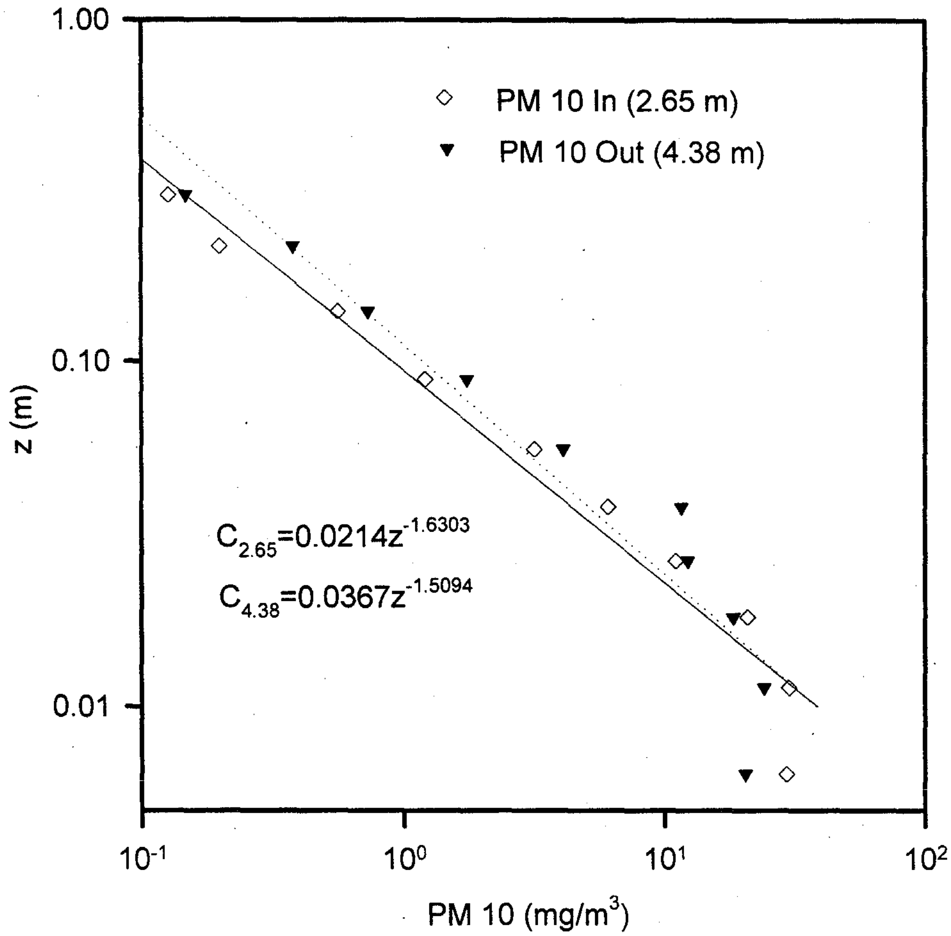
6.4000e-3	2.5167	3.4553
0.0114	0.2897	0.5317
0.0183	0.1215	0.2240
0.0267	0.0408	0.0863
0.0381	0.0398	0.1382
0.0559	0.0582	0.0530
0.0889	0.0560	0.0253
0.1397	0.0133	0.0142
0.2159	0.0108	0.0182
0.3048	0.0255	0.0178



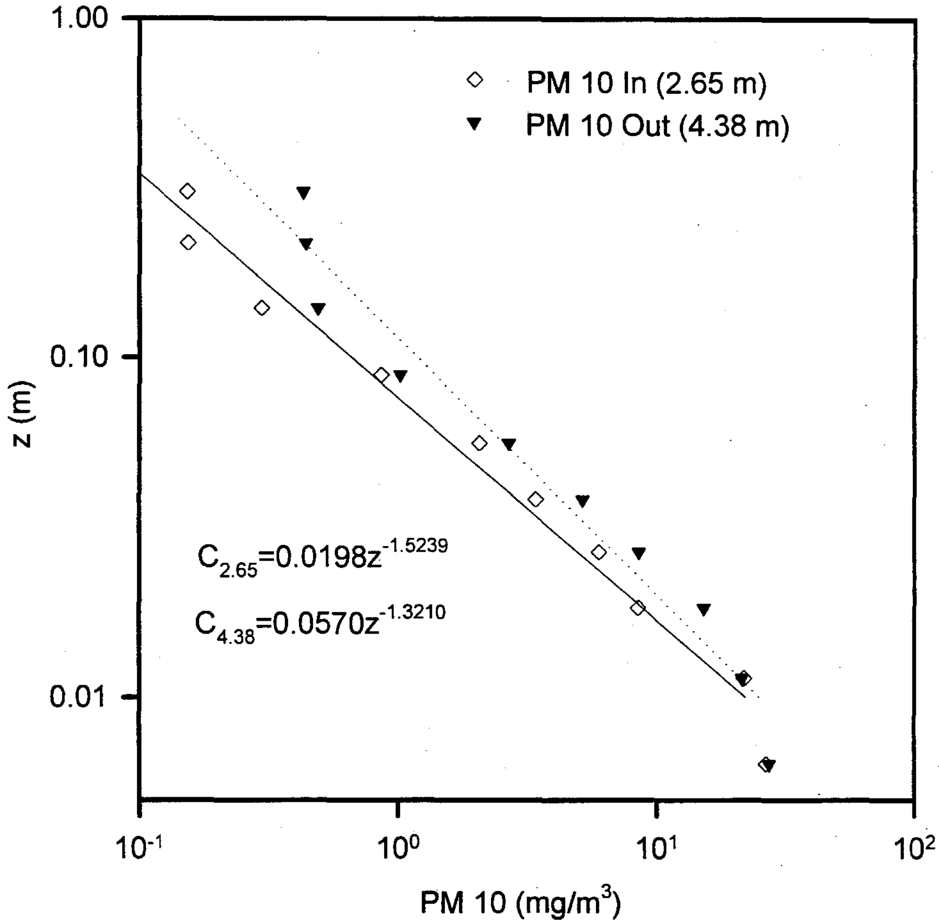
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	13.1275	13.3918
0.0114	6.6110	9.8825
0.0183	5.2455	7.7848
0.0267	3.8967	5.6887
0.0381	1.6877	2.5883
0.0559	0.5742	1.0197
0.0889	0.2127	0.5058
0.1397	0.0990	0.3395
0.2159	0.0483	0.1402
0.3048	0.0638	0.0433

North Sand (Soil #2), uref = 11.6 m/s



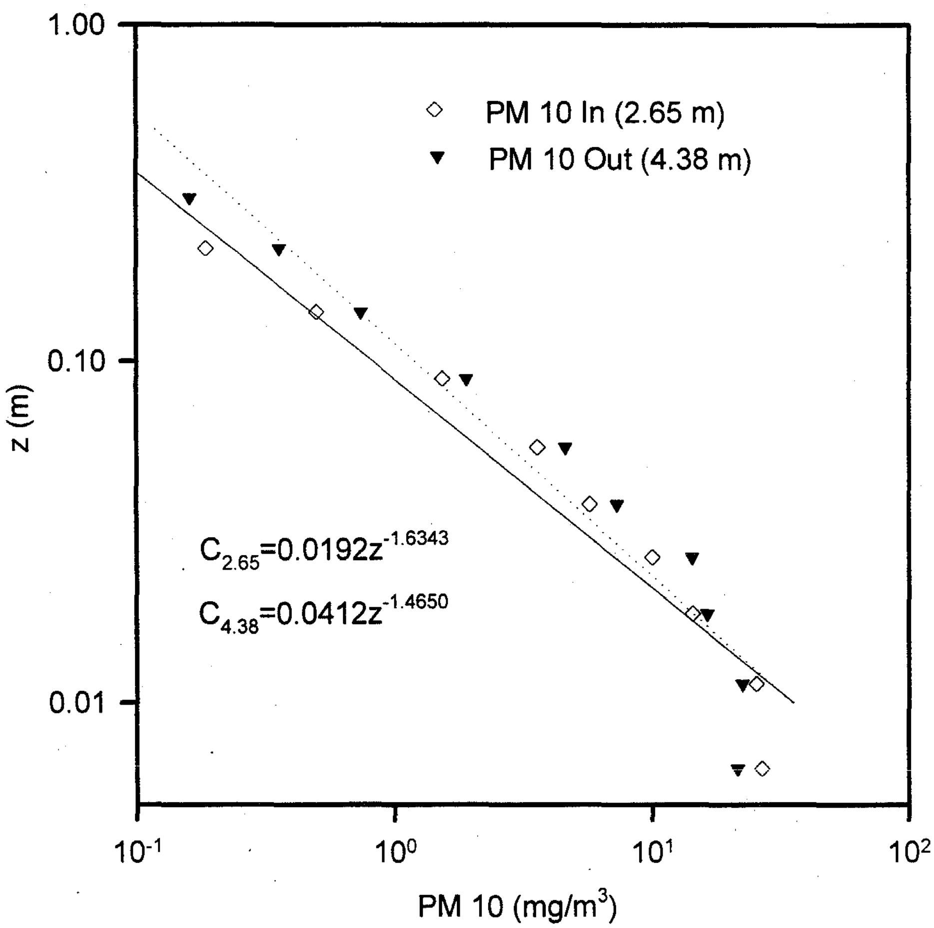
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	29.3345	20.4267
0.0114	30.0945	24.1683
0.0183	20.9152	18.4473
0.0267	11.0273	12.2728
0.0381	6.0918	11.6820
0.0559	3.1658	4.1098
0.0889	1.2108	1.7528
0.1397	0.5632	0.7347
0.2159	0.1997	0.3802
0.3048	0.1273	0.1482

North Sand (Soil #2), uref = 12.9 m/s



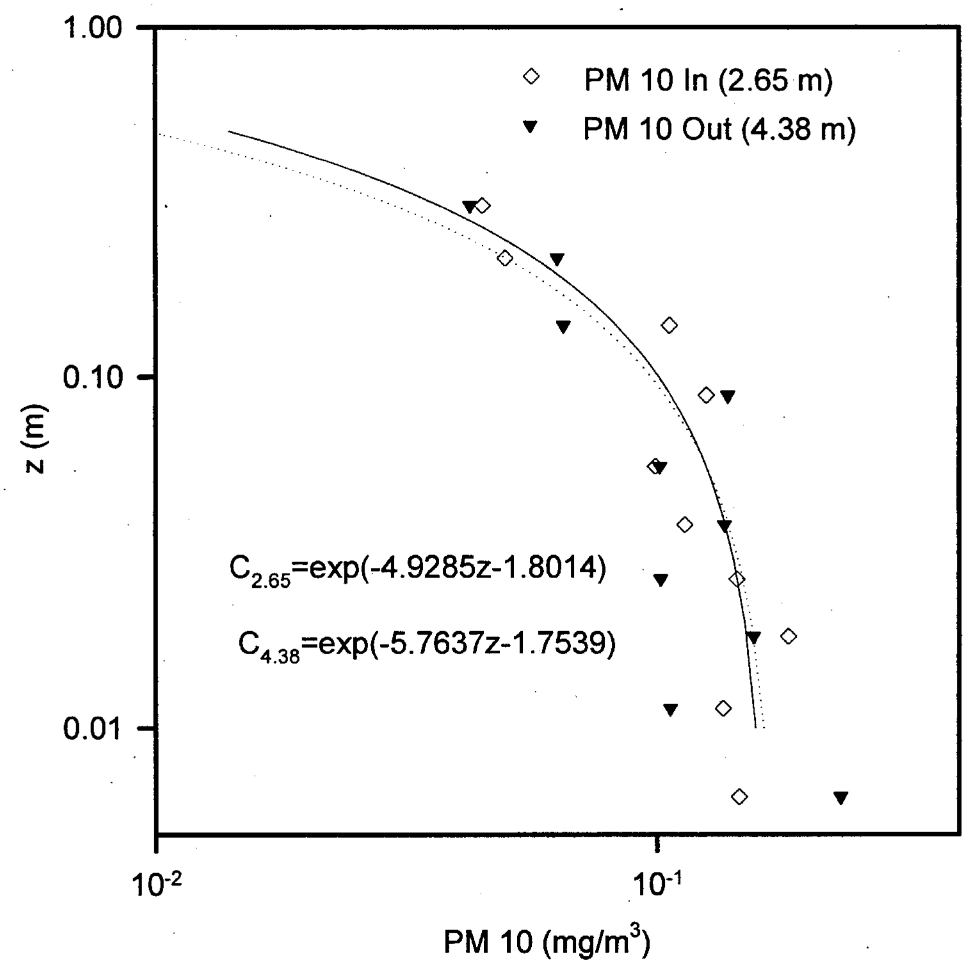
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	26.5583	27.3153
0.0114	21.7988	21.4512
0.0183	8.4728	15.2630
0.0267	5.9755	8.5362
0.0381	3.4195	5.1922
0.0559	2.0665	2.6862
0.0889	0.8605	1.0203
0.1397	0.2968	0.4913
0.2159	0.1547	0.4393
0.3048	0.1537	0.4303

North Sand (Soil #2), uref = 13.0 m/s



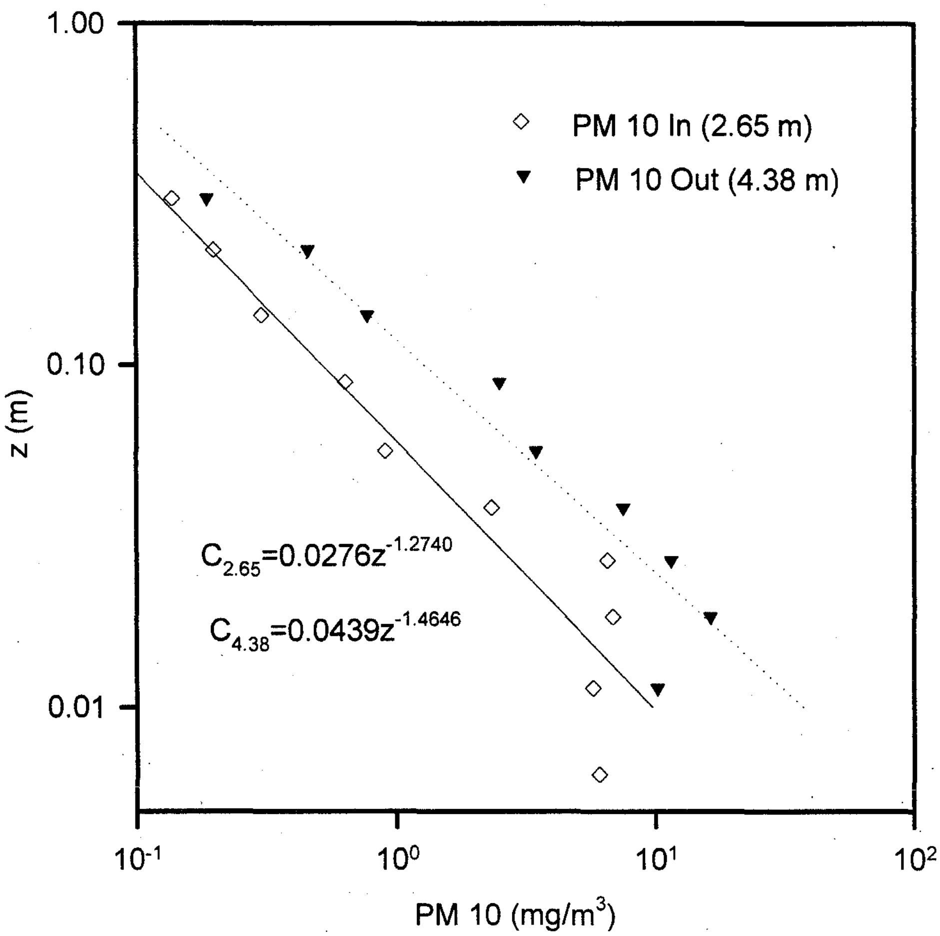
z, Height (m)	IN PM_{10} (mg/m³)	Out PM_{10} (mg/m³)
6.4000e-3	26.7243	21.5140
0.0114	25.3913	22.4032
0.0183	14.3915	16.4068
0.0267	10.0022	14.2877
0.0381	5.7423	7.3338
0.0559	3.5943	4.6132
0.0889	1.5337	1.9163
0.1397	0.4985	0.7427
0.2159	0.1855	0.3567
0.3048	0.0915	0.1613

Dirty Socks Dune Sand (Soil #3), uref = 9.0 m/s



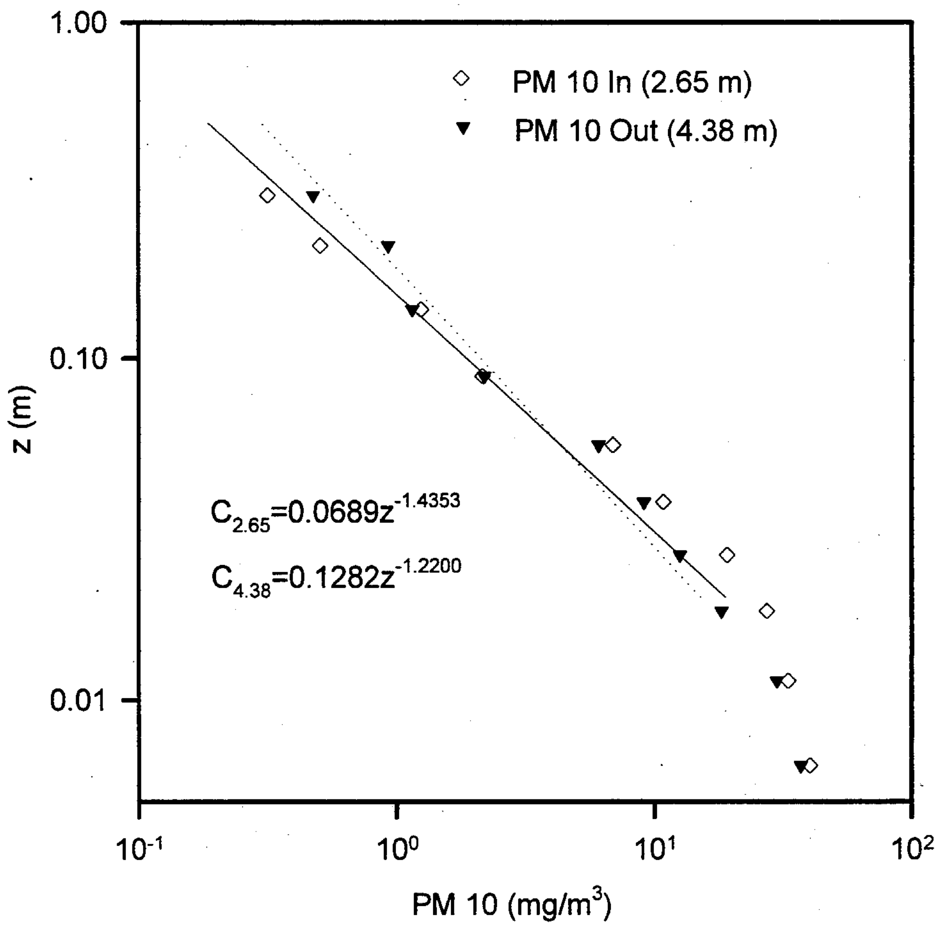
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	0.1457	0.2325
0.0114	0.1353	0.1063
0.0183	0.1827	0.1558
0.0267	0.1442	0.1017
0.0381	0.1135	0.1363
0.0559	0.0992	0.1012
0.0889	0.1252	0.1383
0.1397	0.1057	0.0650
0.2159	0.0497	0.0632
0.3048	0.0448	0.0423

Dirty Socks Dune Sand (Soil #3), uref = 9.9 m/s



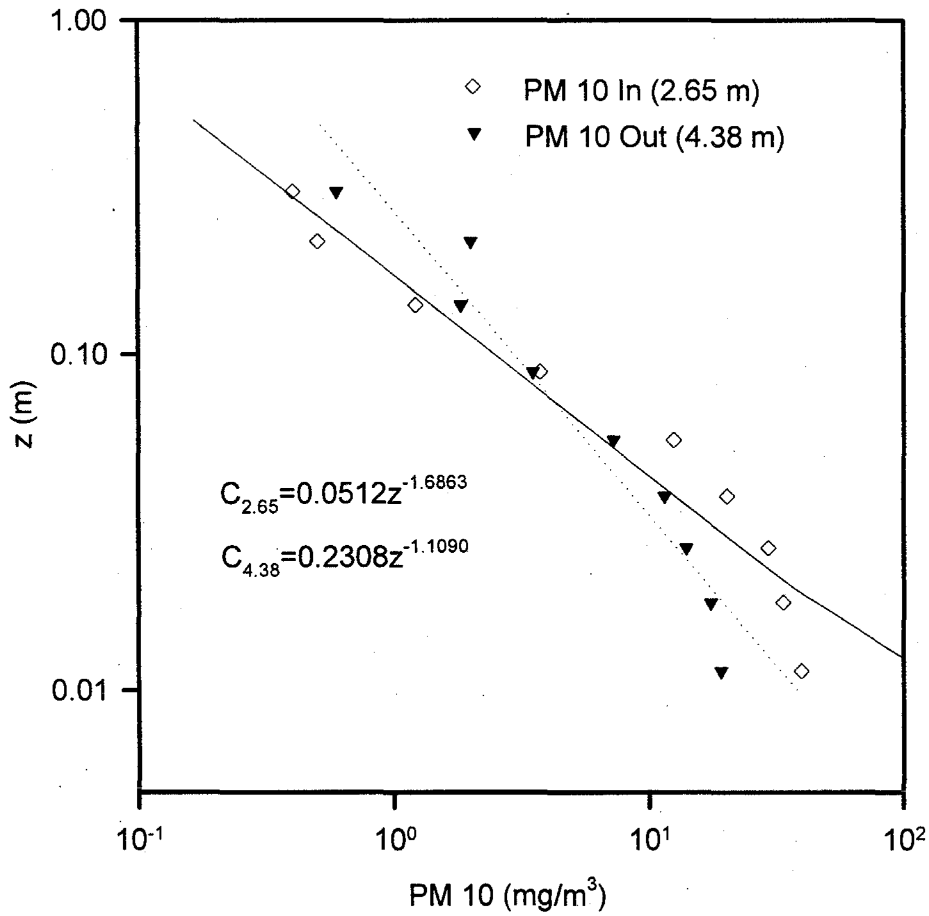
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	6.0358	
0.0114	5.7202	10.1693
0.0183	6.8148	16.3850
0.0267	6.5053	11.4887
0.0381	2.3307	7.5263
0.0559	0.9040	3.4472
0.0889	0.6350	2.5035
0.1397	0.3030	0.7740
0.2159	0.1982	0.4575
0.3048	0.1378	0.1872

Dirty Socks Dune Sand (Soil #3), uref = 11.5 m/s



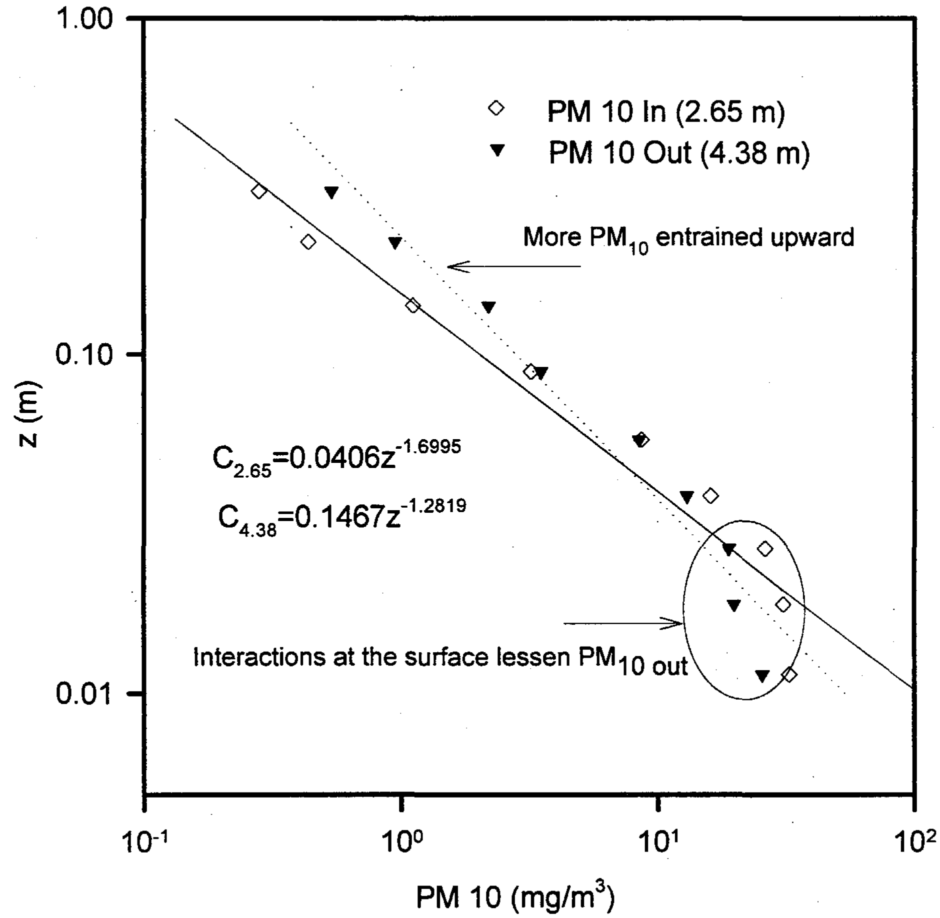
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	40.0247	36.9838
0.0114	32.9505	29.8385
0.0183	27.2605	18.2048
0.0267	19.1332	12.5675
0.0381	10.8115	9.1010
0.0559	6.8925	6.0720
0.0889	2.1512	2.1875
0.1397	1.2445	1.1520
0.2159	0.5062	0.9303
0.3048	0.3157	0.4763

Dirty Socks Dune Sand (Soil #3), uref = 12.6 m/s

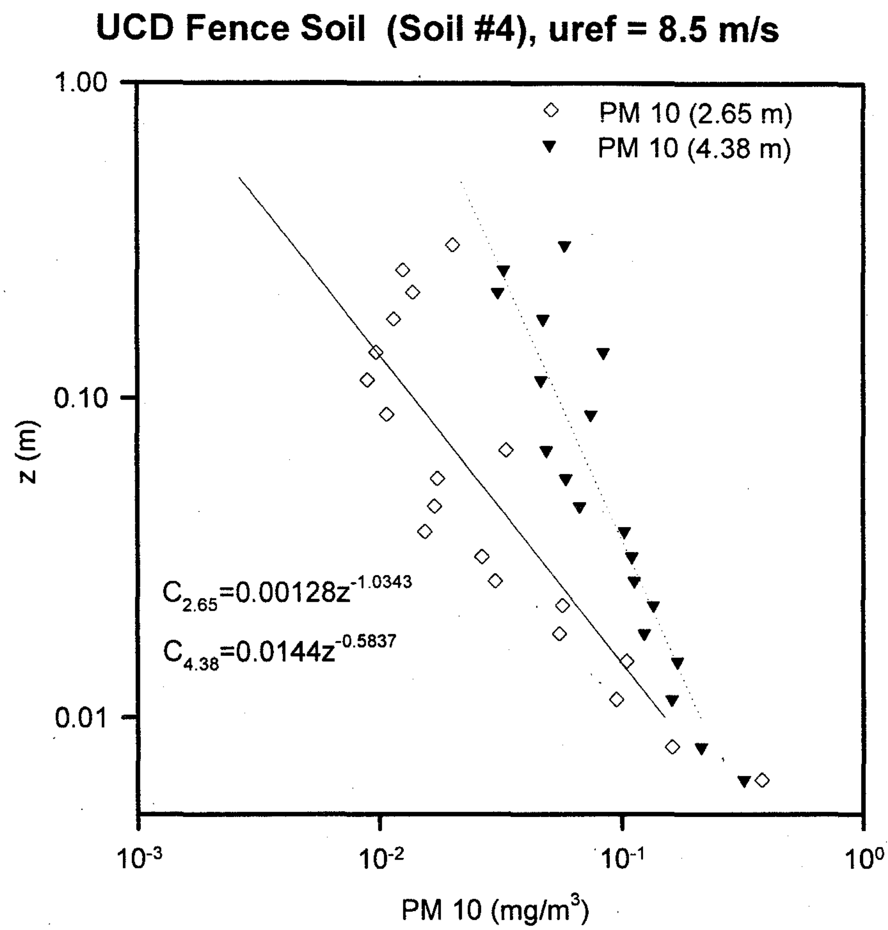


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		
0.0114	39.6815	19.1957
0.0183	33.4980	17.4493
0.0267	29.3905	14.0095
0.0381	20.2427	11.5325
0.0559	12.4847	7.2353
0.0889	3.7415	3.5150
0.1397	1.2190	1.8380
0.2159	0.5037	2.0062
0.3048	0.4028	0.5988

Dirty Socks Dune Sand (Soil #3), uref = 12.9 m/s

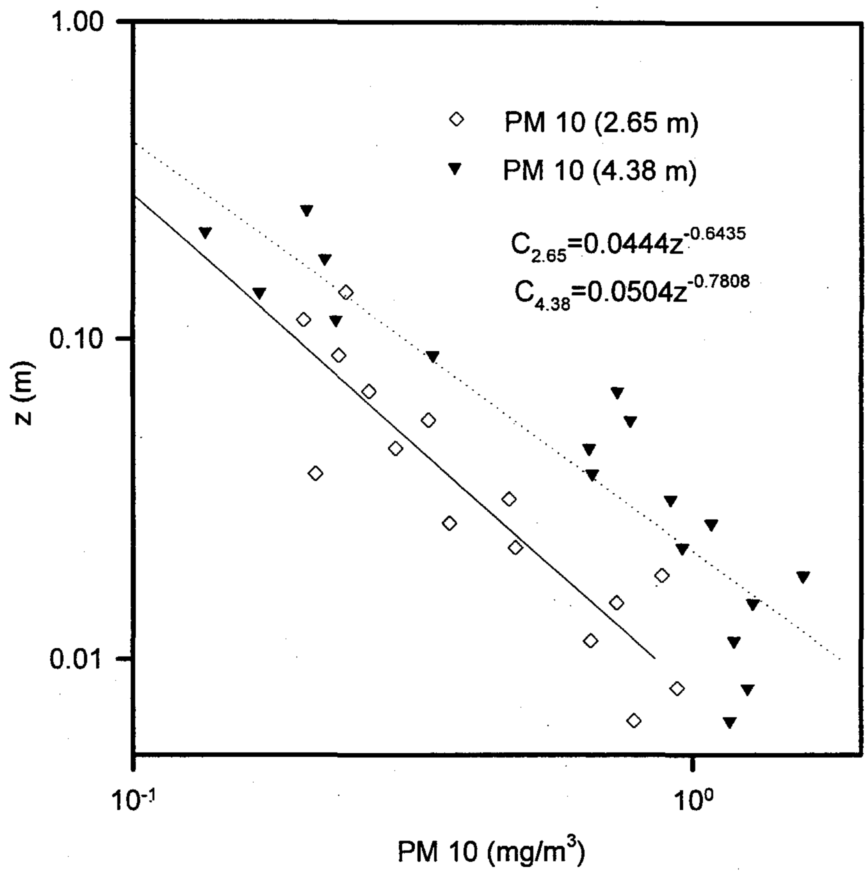


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		
0.0114	32.5657	25.5990
0.0183	30.8997	19.8883
0.0267	26.2645	18.9075
0.0381	15.9912	12.9542
0.0559	8.5868	8.4270
0.0889	3.2002	3.5008
0.1397	1.1148	2.1975
0.2159	0.4362	0.9525
0.3048	0.2795	0.5355



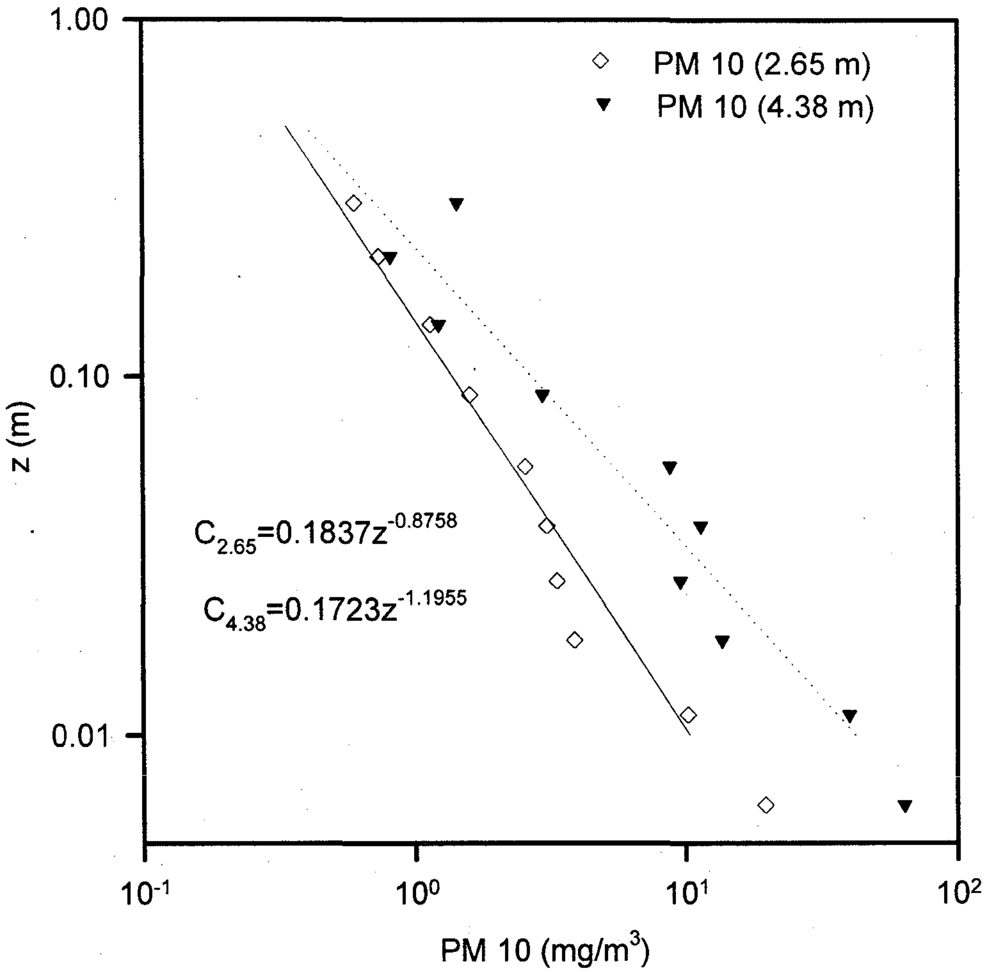
z, Height (m)	IN PM_{10} (mg/m³)	Out PM_{10} (mg/m³)
6.4000e-3	0.3797	0.3204
8.1000e-3	0.1607	0.2121
0.0114	0.0949	0.1609
0.0150	0.1047	0.1698
0.0183	0.0554	0.1239
0.0224	0.0571	0.1356
0.0267	0.0300	0.1125
0.0318	0.0265	0.1100
0.0381	0.0154	0.1027
0.0457	0.0169	0.0672
0.0559	0.0174	0.0591
0.0686	0.0335	0.0492
0.0889	0.0107	0.0745
0.1143	8.9000e-3	0.0466
0.1397	9.7000e-3	0.0842
0.1778	0.0115	0.0476
0.2159	0.0138	0.0310
0.2540	0.0125	0.0328
0.3048	0.0201	0.0583

UCD Fence Soil (Soil #4), uref = 9.9 m/s



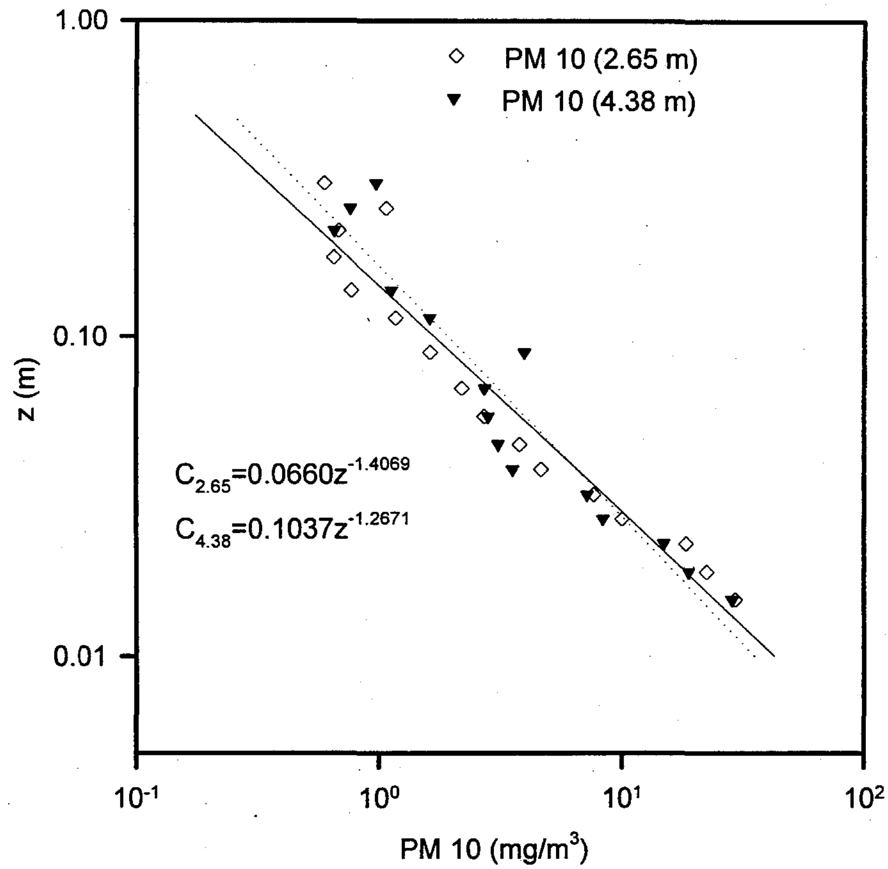
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	0.7858	1.1645
8.1000e-3	0.9386	1.2534
0.0114	0.6575	1.1863
0.0150	0.7305	1.2787
0.0183	0.8799	1.5715
0.0224	0.4816	0.9574
0.0267	0.3671	1.0789
0.0318	0.4692	0.9131
0.0381	0.2113	0.6616
0.0457	0.2942	0.6533
0.0559	0.3370	0.7738
0.0686	0.2637	0.7340
0.0889	0.2328	0.3435
0.1143	0.2015	0.2303
0.1397	0.2393	0.1677
0.1778		0.2195
0.2159		0.1343
0.2540		0.2038
0.3048		

UCD Fence Soil (Soil #4), uref = 10.5 m/s



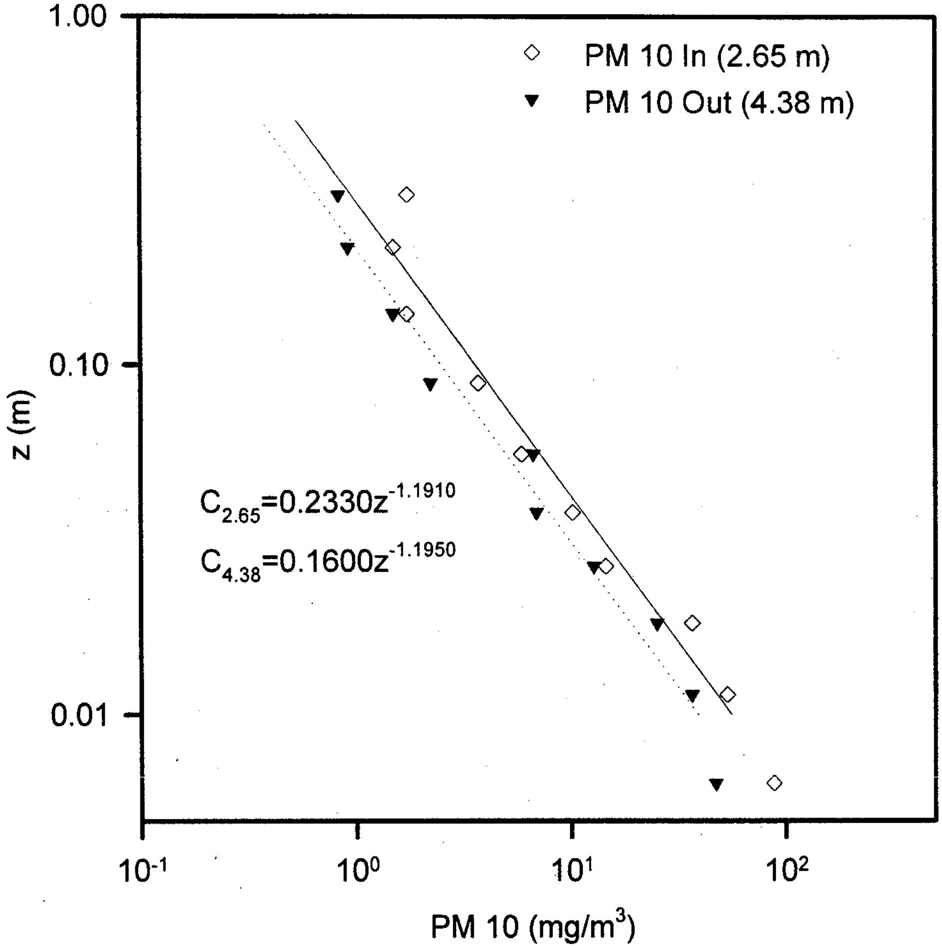
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	19.6630	64.0158
0.0114	10.1770	40.2770
0.0183	3.8717	13.6893
0.0267	3.3302	9.5423
0.0381	3.0567	11.3703
0.0559	2.5475	8.7675
0.0889	1.5972	2.9612
0.1397	1.1445	1.2325
0.2159	0.7363	0.8127
0.3048	0.6000	1.4348

UCD Fence Soil (Soil #4), uref = 11.6 m/s



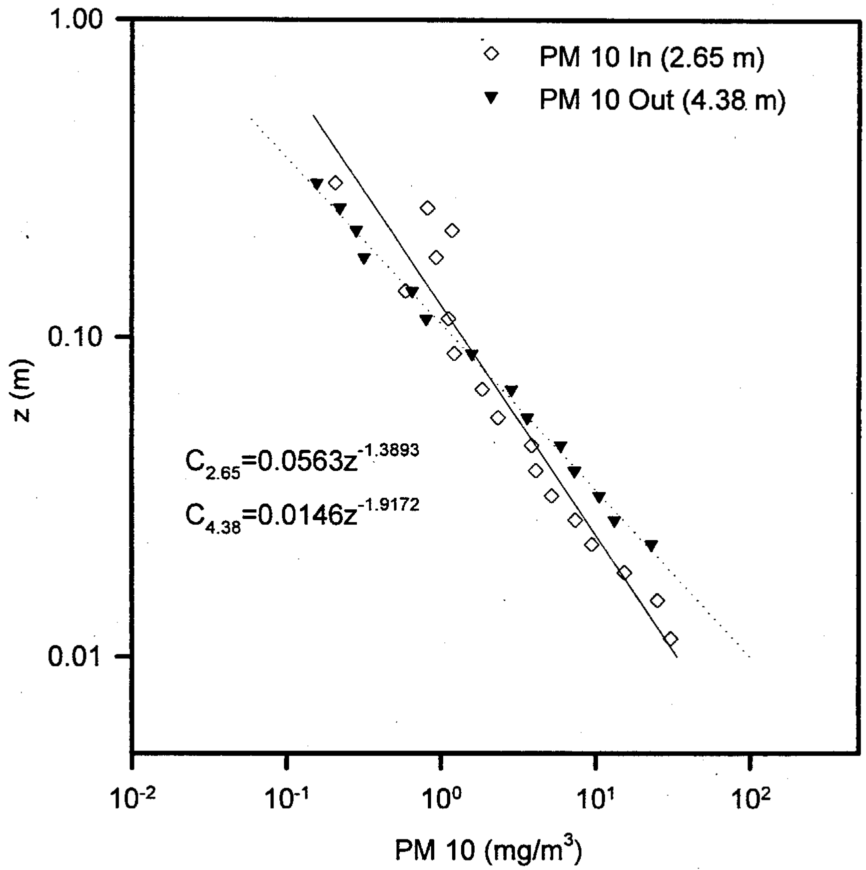
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		
8.1000e-3		
0.0114		
0.0150	29.4085	28.6102
0.0183	22.4193	18.8723
0.0224	18.4192	14.9188
0.0267	10.0098	8.3480
0.0318	7.6268	7.1768
0.0381	4.6388	3.5470
0.0457	3.7807	3.0957
0.0559	2.7097	2.8145
0.0686	2.1923	2.7187
0.0889	1.6225	3.9455
0.1143	1.1665	1.6163
0.1397	0.7688	1.1247
0.1778	0.6510	
0.2159	0.6840	0.6552
0.2540	1.0703	0.7630
0.3048	0.5965	0.9732

UCD Fence Soil (Soil #4), uref = 12.7 m/s



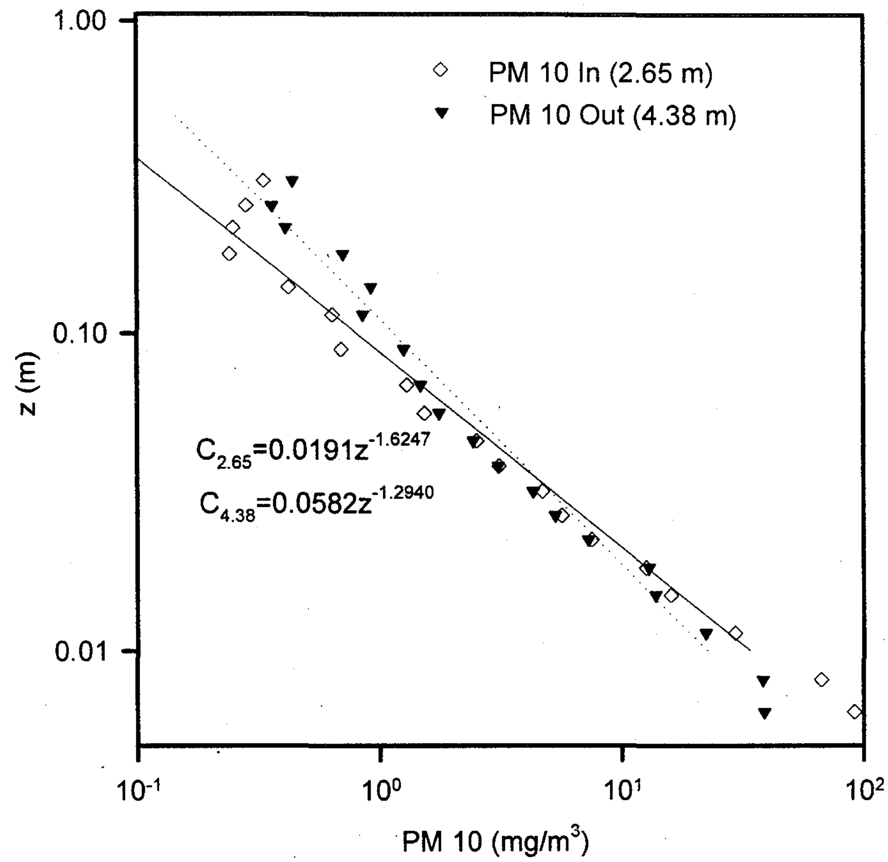
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	87.9263	47.3177
0.0114	53.2815	36.5950
0.0183	36.6187	25.1873
0.0267	14.5422	12.8017
0.0381	10.1978	6.9348
0.0559	5.8973	6.7003
0.0889	3.7203	2.2323
0.1397	1.7315	1.4930
0.2159	1.4992	0.9228
0.3048	1.7455	0.8347

UCD Fence Soil (Soil #4), uref = 13.0 m/s



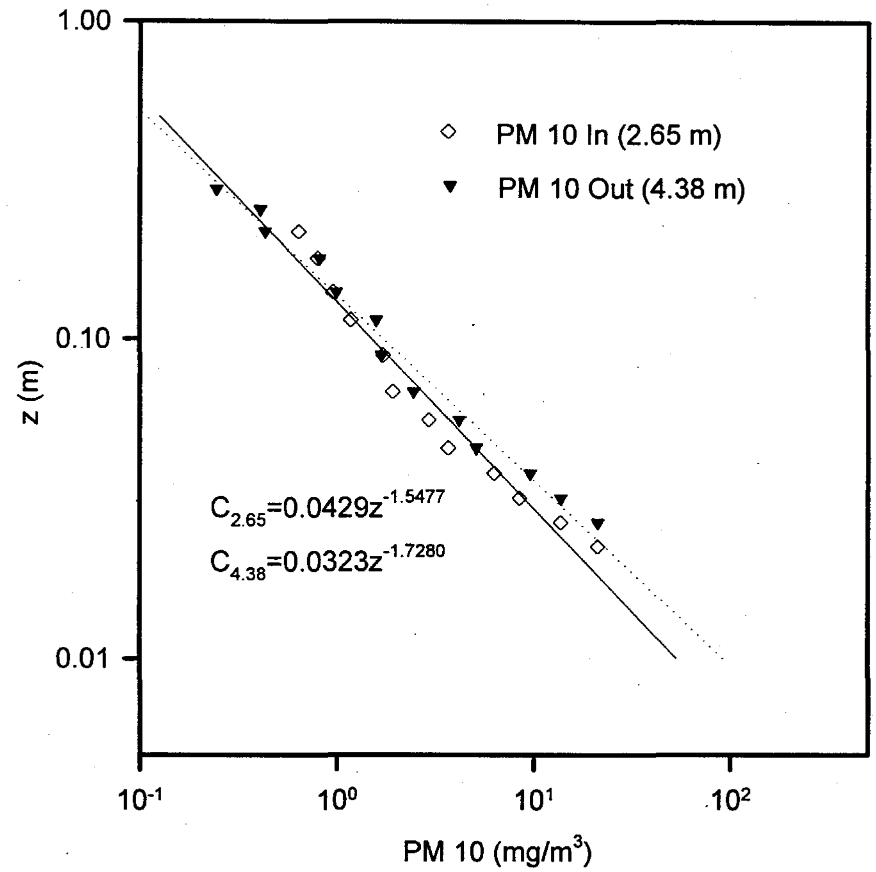
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		
8.1000e-3		
0.0114	30.5303	
0.0150	25.0753	
0.0183	15.3512	
0.0224	9.4415	22.9692
0.0267	7.3765	13.2938
0.0318	5.1768	10.5433
0.0381	4.0907	7.2915
0.0457	3.8518	5.9338
0.0559	2.3258	3.6052
0.0686	1.8403	2.8490
0.0889	1.2165	1.5807
0.1143	1.1117	0.8032
0.1397	0.5867	0.6498
0.1778	0.9287	0.3172
0.2159	1.1757	0.2820
0.2540	0.8148	0.2212
0.3048	0.2063	0.1568

UCD Fence Soil (Soil #4), uref = 13.1 m/s



z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	91.3318	38.7728
8.1000e-3	66.9330	38.3008
0.0114	29.3088	22.2372
0.0150	15.9738	13.8203
0.0183	12.6587	12.9898
0.0224	7.5227	7.3032
0.0267	5.6720	5.3300
0.0318	4.7023	4.3213
0.0381	3.1110	3.0935
0.0457	2.5182	2.4397
0.0559	1.5313	1.7660
0.0686	1.3007	1.4793
0.0889	0.6963	1.2645
0.1143	0.6370	0.8533
0.1397	0.4210	0.9237
0.1778	0.2408	0.7073
0.2159	0.2495	0.4110
0.2540	0.2820	0.3618
0.3048	0.3337	0.4392

UCD Fence Soil (Soil #4), uref = 13.7 m/s

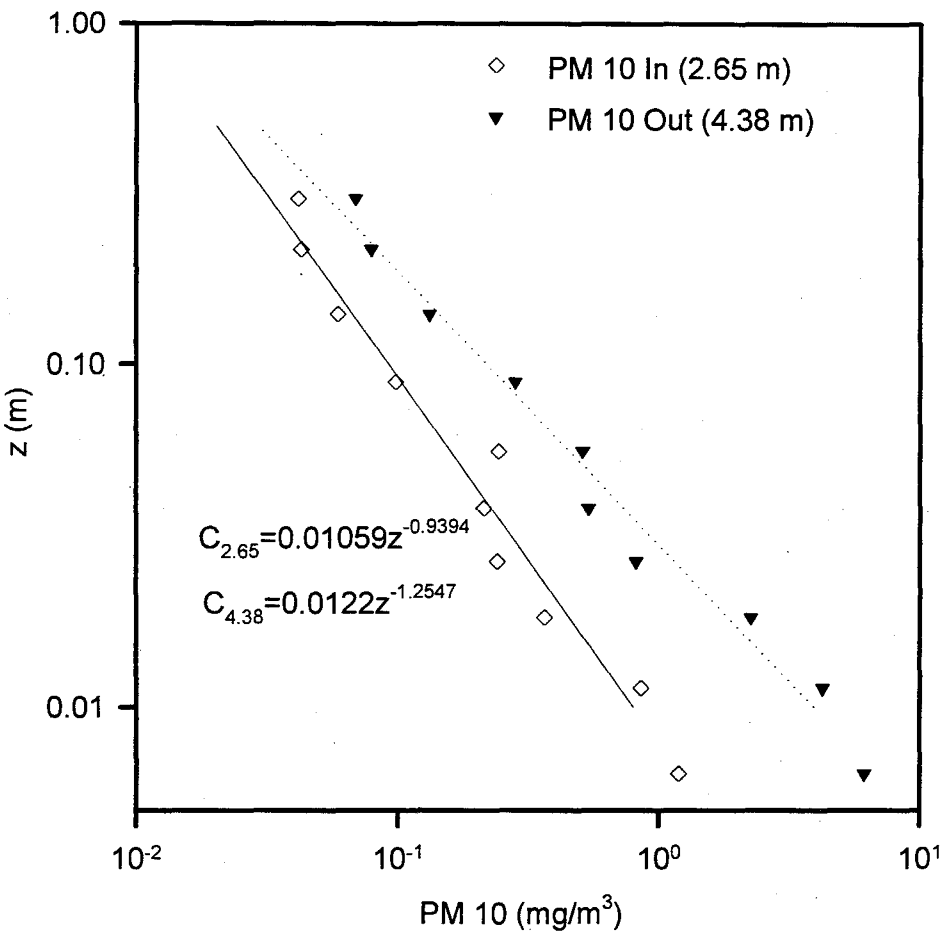


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		
8.1000e-3		
0.0114		
0.0150		
0.0183		
0.0224	21.1398	
0.0267	13.6650	21.1543
0.0318	8.4627	13.7613
0.0381	6.2828	9.5877
0.0457	3.6648	5.1032
0.0559	2.9265	4.1832
0.0686	1.9227	2.4550
0.0889	1.7187	1.6862
0.1143	1.1825	1.5980
0.1397	0.9592	0.9998
0.1778	0.8025	0.8203
0.2159	0.6413	0.4345
0.2540		0.4092
0.2946		0.2458

Appendix B:

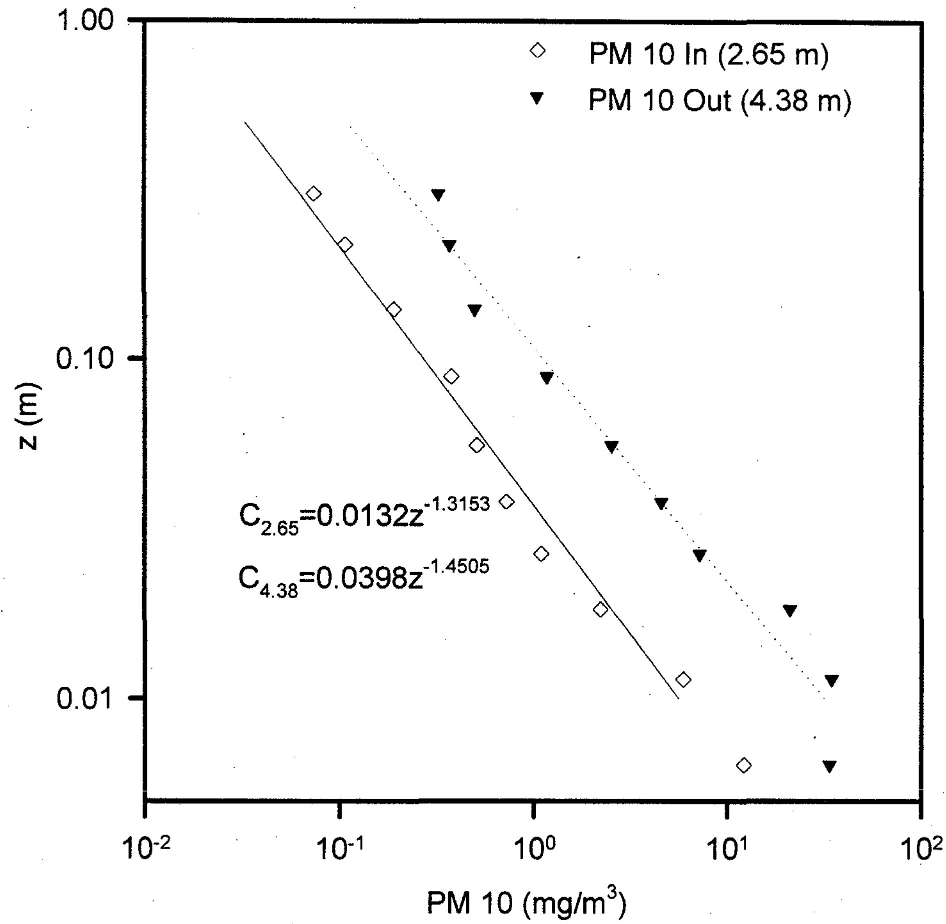
Enhanced Saltation Emissions Concentration Profiles
and
Velocity Profiles (not in text)

North Saltation Simulation, uref = 9.2 m/s

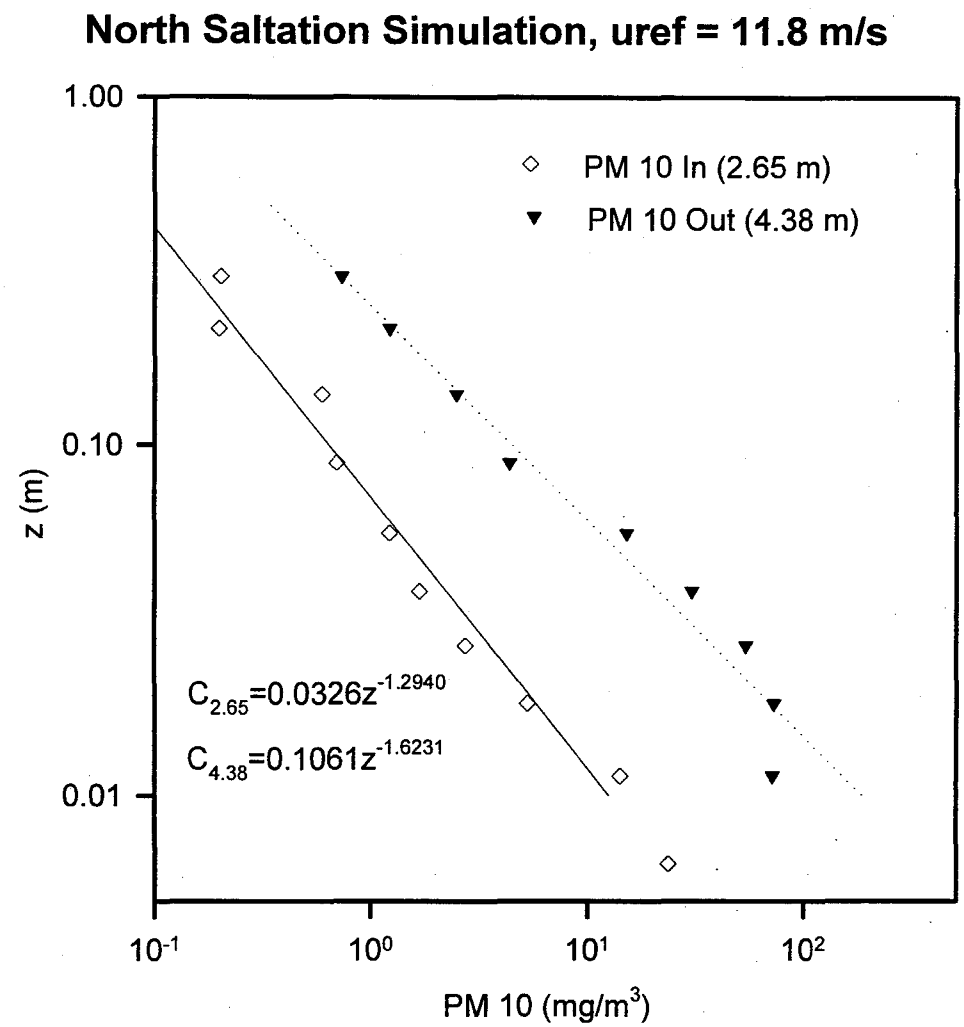


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	1.1917	6.1152
0.0114	0.8545	4.2428
0.0183	0.3645	2.2558
0.0267	0.2405	0.8193
0.0381	0.2135	0.5362
0.0559	0.2428	0.5095
0.0889	0.0980	0.2812
0.1397	0.0590	0.1322
0.2159	0.0428	0.0793
0.3048	0.0415	0.0688

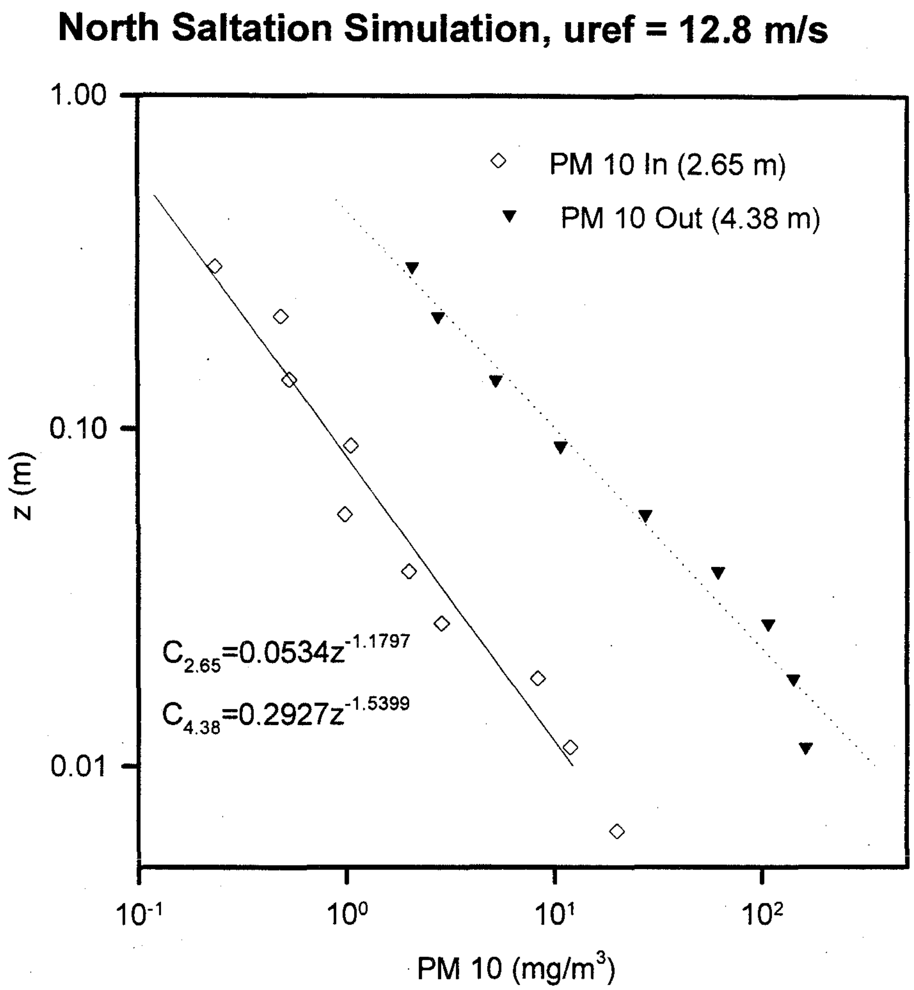
North Saltation Simulation, uref = 10.0 m/s



z, Height (m)	IN PM_{10} (mg/m³)	Out PM_{10} (mg/m³)
6.4000e-3	12.2097	33.6473
0.0114	5.9308	34.4260
0.0183	2.2227	21.2405
0.0267	1.0962	7.2445
0.0381	0.7225	4.5773
0.0559	0.5088	2.5332
0.0889	0.3763	1.1735
0.1397	0.1902	0.4967
0.2159	0.1077	0.3708
0.3048	0.0743	0.3250



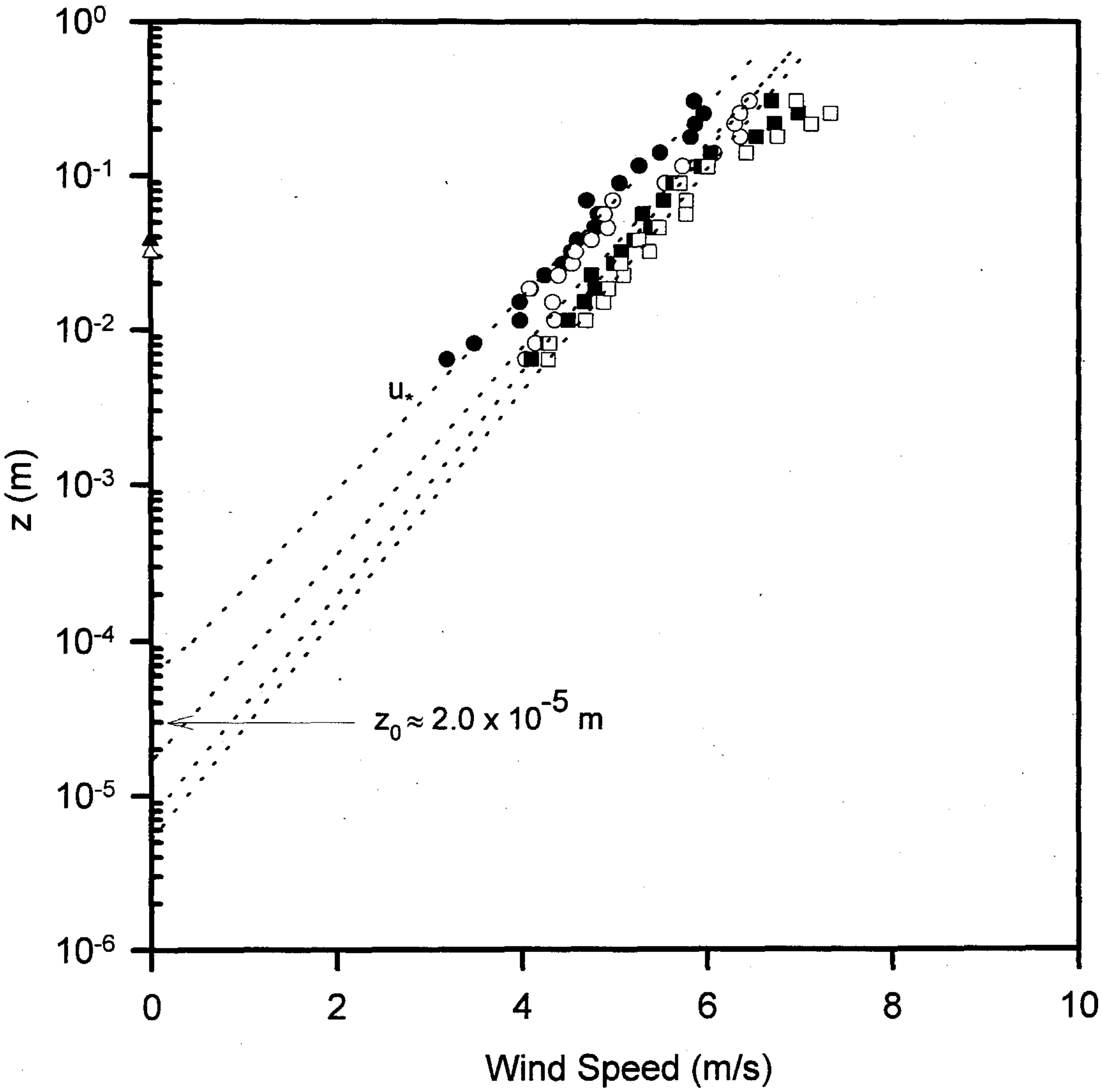
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	23.6453	
0.0114	14.1407	72.0645
0.0183	5.2732	72.7298
0.0267	2.7333	54.1915
0.0381	1.6770	30.4213
0.0559	1.2202	15.1283
0.0889	0.6992	4.3695
0.1397	0.5950	2.4843
0.2159	0.1985	1.2313
0.3048	0.2020	0.7375

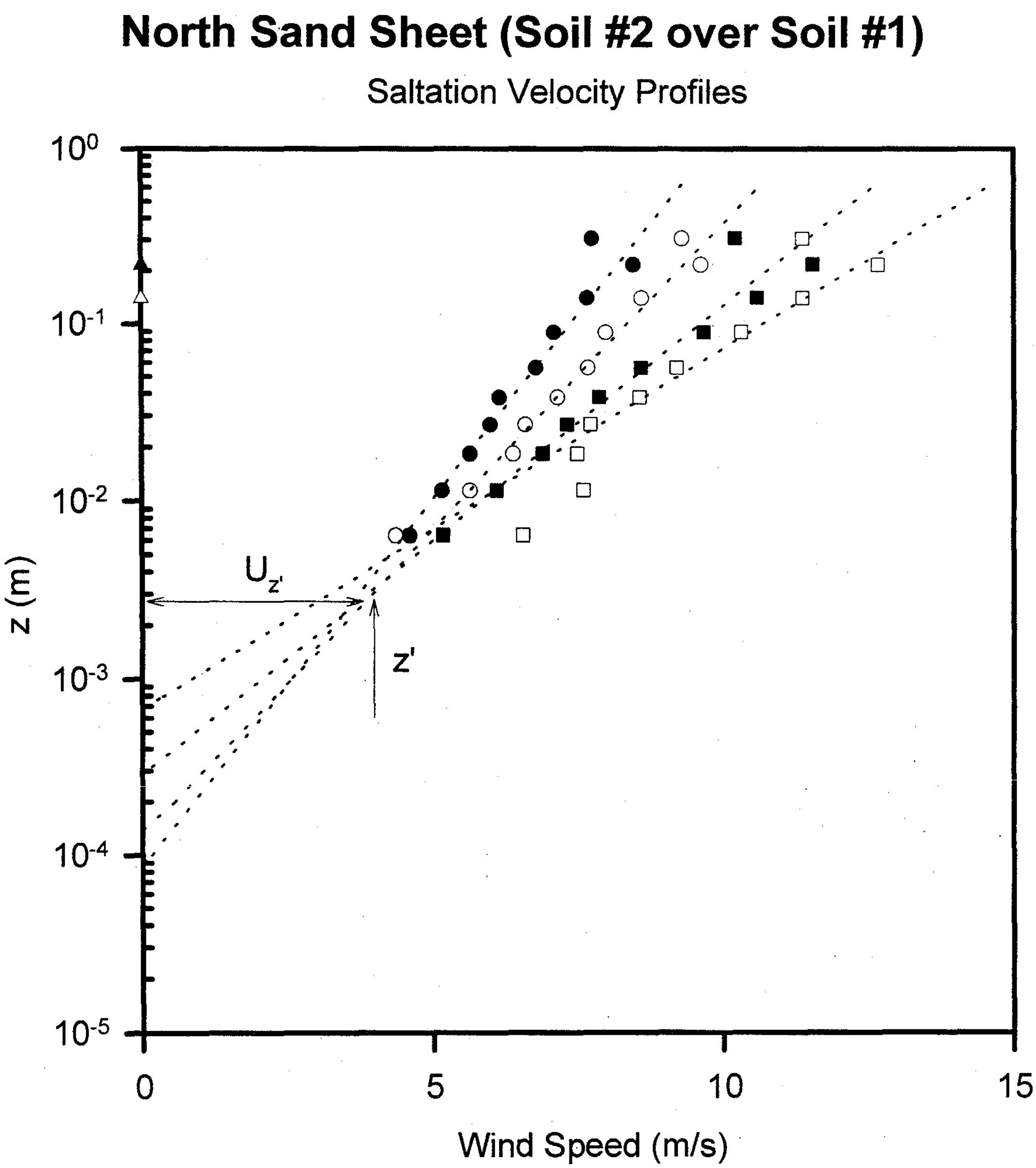


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	20.0838	
0.0114	11.9022	164.2668
0.0183	8.3325	143.7332
0.0267	2.8685	107.6187
0.0381	1.9958	61.7028
0.0559	0.9903	27.6598
0.0889	1.0585	10.7825
0.1397	0.5332	5.2537
0.2159	0.4882	2.7945
0.3048	0.2350	2.0923

North Sand Sheet (Soil #2 behind Soil #1)

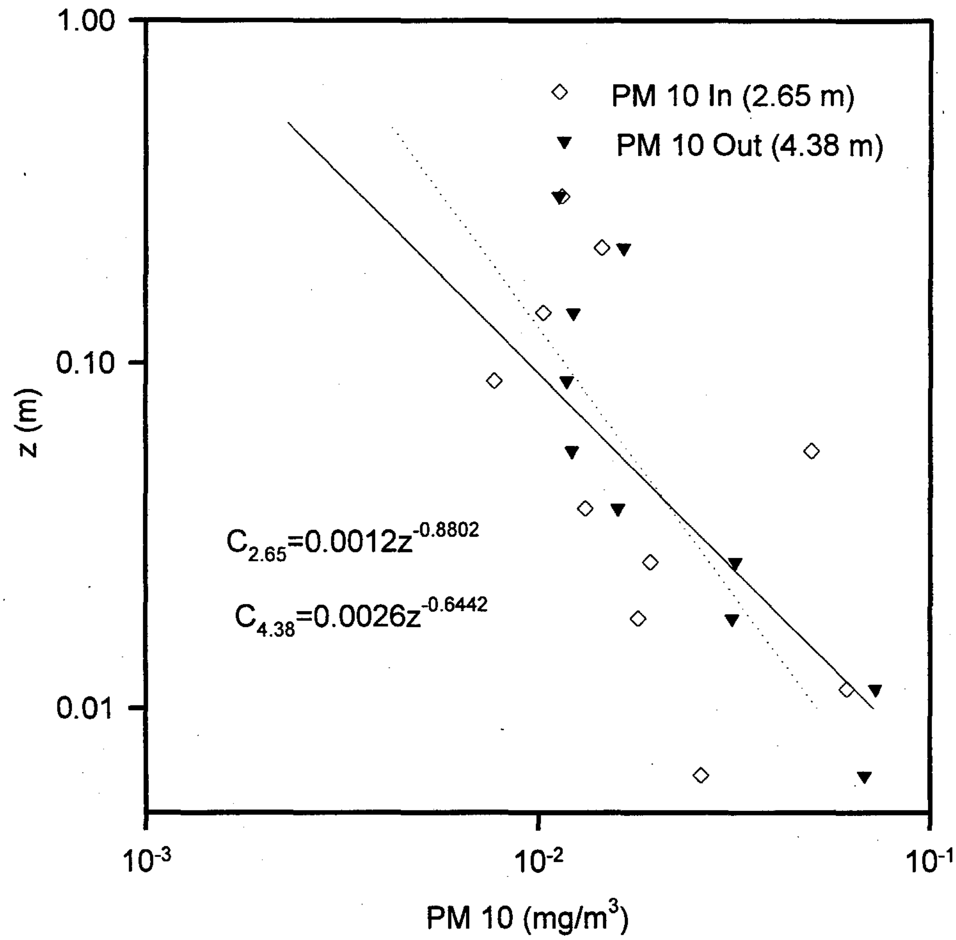
Pre-Saltation Velocity Profiles





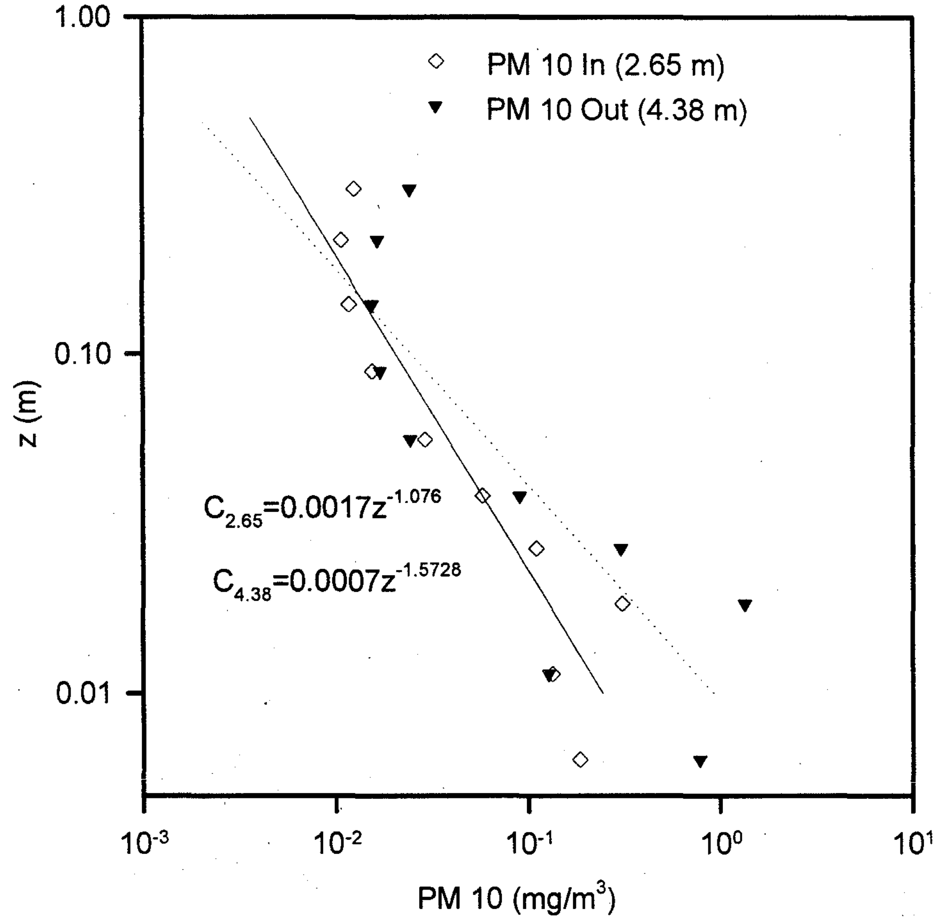
North Sand Sheet (Soil #2 over Soil #1)
Saltation Velocity Profiles
10⁰
10⁻¹
10⁻²
10⁻³
10⁻⁴
10⁻⁵
z (m)
U_z'
z'
0
5
10
15
Wind Speed (m/s)

South Sand Saltation Simulation, uref = 8.4 m/s



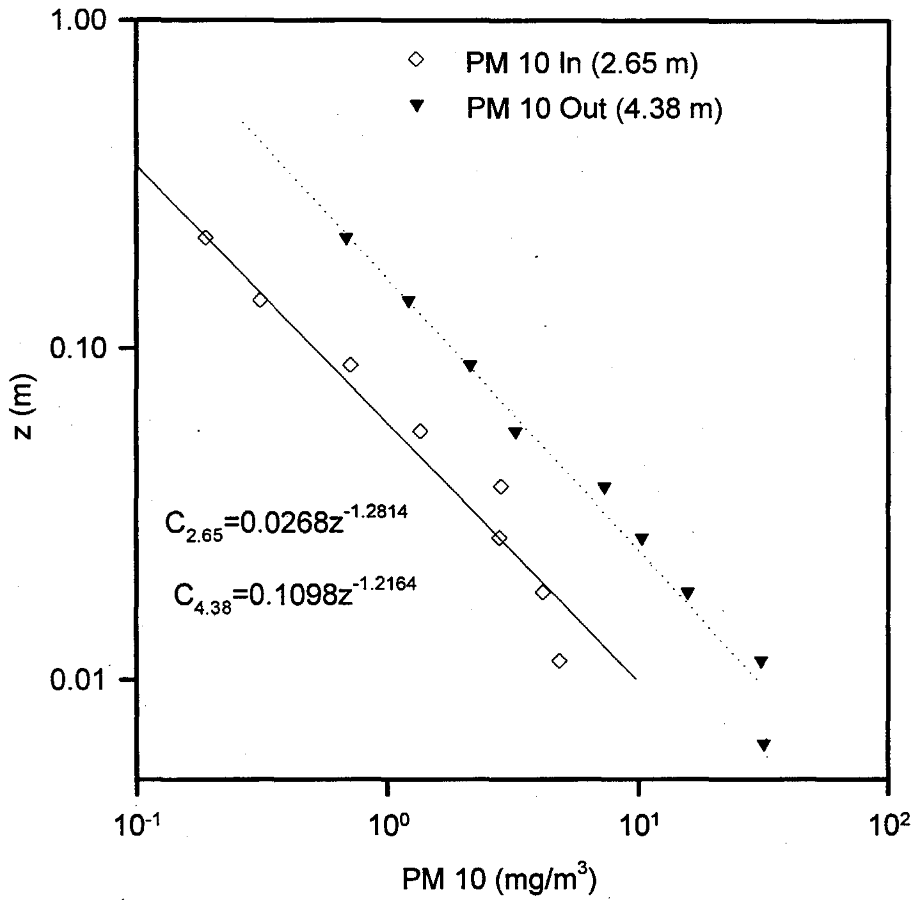
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	0.0260	0.0680
0.0114	0.0612	0.0725
0.0183	0.0180	0.0313
0.0267	0.0193	0.0318
0.0381	0.0132	0.0160
0.0559	0.0497	0.0122
0.0889	7.7000e-3	0.0118
0.1397	0.0103	0.0123
0.2159	0.0145	0.0165
0.3048	0.0115	0.0113

South Sand Saltation Simulation, uref = 9.3 m/s



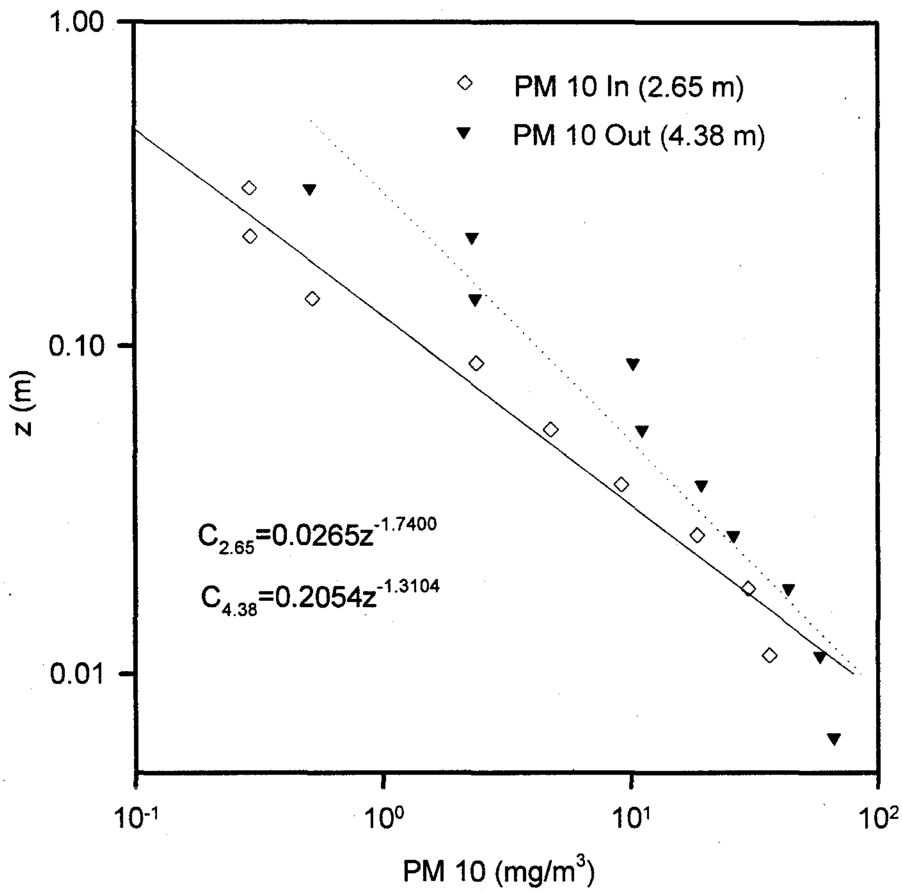
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	0.1840	0.7798
0.0114	0.1332	0.1273
0.0183	0.3075	1.3393
0.0267	0.1095	0.3035
0.0381	0.0578	0.0903
0.0559	0.0290	0.0243
0.0889	0.0155	0.0170
0.1397	0.0118	0.0155
0.2159	0.0107	0.0165
0.3048	0.0125	0.0243

South Sand Saltation Simulation, uref = 11.1 m/s



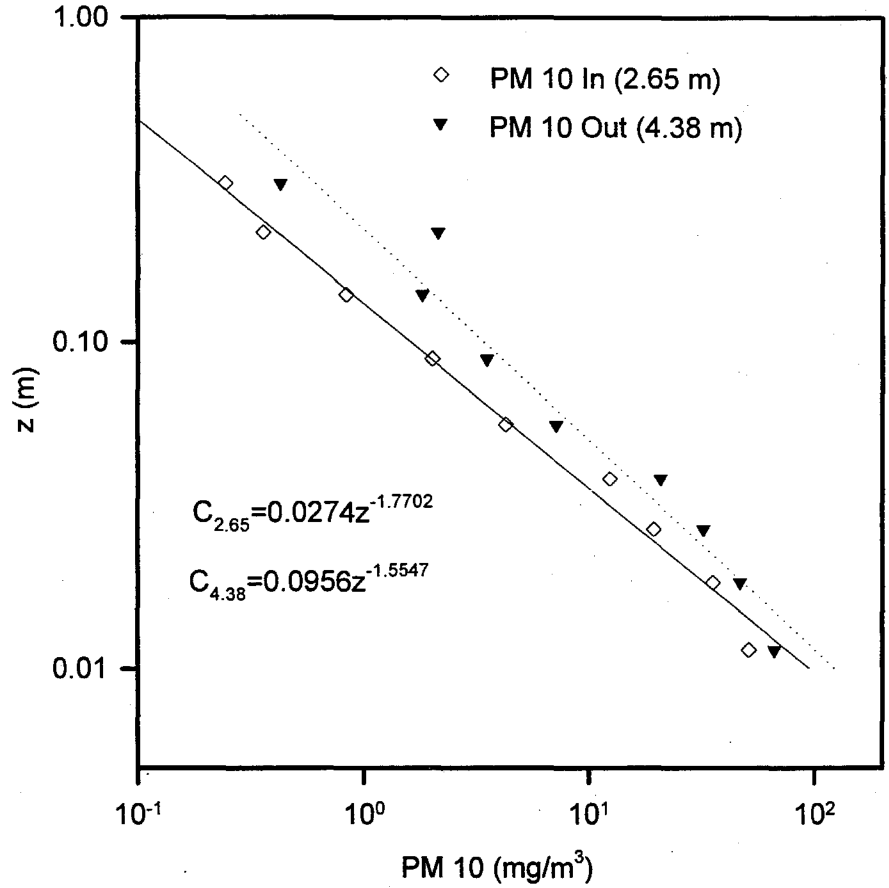
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		31.8120
0.0114	4.8297	30.9695
0.0183	4.1390	15.6940
0.0267	2.7863	10.3048
0.0381	2.8210	7.2908
0.0559	1.3528	3.2373
0.0889	0.7118	2.1338
0.1397	0.3113	1.2193
0.2159	0.1883	0.6867
0.3048	0.0125	0.0243

South Saltation Simulation, uref = 12.8 m/s



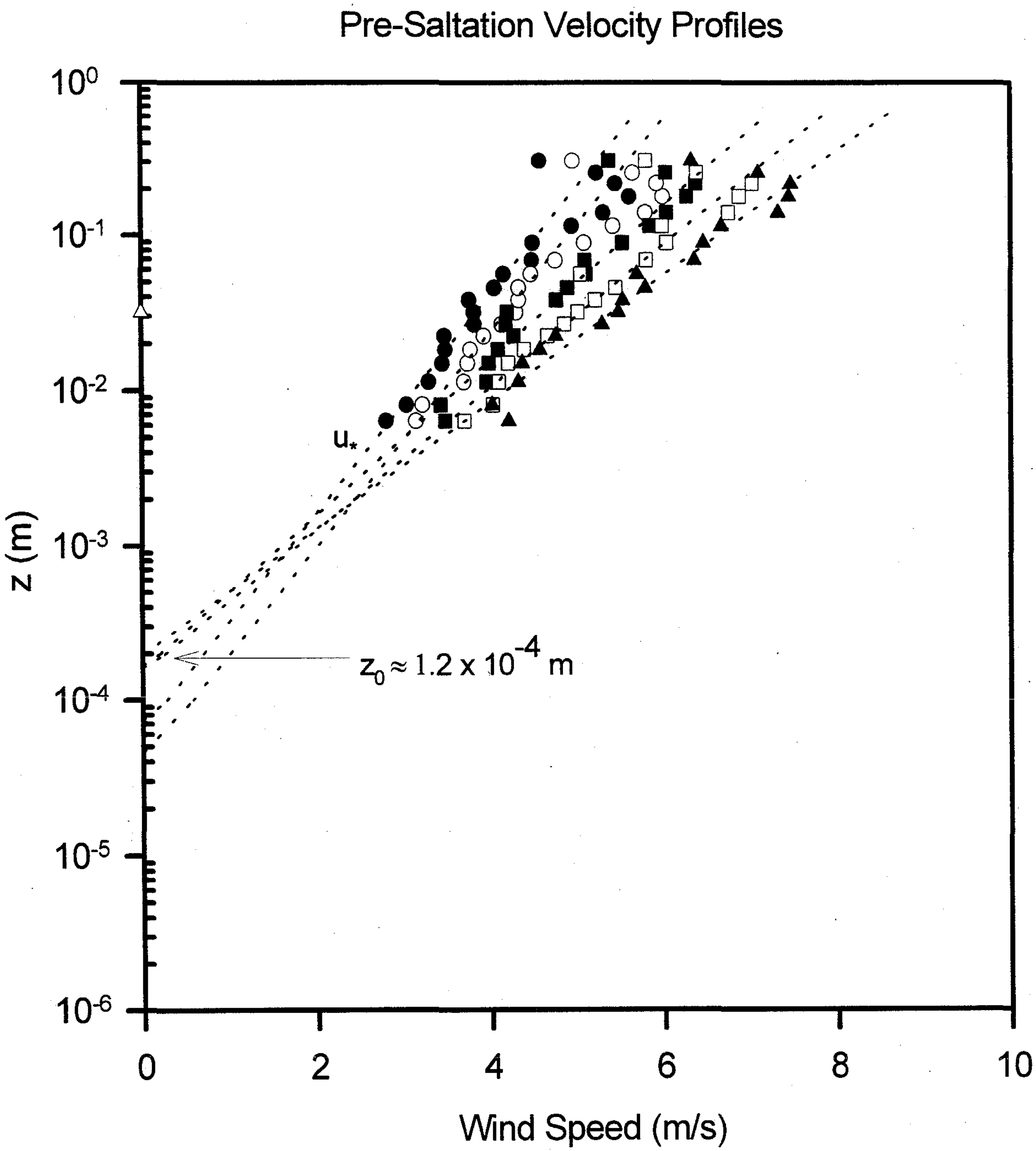
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		66.4278
0.0114	36.3038	58.4995
0.0183	29.6993	43.4360
0.0267	18.5472	25.9758
0.0381	9.1788	19.3397
0.0559	4.7502	11.1018
0.0889	2.3967	10.2558
0.1397	0.5243	2.3788
0.2159	0.2925	2.3055
0.3048	0.2910	0.5118

South Sand Saltation Simulation, uref = 12.9 m/s



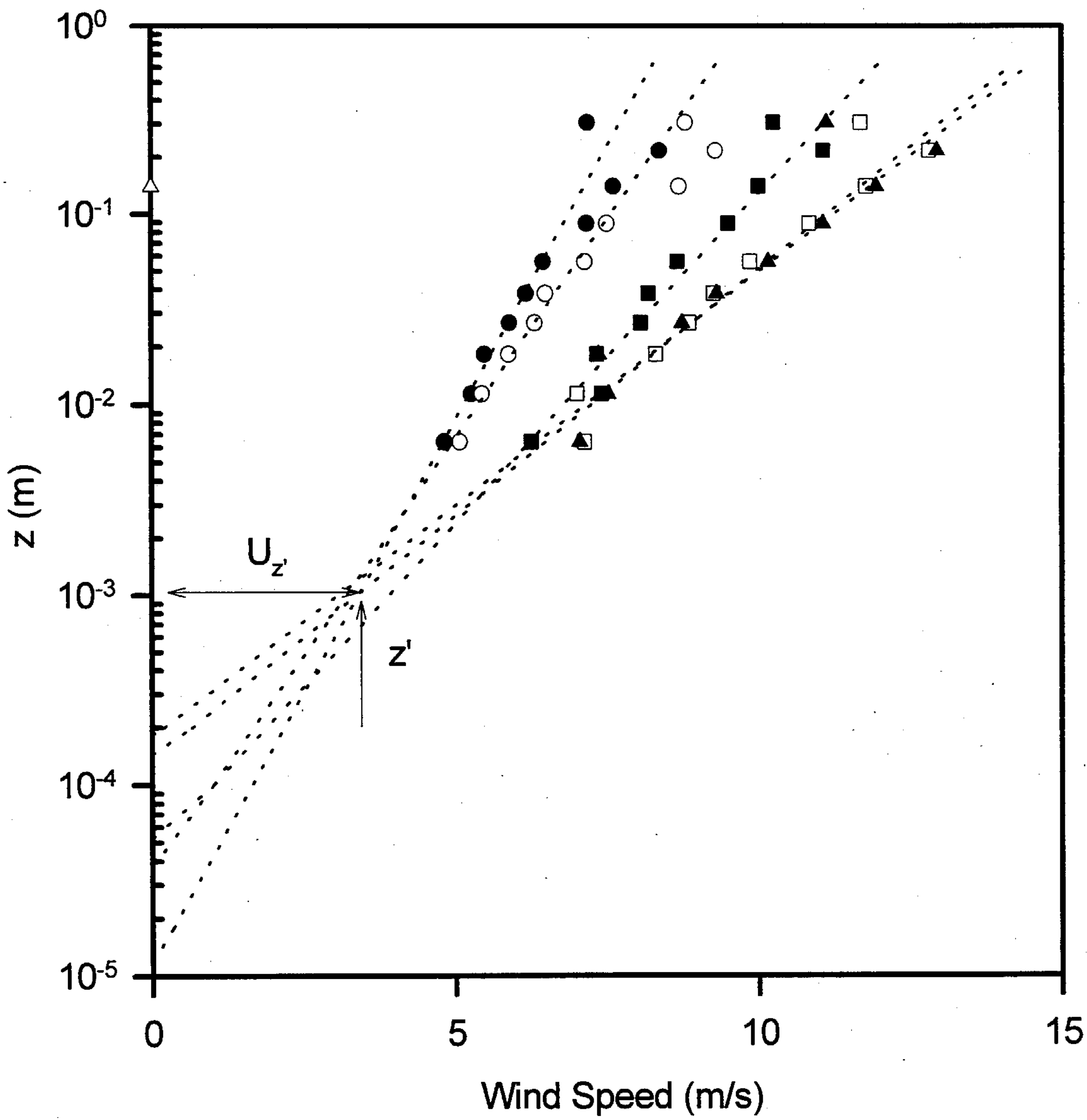
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		
0.0114	51.1668	66.4727
0.0183	35.3607	46.7203
0.0267	19.4060	32.2407
0.0381	12.3713	20.7952
0.0559	4.2883	7.1967
0.0889	2.0137	3.5290
0.1397	0.8370	1.8273
0.2159	0.3577	2.1392
0.3048	0.2440	0.4275

South Sand Sheet (Soil #3 behind Soil #4)



South Sand Sheet (Soil #3 over Soil #4)

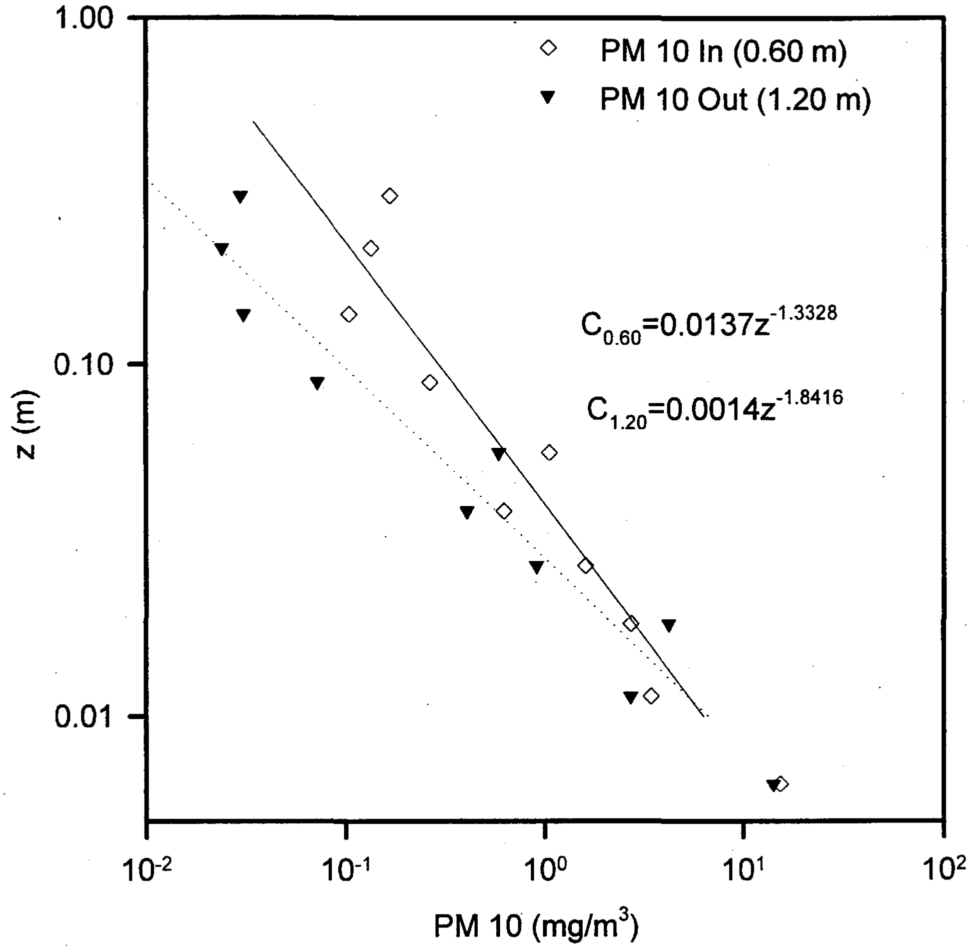
Saltation Velocity Profiles



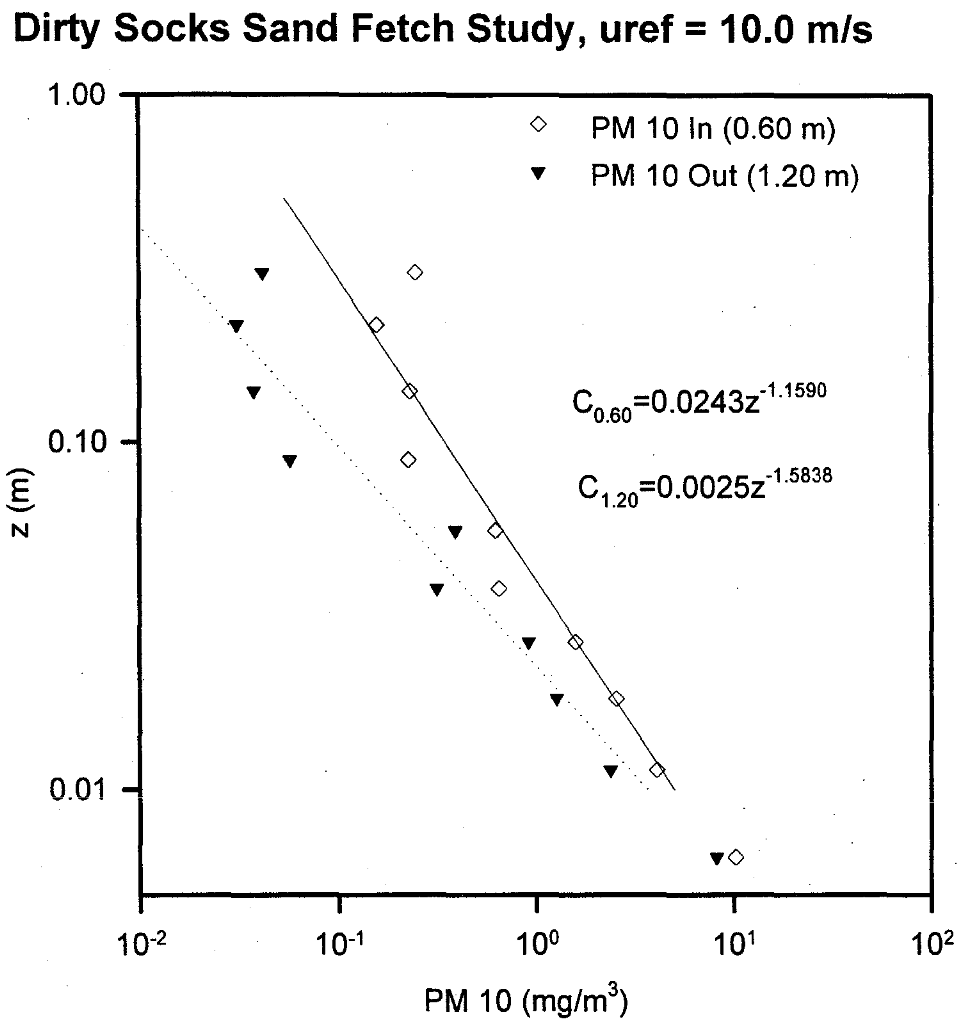
Appendix C:

Fetch Study Concentration Profiles
and
Velocity Profiles (not in text)

Dirty Socks Sand Fetch Study, uref = 9.3 m/s

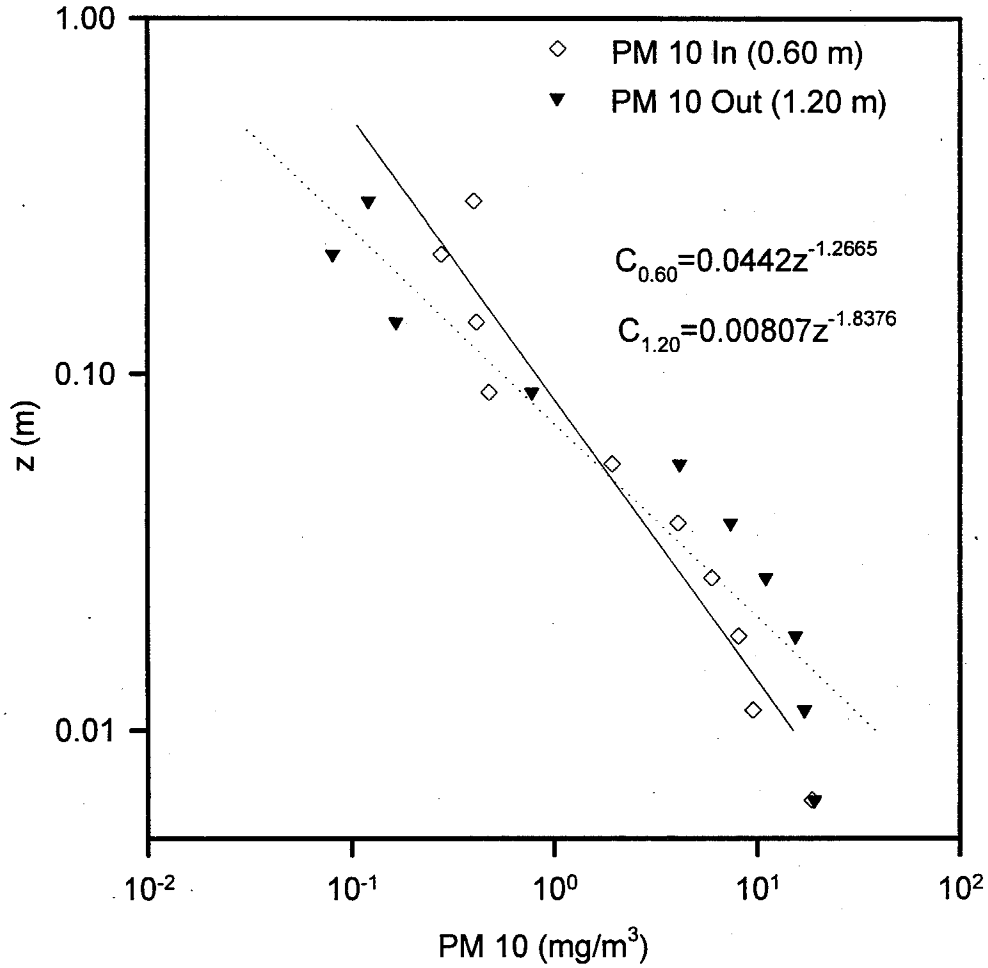


z, Height (m)	IN PM_{10} (mg/m³)	Out PM_{10} (mg/m³)
6.4000e-3	15.2890	14.2120
0.0114	3.4430	2.7287
0.0183	2.7298	4.2477
0.0267	1.6057	0.9132
0.0381	0.6248	0.4087
0.0559	1.0592	0.5903
0.0889	0.2663	0.0727
0.1397	0.1048	0.0310
0.2159	0.1343	0.0240
0.3048	0.1677	0.0298



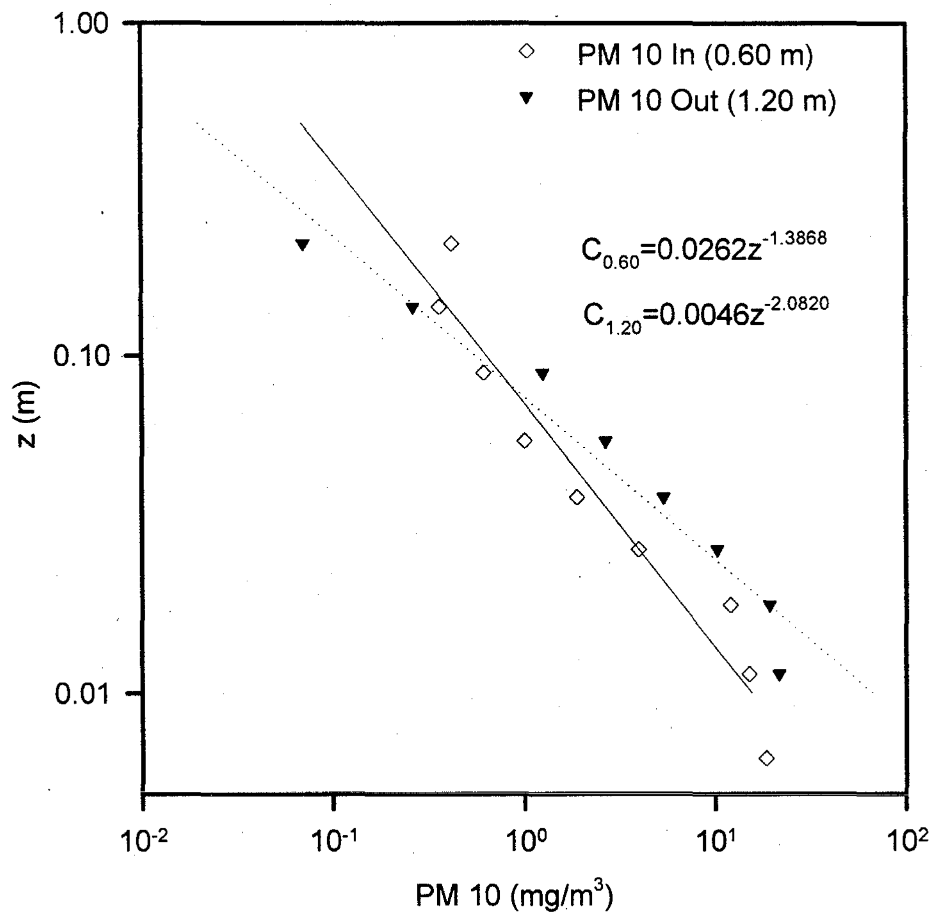
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	10.2273	8.2302
0.0114	4.0978	2.3918
0.0183	2.5468	1.2752
0.0267	1.5955	0.9223
0.0381	0.6512	0.3173
0.0559	0.6287	0.3945
0.0889	0.2277	0.0572
0.1397	0.2320	0.0375
0.2159	0.1577	0.0310
0.3048	0.2475	0.0417

Dirty Socks Sand Fetch Study, uref = 12.1 m/s



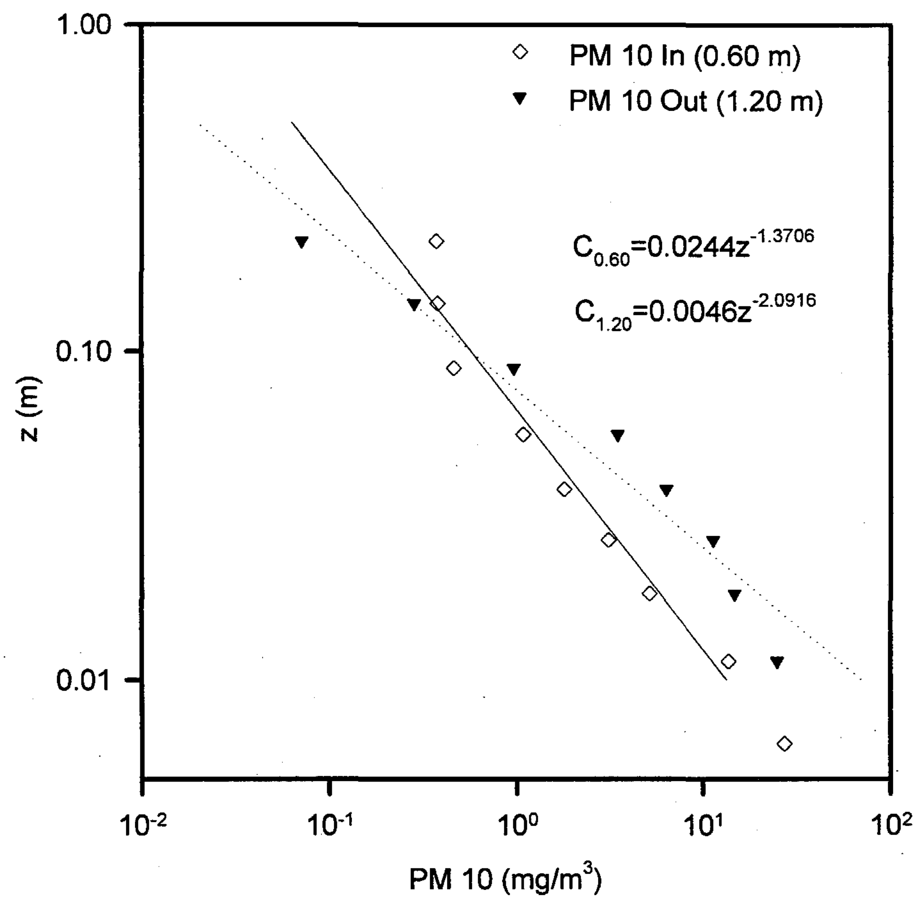
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	18.6160	19.1028
0.0114	9.5232	17.0665
0.0183	8.0820	15.4315
0.0267	5.9742	11.0305
0.0381	4.0715	7.4123
0.0559	1.9313	4.1523
0.0889	0.4792	0.7800
0.1397	0.4168	0.1668
0.2159	0.2783	0.0812
0.3048	0.4037	0.1217

Dirty Socks Sand Fetch Study, uref = 13.1 m/s

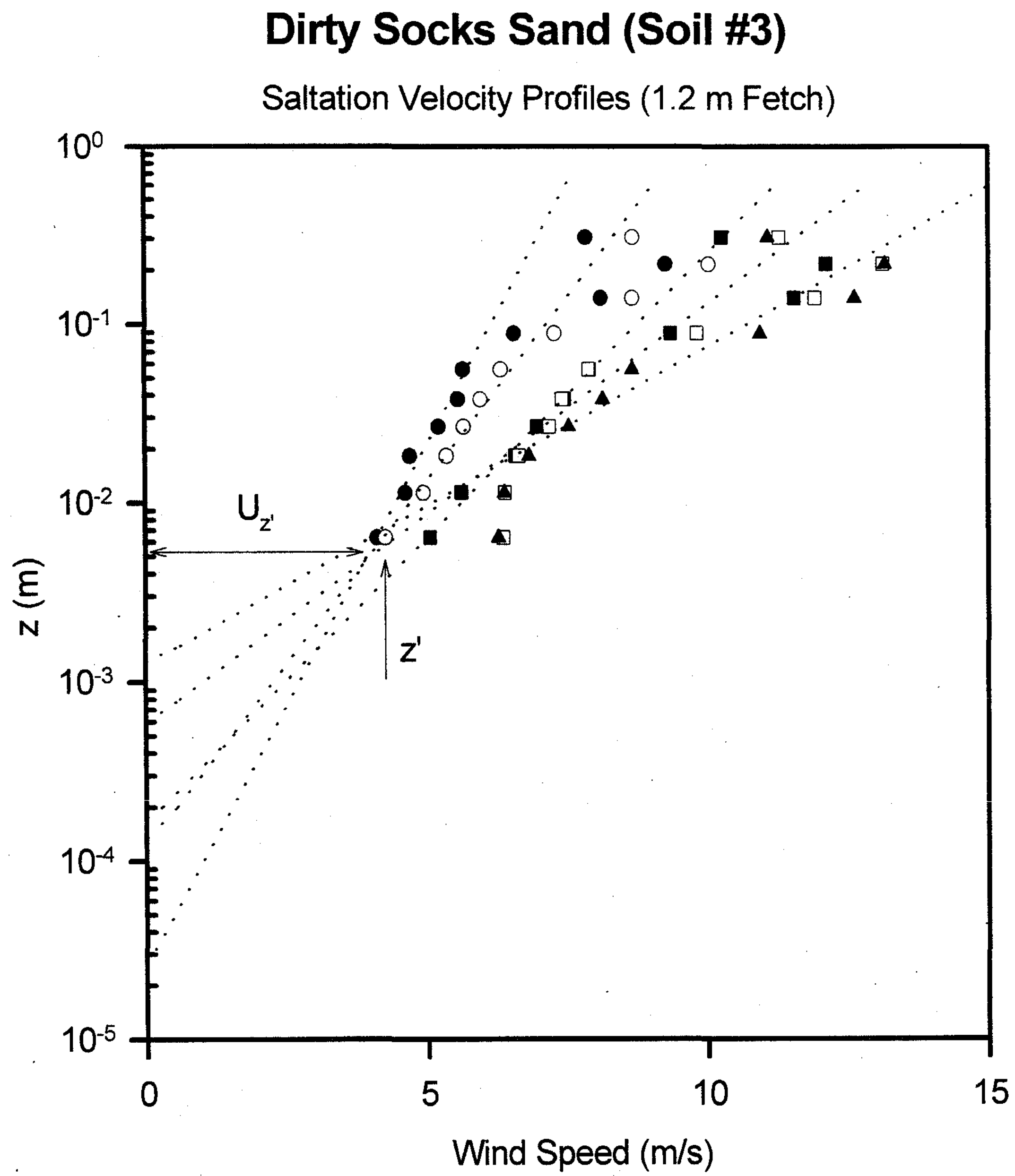


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	18.3672	
0.0114	15.0765	21.6750
0.0183	12.0108	19.2975
0.0267	3.9650	10.2873
0.0381	1.8818	5.3800
0.0559	1.0008	2.6558
0.0889	0.6147	1.2532
0.1397	0.3622	0.2650
0.2159	0.4195	0.0703
0.3048		

Dirty Socks Sand Fetch Study, uref = 13.2 m/s

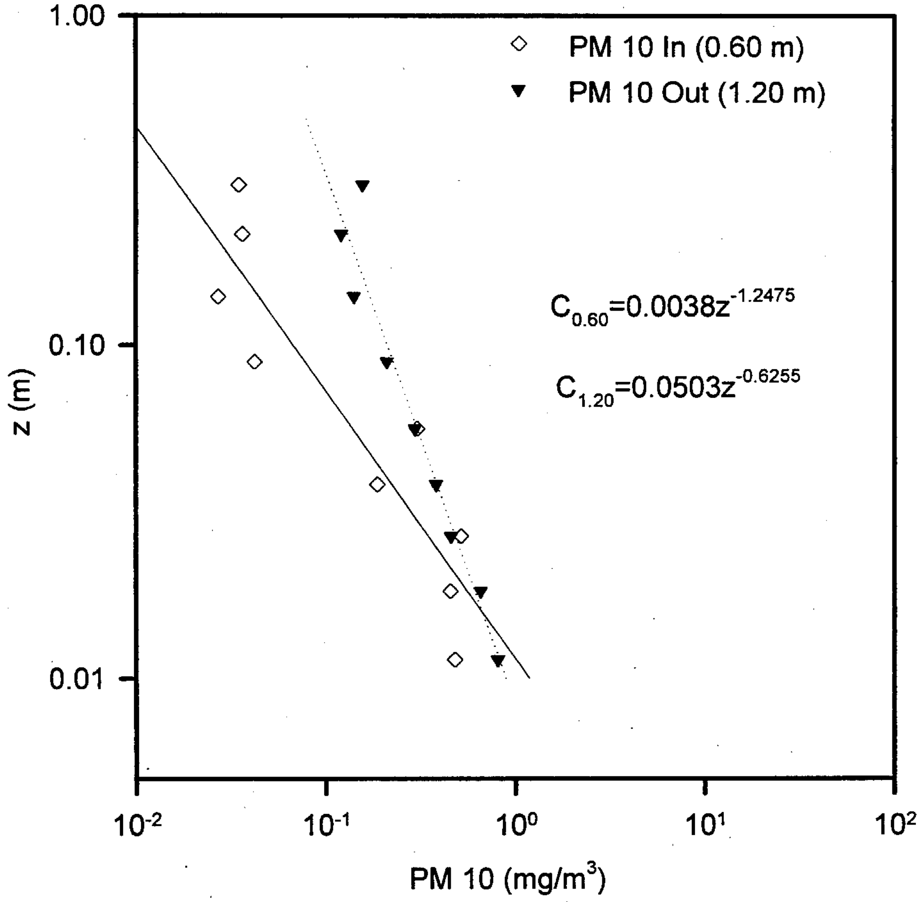


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	27.2623	
0.0114	13.7172	24.9363
0.0183	5.1597	14.7115
0.0267	3.1117	11.3385
0.0381	1.7998	6.3755
0.0559	1.0860	3.4902
0.0889	0.4620	0.9660
0.1397	0.3798	0.2855
0.2159	0.3713	0.0715
0.3048		



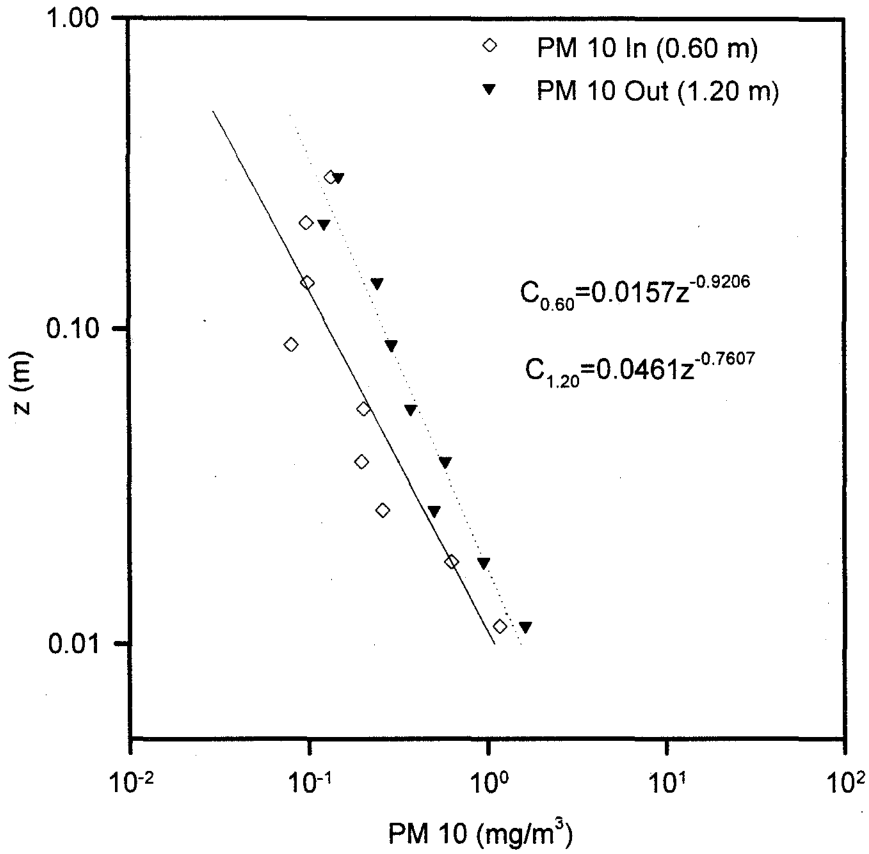
Dirty Socks Sand (Soil #3)
Saltation Velocity Profiles (1.2 m Fetch)
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
z (m)
$U_{z'}$
z'
0
5
10
15
Wind Speed (m/s)

UCD Fence Soil Fetch Study, uref = 9.5 m/s



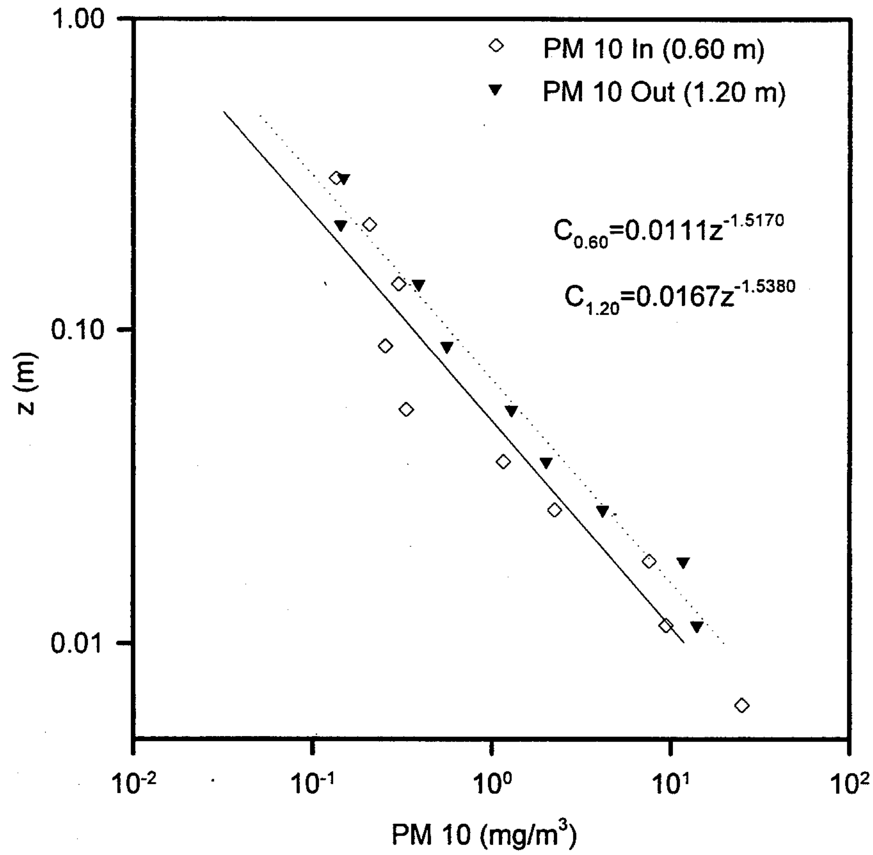
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		
0.0114	0.4808	0.8083
0.0183	0.4558	0.6573
0.0267	0.5187	0.4600
0.0381	0.1872	0.3837
0.0559	0.3045	0.2965
0.0889	0.0420	0.2110
0.1397	0.0270	0.1415
0.2159	0.0362	0.1210
0.3048	0.0347	0.1570

UCD Fence Soil Fetch Study, uref = 10.3 m/s



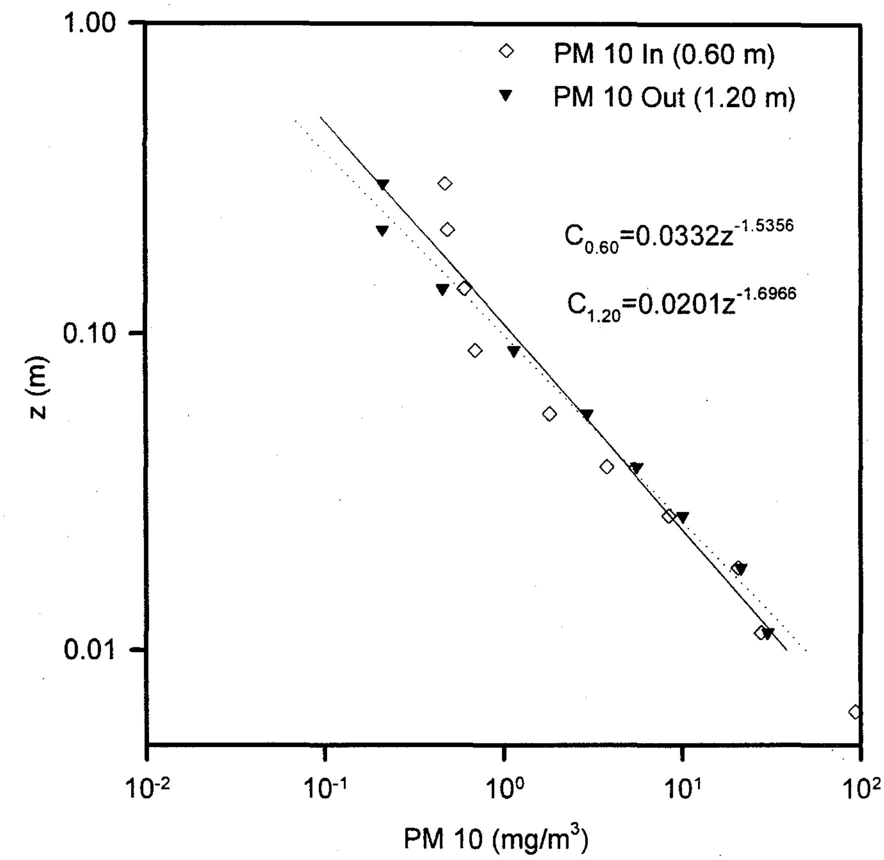
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		
0.0114	1.1653	1.6175
0.0183	0.6285	0.9535
0.0267	0.2603	0.5057
0.0381	0.1977	0.5808
0.0559	0.2040	0.3740
0.0889	0.0808	0.2937
0.1397	0.0993	0.2437
0.2159	0.0982	0.1237
0.3048	0.1353	0.1492

UCD Fence Soil Fetch Study, uref = 11.8 m/s

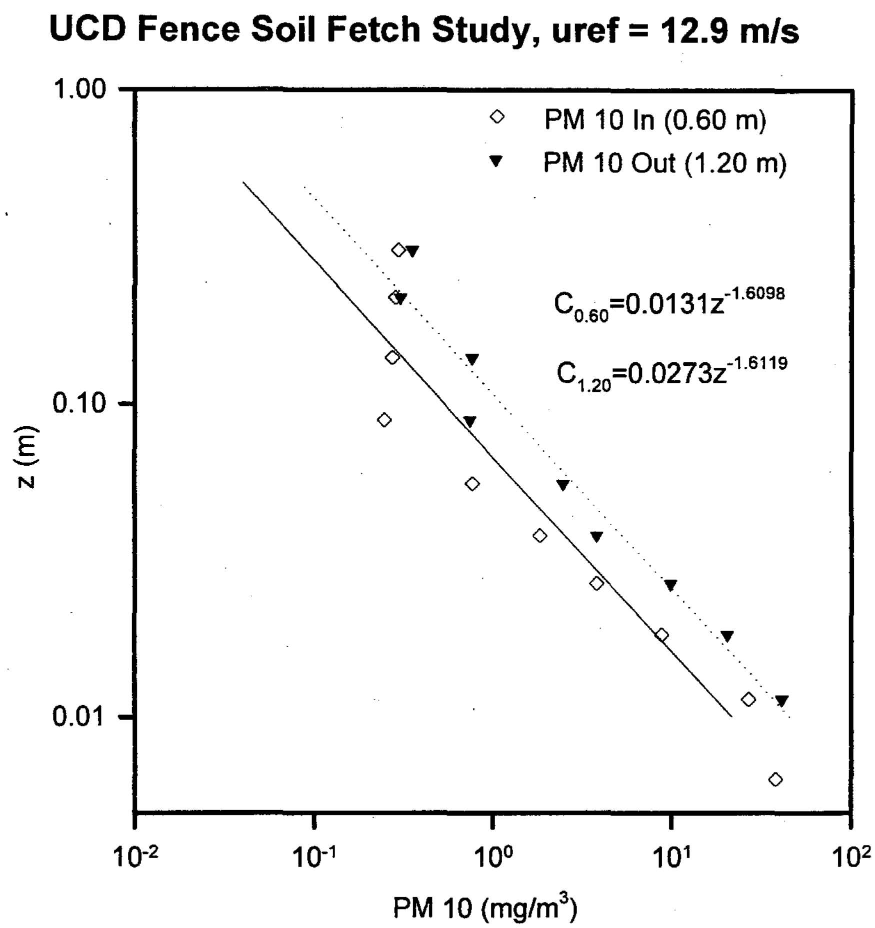


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	25.0592	
0.0114	9.4385	14.0503
0.0183	7.5797	11.7743
0.0267	2.2427	4.1620
0.0381	1.1572	2.0133
0.0559	0.3335	1.2868
0.0889	0.2547	0.5613
0.1397	0.3017	0.3897
0.2159	0.2078	0.1435
0.3048	0.1353	0.1492

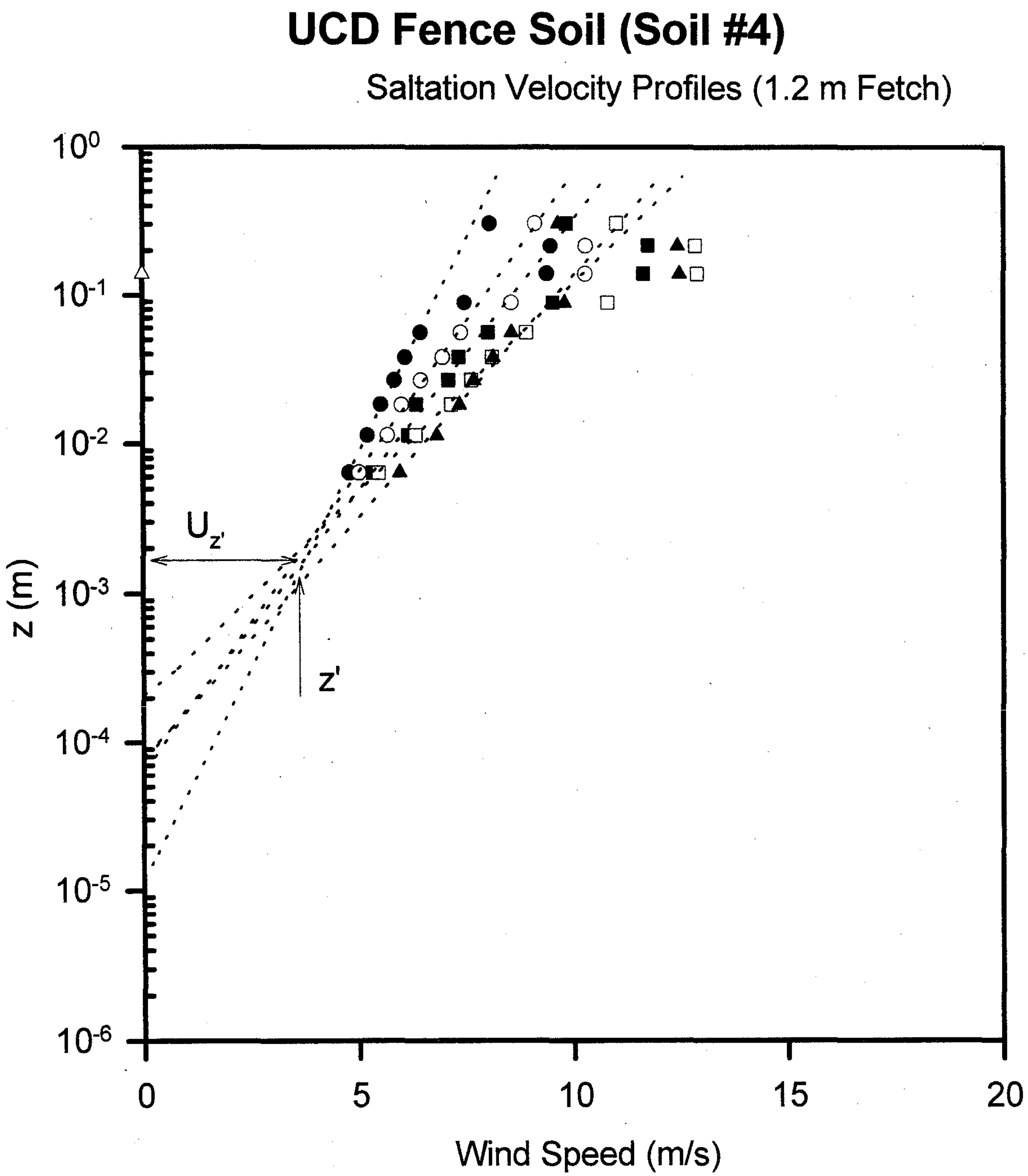
UCD Fence Soil Fetch Study, uref = 12.4 m/s

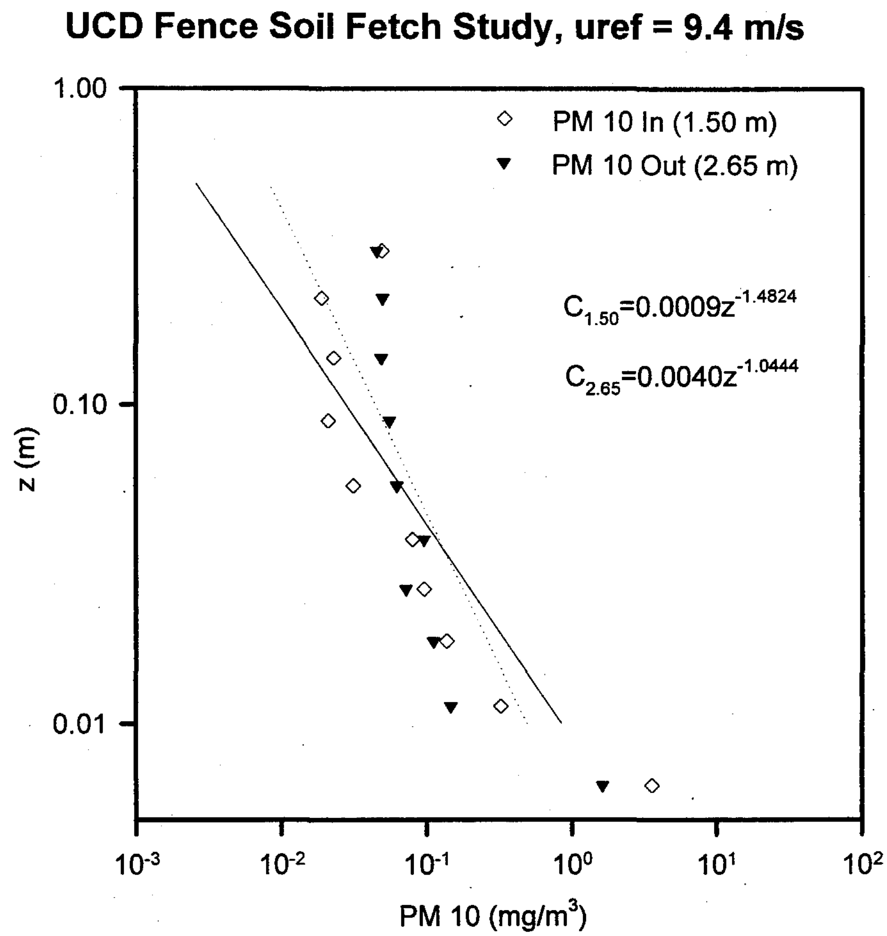


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	93.4367	
0.0114	27.7715	30.1713
0.0183	20.5950	21.4218
0.0267	8.4613	10.1405
0.0381	3.7860	5.5848
0.0559	1.8100	2.9392
0.0889	0.7015	1.1540
0.1397	0.6057	0.4602
0.2159	0.4903	0.2137
0.3048	0.4777	0.2153

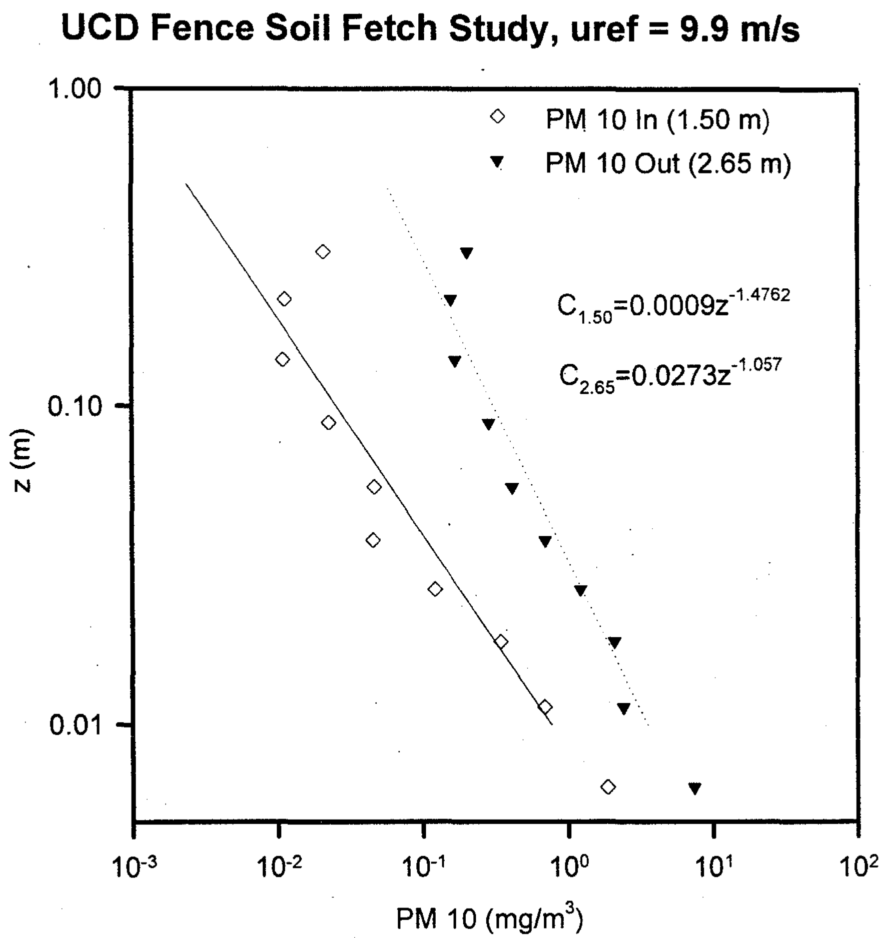


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	38.3653	
0.0114	26.8048	41.3678
0.0183	8.8093	20.4723
0.0267	3.8142	9.8698
0.0381	1.8323	3.8163
0.0559	0.7698	2.4767
0.0889	0.2462	0.7423
0.1397	0.2737	0.7652
0.2159	0.2867	0.3053
0.3048	0.2953	0.3528

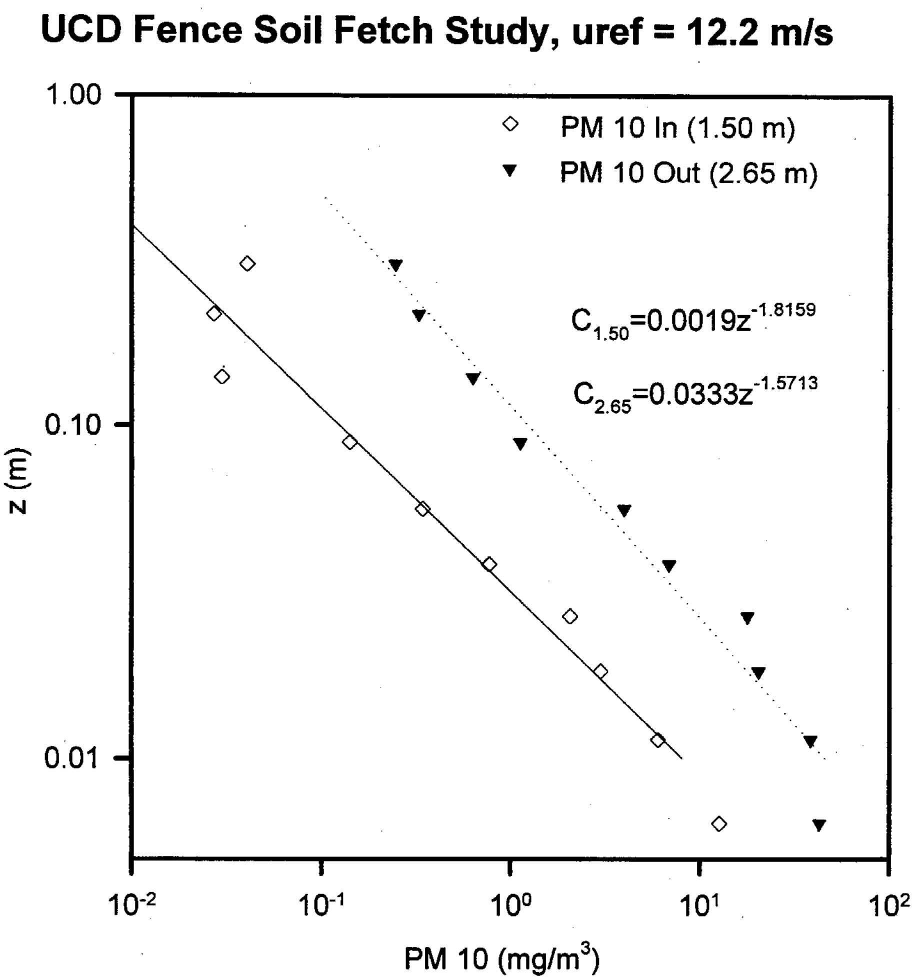

UCD Fence Soil (Soil #4)
Saltation Velocity Profiles (1.2 m Fetch)
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
z (m)
U_z'
z'
0
5
10
15
20
Wind Speed (m/s)



z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	3.5830	1.6295
0.0114	0.3245	0.1475
0.0183	0.1370	0.1115
0.0267	0.0960	0.0723
0.0381	0.0800	0.0963
0.0559	0.0315	0.0627
0.0889	0.0212	0.0558
0.1397	0.0232	0.0492
0.2159	0.0190	0.0498
0.3048	0.0493	0.0455

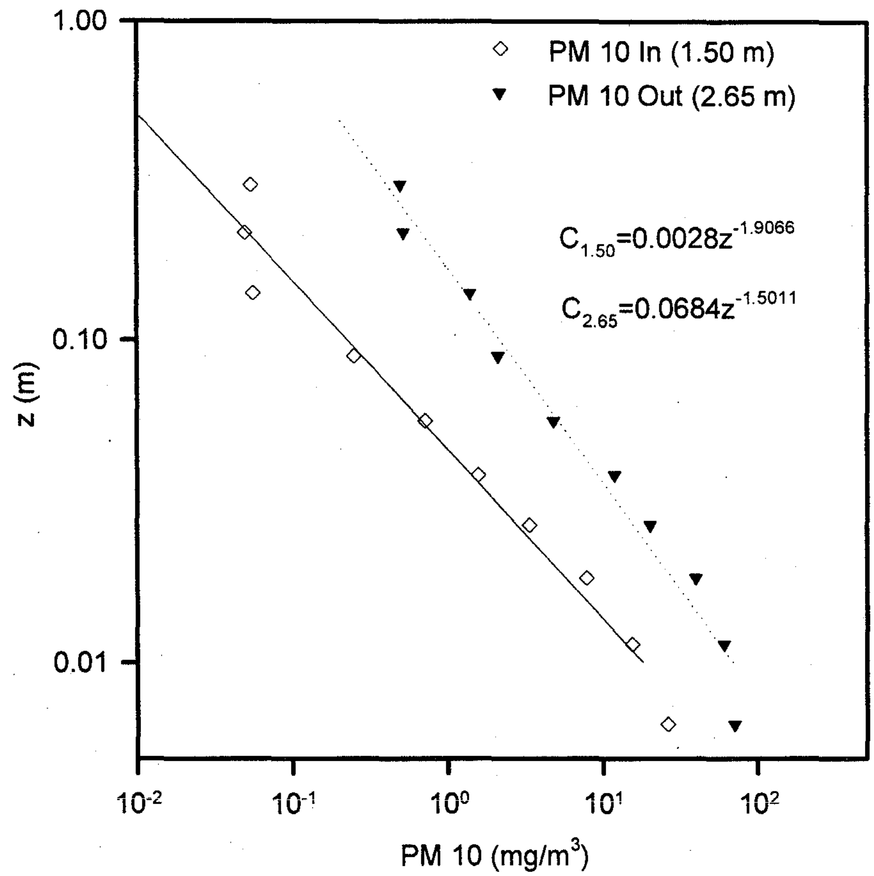


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	1.8687	7.4107
0.0114	0.6875	2.4220
0.0183	0.3442	2.0857
0.0267	0.1220	1.2252
0.0381	0.0458	0.7015
0.0559	0.0465	0.4143
0.0889	0.0228	0.2878
0.1397	0.0110	0.1695
0.2159	0.0113	0.1580
0.3048	0.0210	0.2050



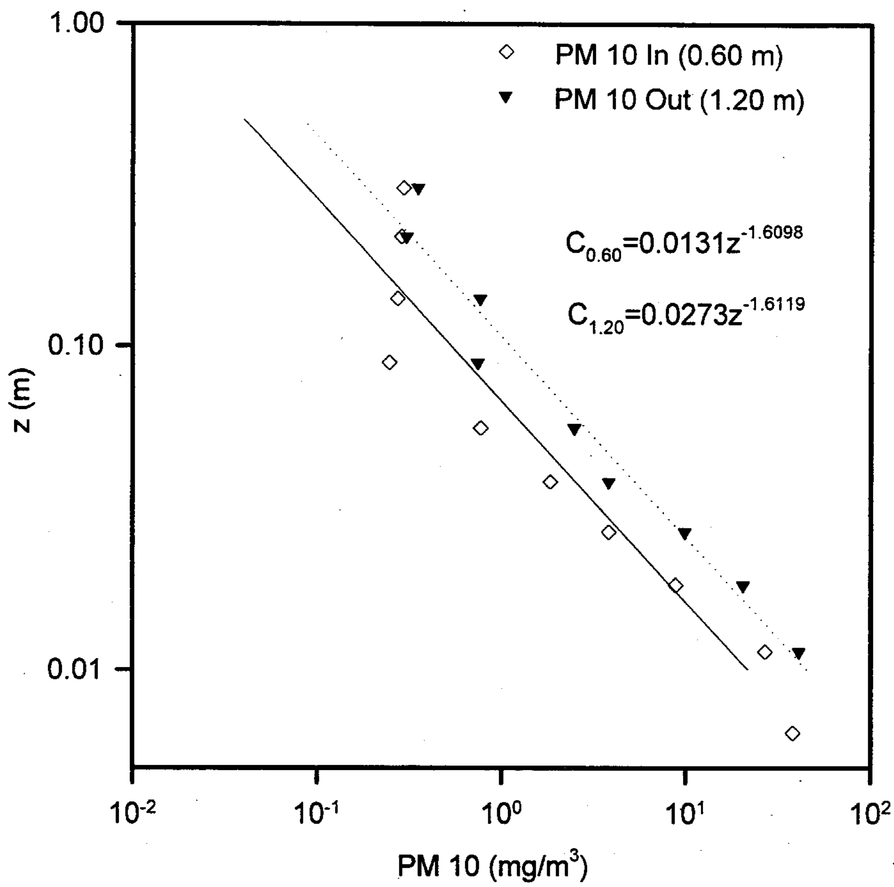
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	12.6830	43.0245
0.0114	6.0160	38.4702
0.0183	2.9972	20.4593
0.0267	2.0652	17.8657
0.0381	0.7710	6.8898
0.0559	0.3428	3.9920
0.0889	0.1410	1.1257
0.1397	0.0298	0.6315
0.2159	0.0270	0.3270
0.3048	0.0405	0.2457

UCD Fence Soil Fetch Study, uref =12.9 m/s

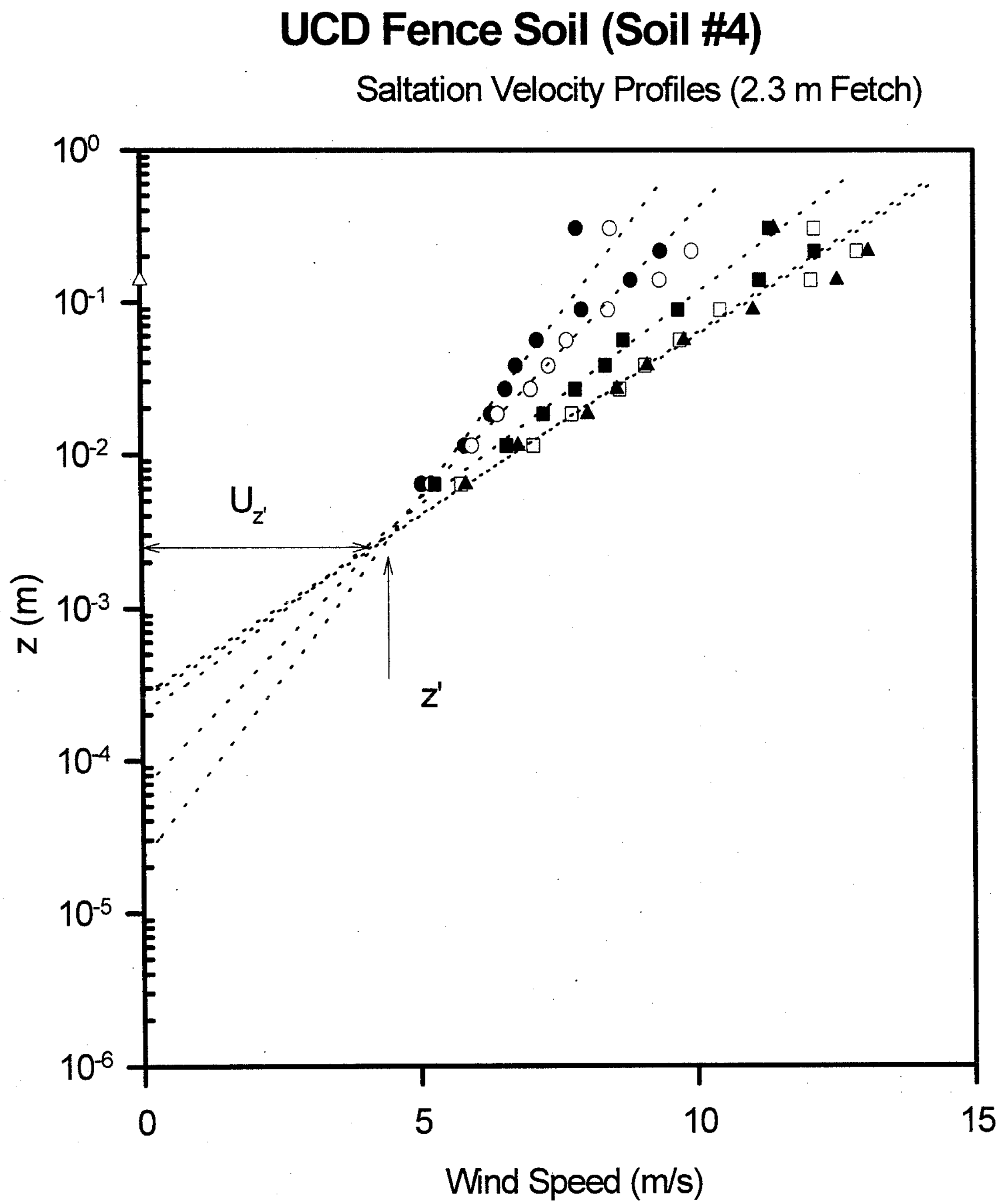


z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	26.0258	70.0990
0.0114	15.4530	60.4150
0.0183	7.8353	39.5763
0.0267	3.3597	20.2573
0.0381	1.5718	11.8832
0.0559	0.7185	4.8493
0.0889	0.2500	2.1205
0.1397	0.0557	1.3907
0.2159	0.0498	0.5233
0.3048	0.0538	0.4963

UCD Fence Soil Fetch Study, uref = 12.9 m/s



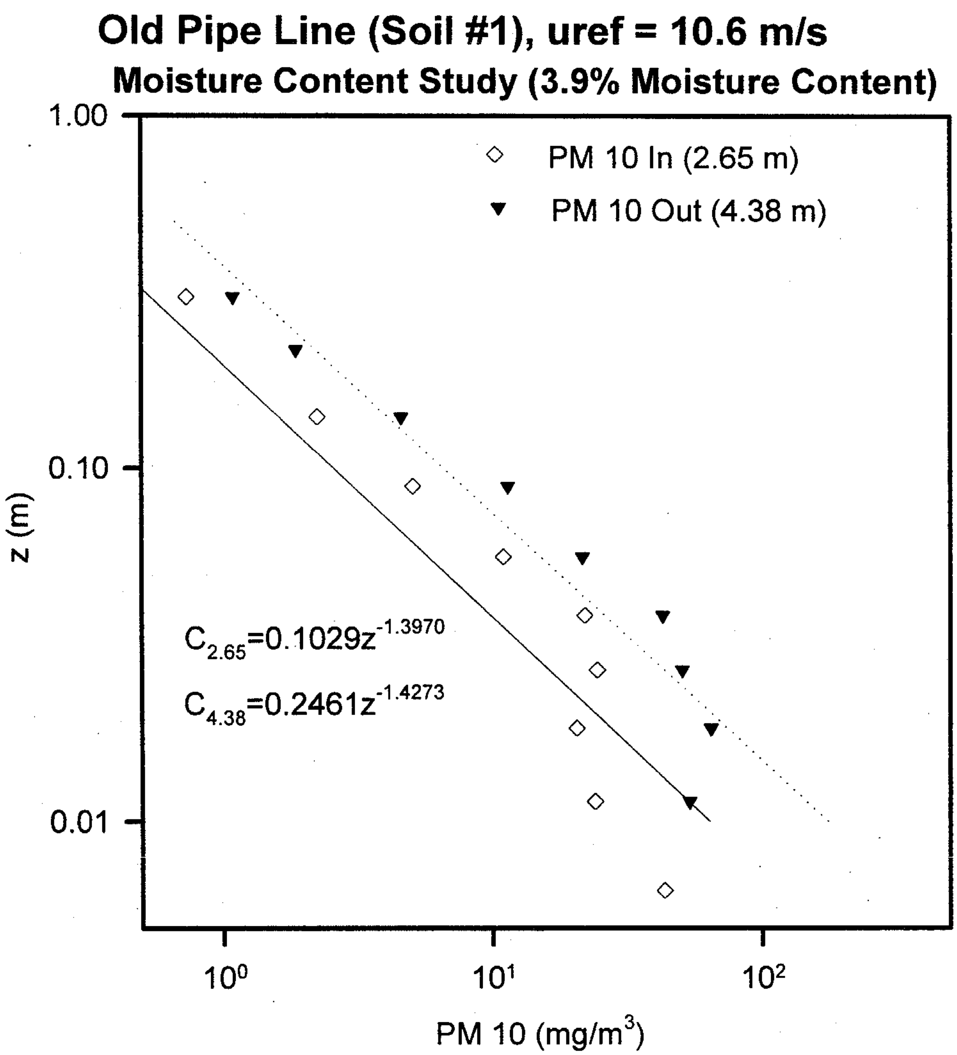
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	38.3653	
0.0114	26.8048	41.3678
0.0183	8.8093	20.4723
0.0267	3.8142	9.8698
0.0381	1.8323	3.8163
0.0559	0.7698	2.4767
0.0889	0.2462	0.7423
0.1397	0.2737	0.7652
0.2159	0.2867	0.3053
0.3048	0.2953	0.3528



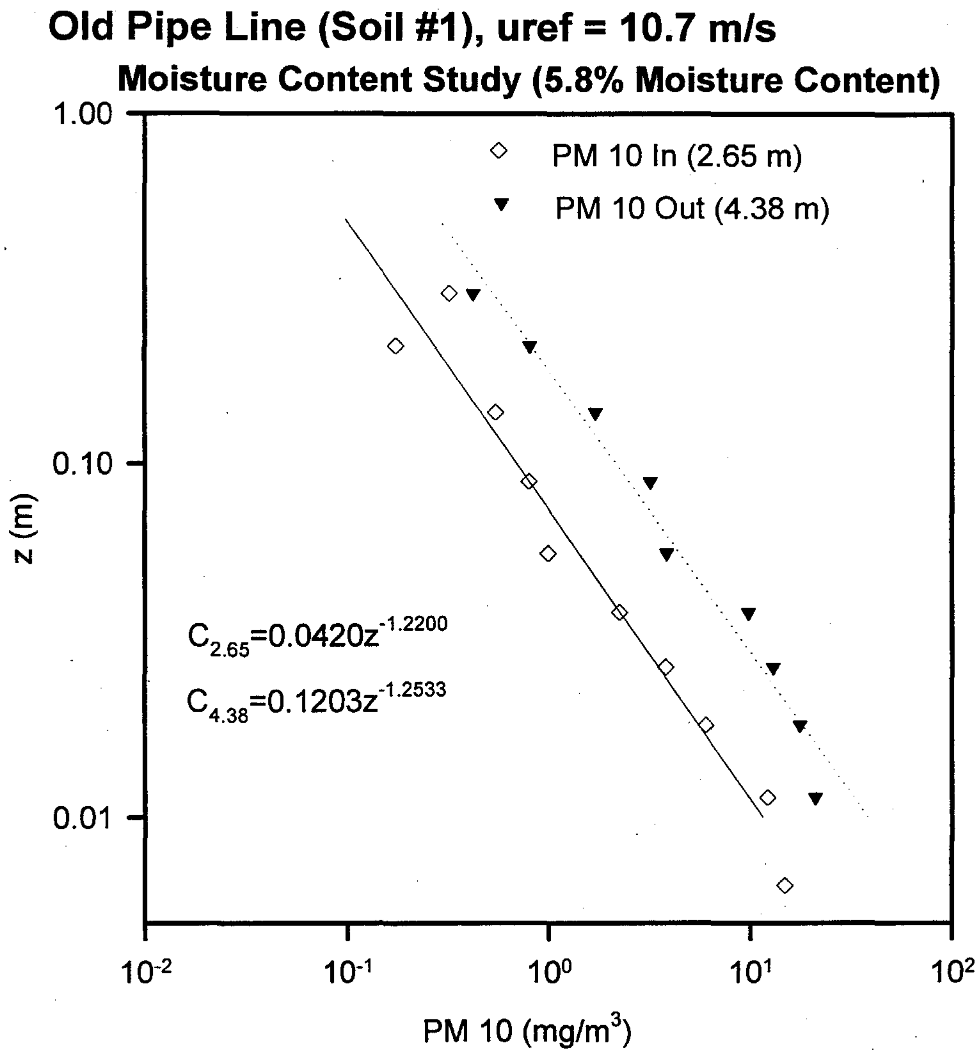
UCD Fence Soil (Soil #4)
Saltation Velocity Profiles (2.3 m Fetch)
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
z (m)
U_z'
z'
0
5
10
15
Wind Speed (m/s)

Appendix D:

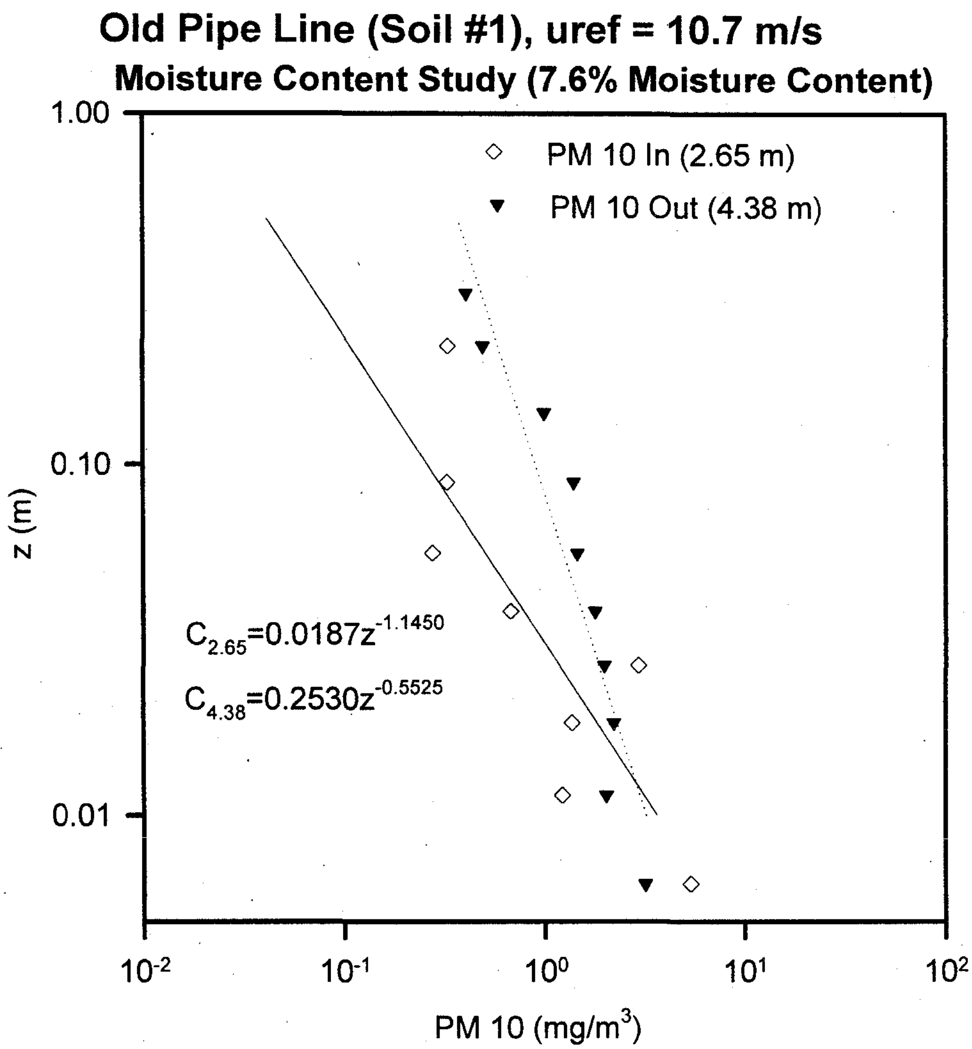
Moisture Content Study Concentration Profiles
and
Velocity Profiles (not in text)



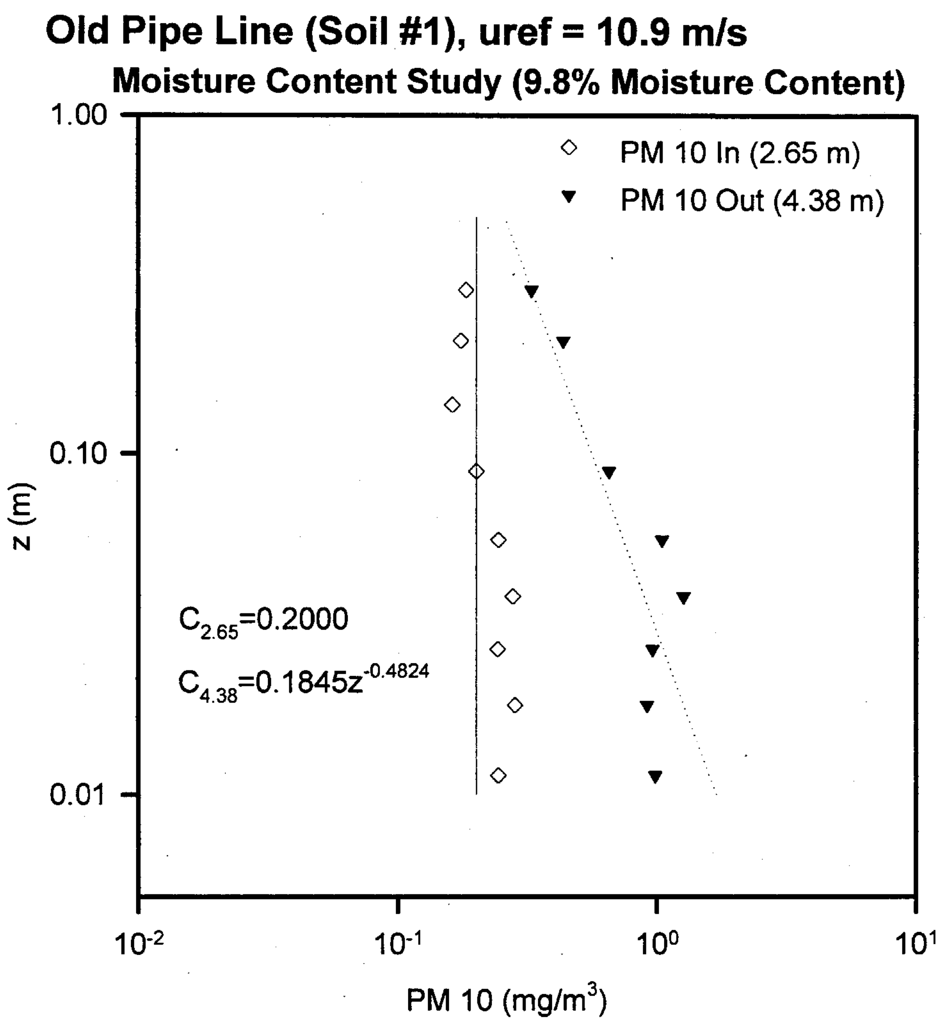
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	43.3812	
0.0114	23.9690	53.8317
0.0183	20.5368	64.6778
0.0267	24.4980	50.5862
0.0381	22.0378	42.8165
0.0559	10.9817	21.6312
0.0889	5.0615	11.4407
0.1397	2.2332	4.5857
0.2159	0.3587	1.8647
0.3048	0.7342	1.0907



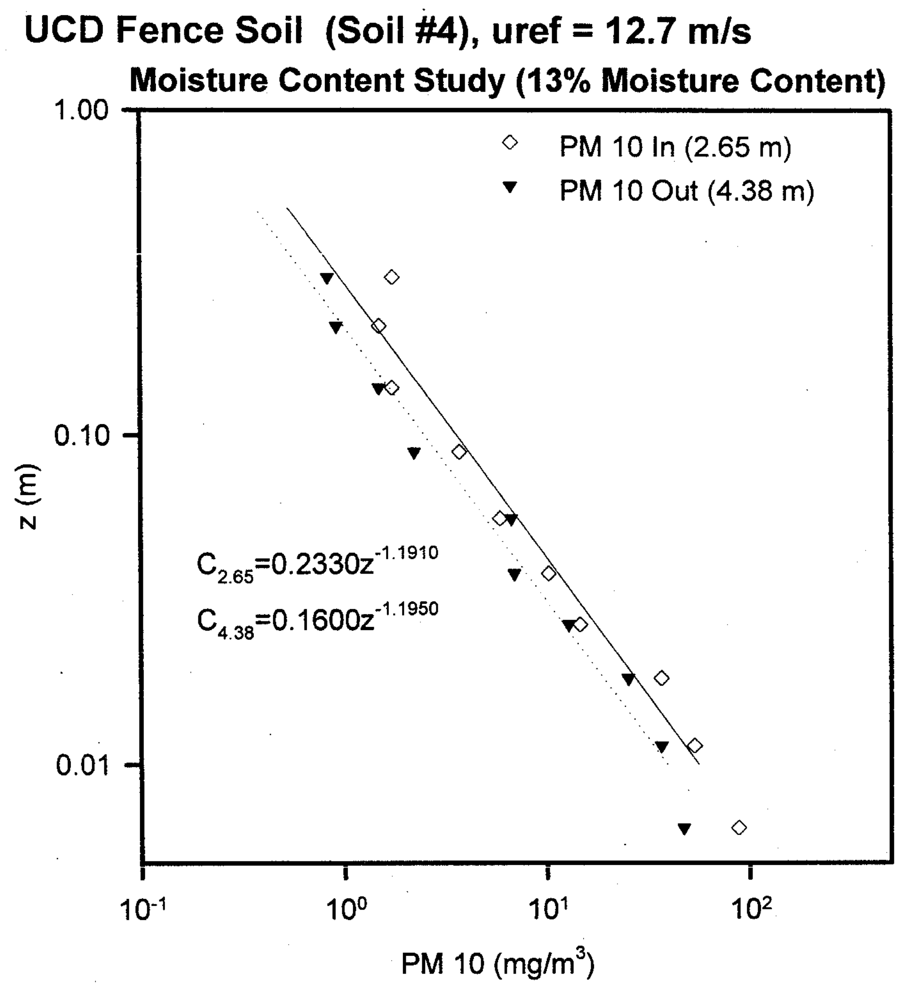
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	14.8547	
0.0114	12.1547	21.0293
0.0183	6.0200	17.6618
0.0267	3.7747	12.9590
0.0381	2.2395	9.7878
0.0559	0.9955	3.8503
0.0889	0.7977	3.1827
0.1397	0.5470	1.7062
0.2159	0.1738	0.8060
0.3048	0.3213	0.4237



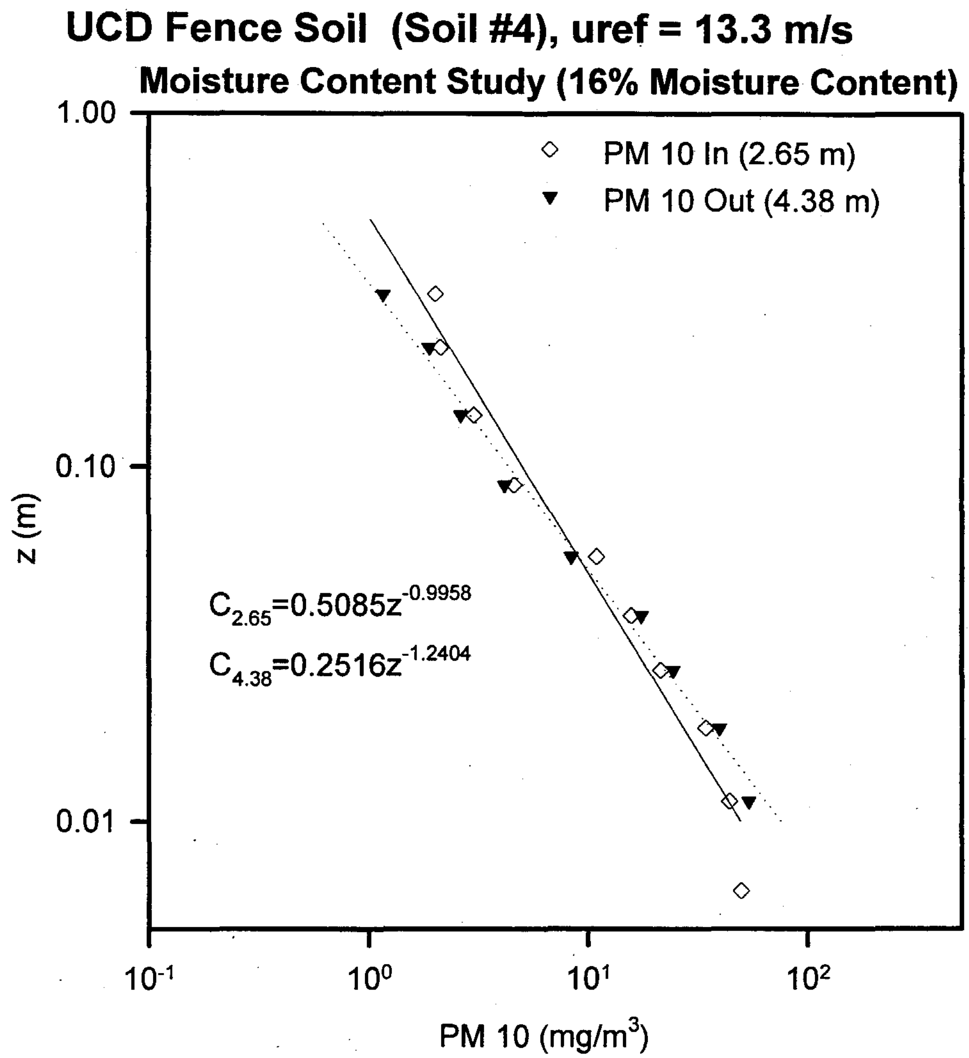
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	5.3880	3.1862
0.0114	1.2212	2.0352
0.0183	1.3680	2.2237
0.0267	2.9413	2.0008
0.0381	0.6773	1.7905
0.0559	0.2770	1.4590
0.0889	0.3275	1.4020
0.1397		0.9983
0.2159	0.3312	0.4965
0.3048		0.4072



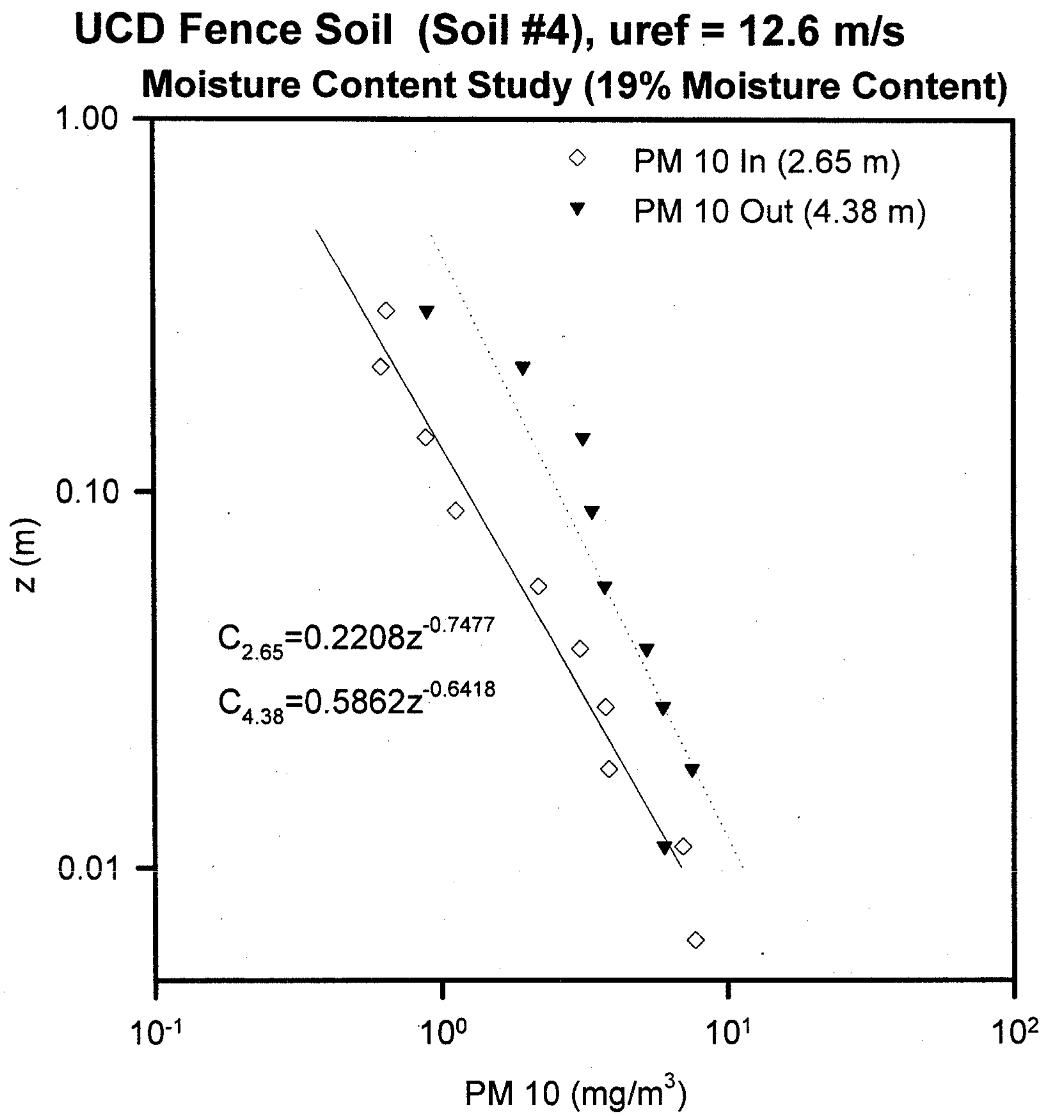
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		
0.0114	0.2435	0.9870
0.0183	0.2823	0.9170
0.0267	0.2422	0.9603
0.0381	0.2767	1.2687
0.0559	0.2433	1.0450
0.0889	0.2003	0.6515
0.1397	0.1618	
0.2159	0.1748	0.4338
0.3048	0.1828	0.3273



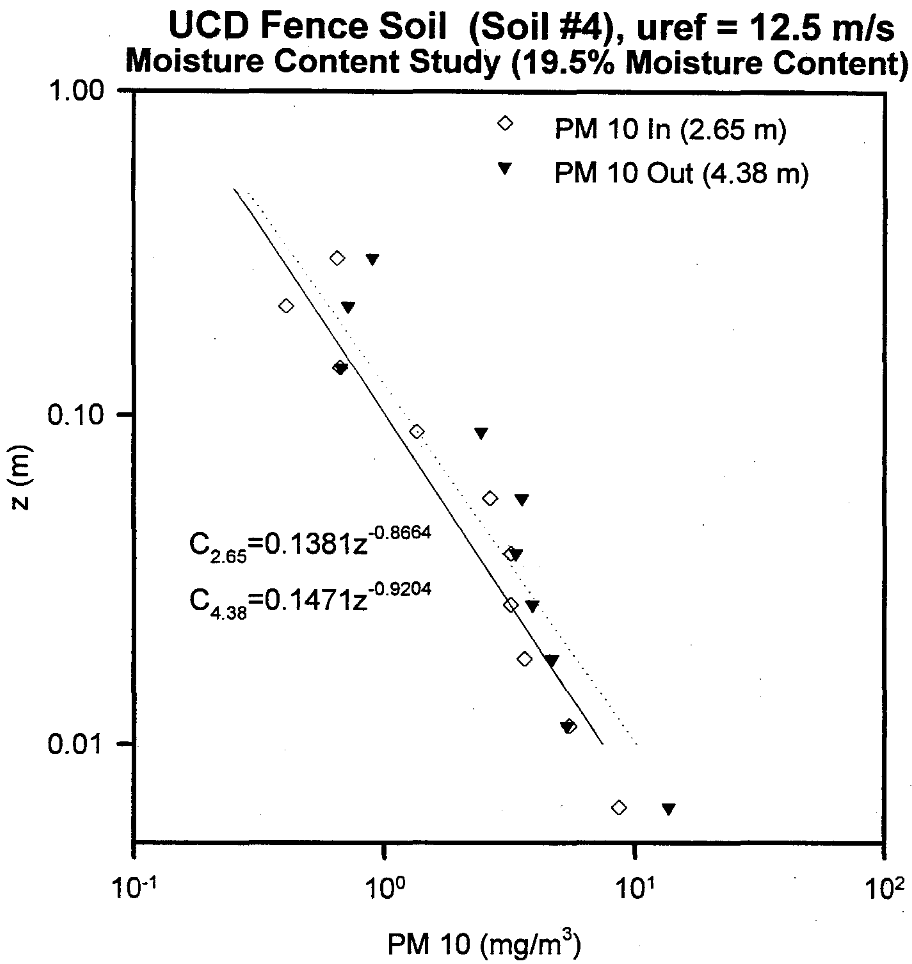
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	87.9263	47.3177
0.0114	53.2815	36.5950
0.0183	36.6187	25.1873
0.0267	14.5422	12.8017
0.0381	10.1978	6.9348
0.0559	5.8973	6.7003
0.0889	3.7203	2.2323
0.1397	1.7315	1.4930
0.2159	1.4992	0.9228
0.3048	1.7455	0.8347



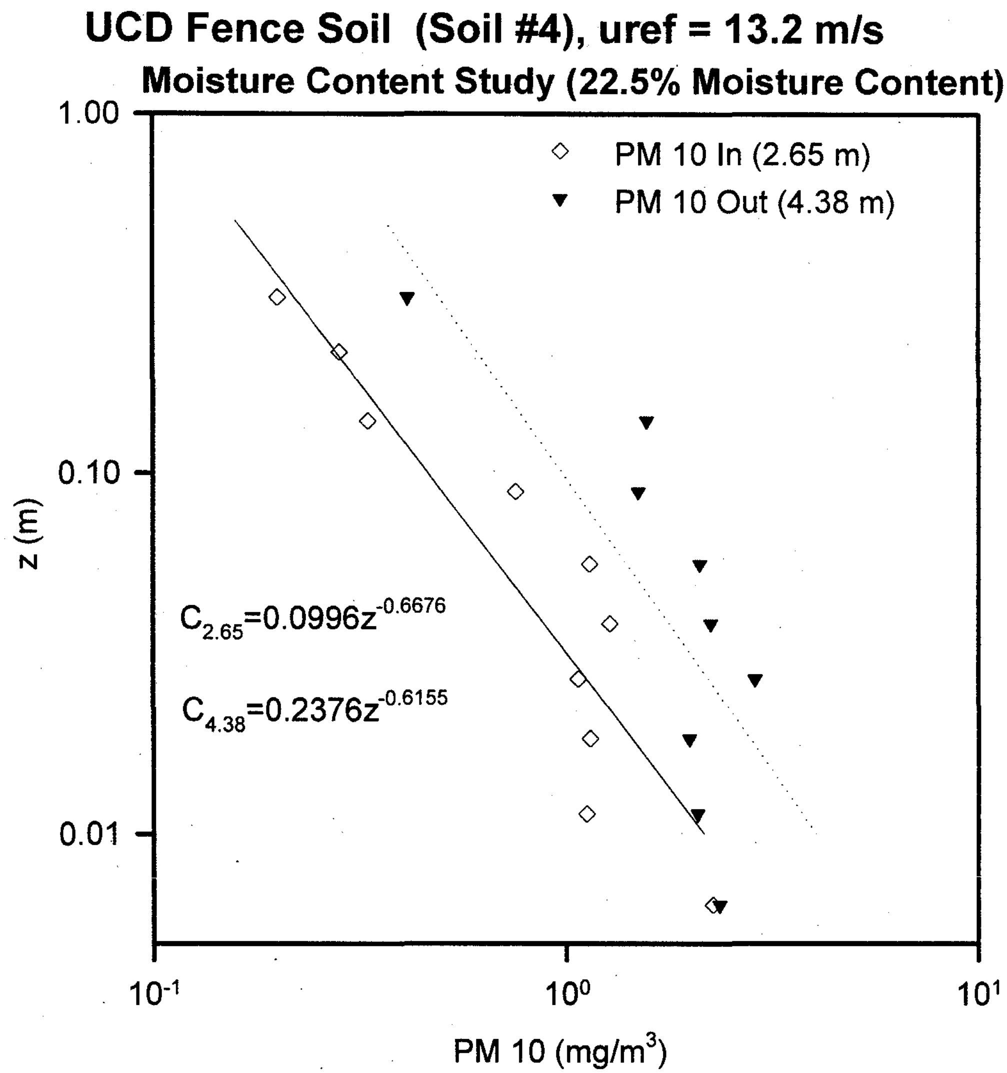
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	49.7905	-------
0.0114	44.1972	54.1072
0.0183	34.3097	39.7012
0.0267	21.4520	24.4382
0.0381	15.7122	17.4458
0.0559	10.8927	8.3698
0.0889	4.5975	4.1707
0.1397	3.0100	2.6280
0.2159	2.1222	1.8828
0.3048	2.0135	1.1698



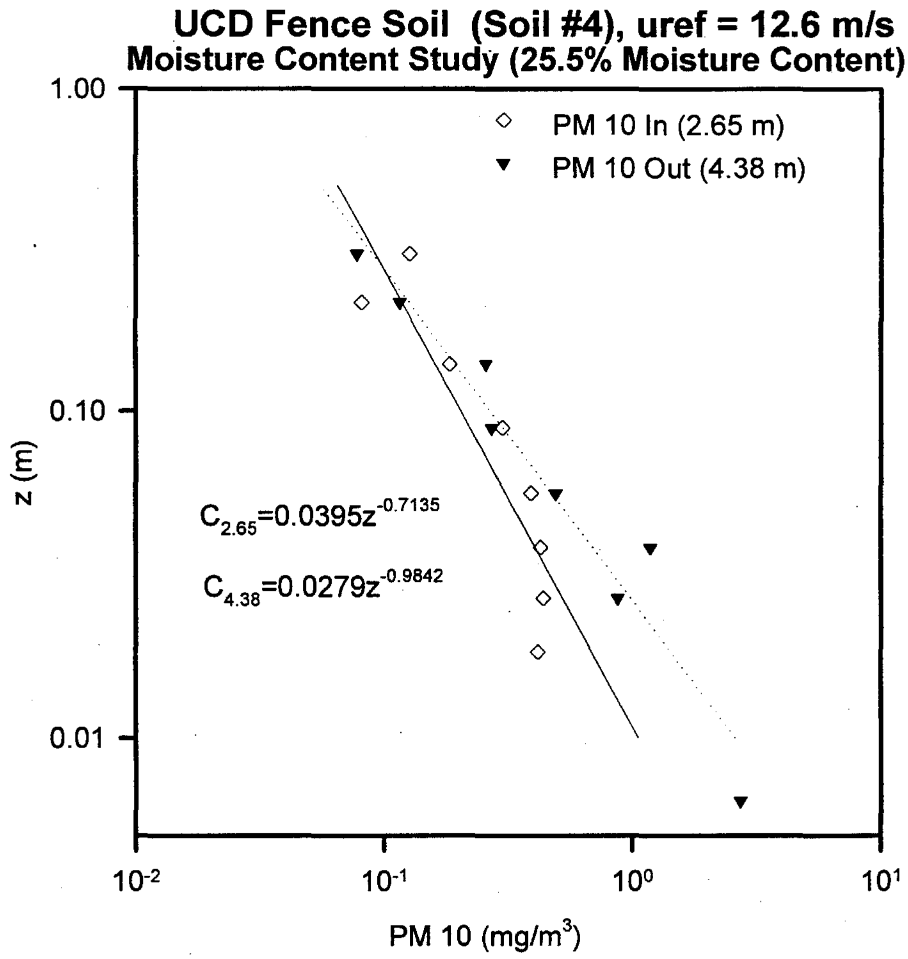
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	7.6932	
0.0114	6.9843	6.0082
0.0183	3.8438	7.5105
0.0267	3.7393	5.9610
0.0381	3.0510	5.2258
0.0559	2.1862	3.7345
0.0889	1.1275	3.3800
0.1397	0.8857	3.1442
0.2159	0.6193	1.9437
0.3048	0.6482	0.8977



z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	8.6580	13.6938
0.0114	5.4703	5.3535
0.0183	3:6385	4.6993
0.0267	3.2005	3.9043
0.0381	3.2053	3.3470
0.0559	2.6550	3.5550
0.0889	1.3508	2.4437
0.1397	0.6645	0.6712
0.2159	0.4057	0.7190
0.3048	0.6482	0.8977



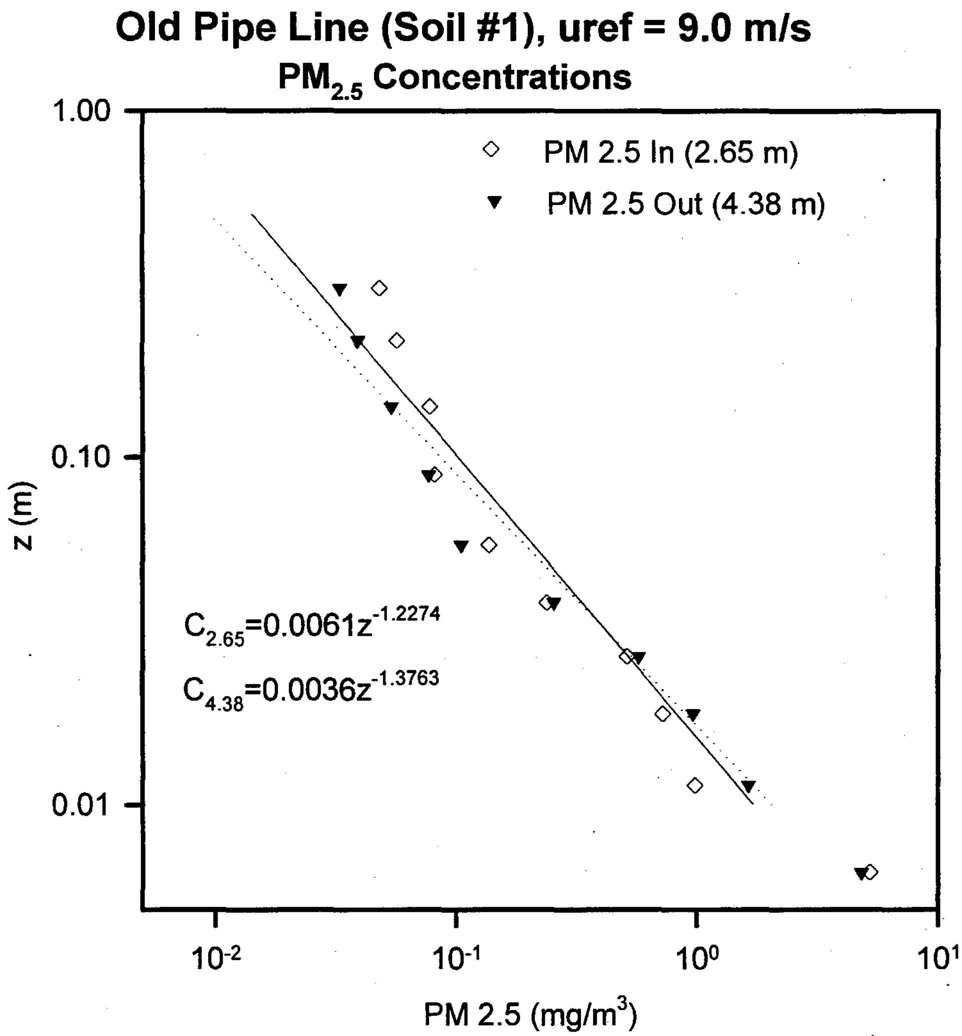
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3	2.2632	2.3492
0.0114	1.1183	2.0768
0.0183	1.1415	1.9828
0.0267	1.0687	2.8660
0.0381	1.2750	2.2378
0.0559	1.1378	2.1033
0.0889	0.7545	1.4955
0.1397	0.3300	1.5660
0.2159	0.2825	
0.3048	0.1998	0.4140



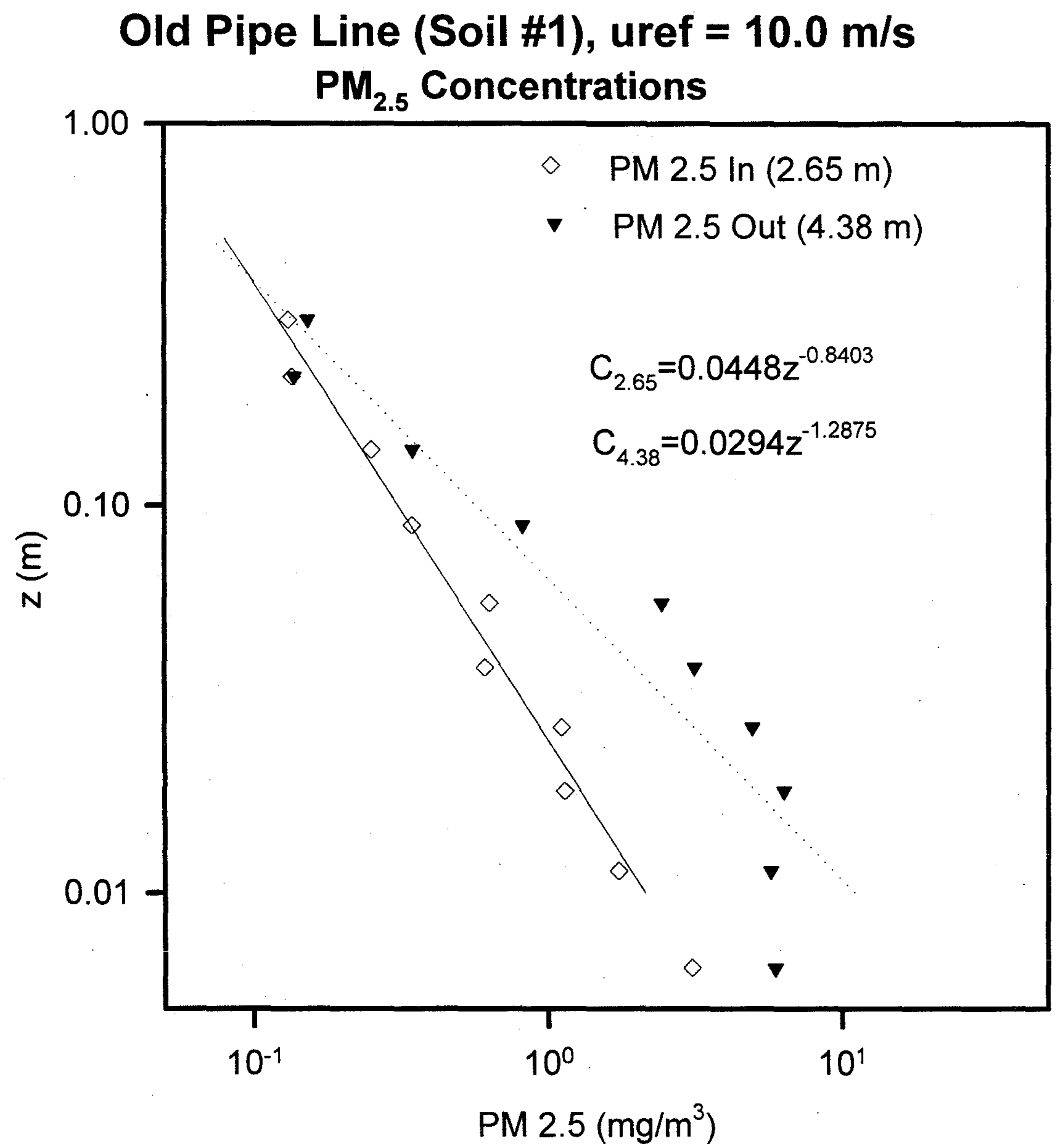
z, Height (m)	IN PM_{10} (mg/m^3)	Out PM_{10} (mg/m^3)
6.4000e-3		2.7145
0.0114		
0.0183	0.4172	
0.0267	0.4377	0.8745
0.0381	0.4268	1.1815
0.0559	0.3917	0.4933
0.0889	0.2992	0.2718
0.1397	0.1845	0.2573
0.2159	0.0808	0.1155
0.3048	0.1267	0.0775

Appendix E:

PM$_{2.5}$ Study Concentration Profiles
and
Velocity Profiles (not in text)



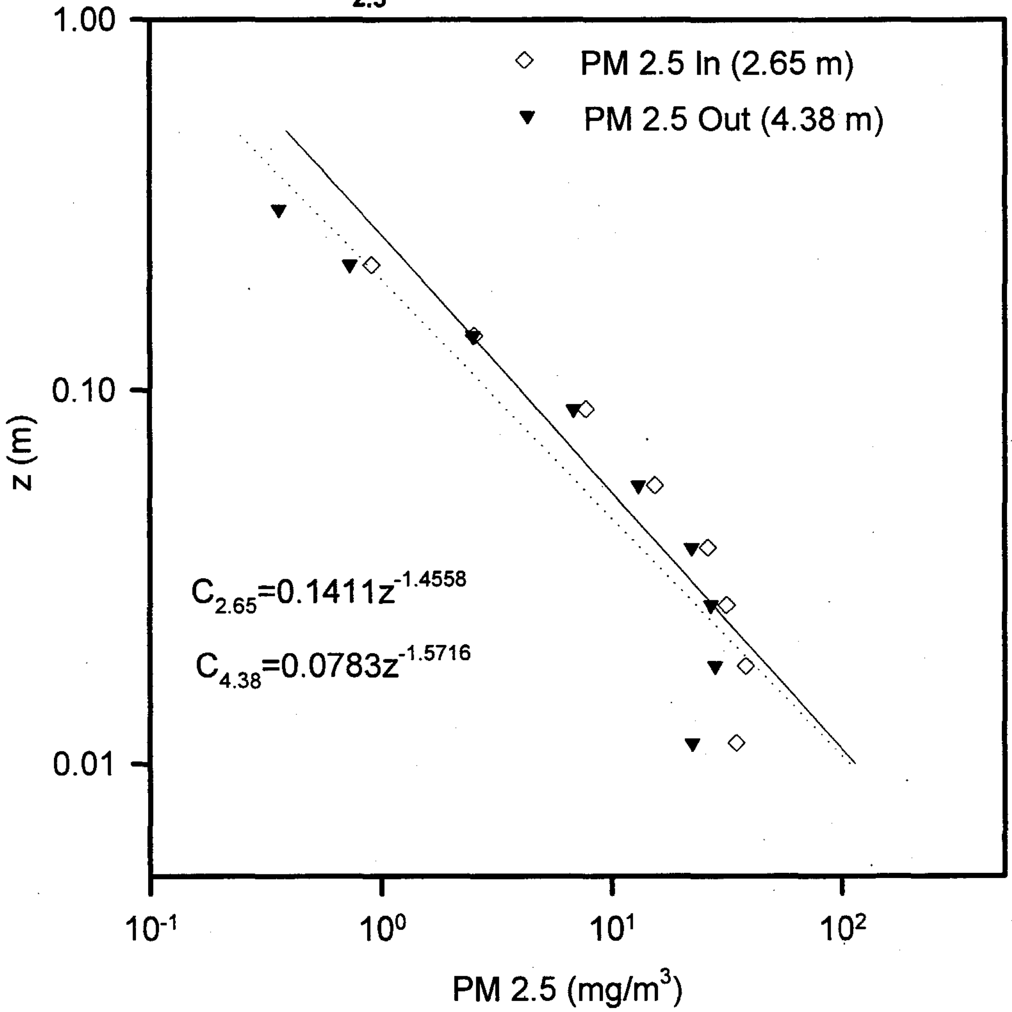
z, Height (m)	IN $PM_{2.5}$ (mg/m^3)	Out $PM_{2.5}$ (mg/m^3)
6.4000e-3	5.2250	4.8218
0.0114	0.9857	1.6472
0.0183	0.7225	0.9655
0.0267	0.5110	0.5723
0.0381	0.2375	0.2548
0.0559	0.1365	0.1048
0.0889	0.0815	0.0772
0.1397	0.0777	0.0540
0.2159	0.0567	0.0392
0.3048	0.0482	0.0330



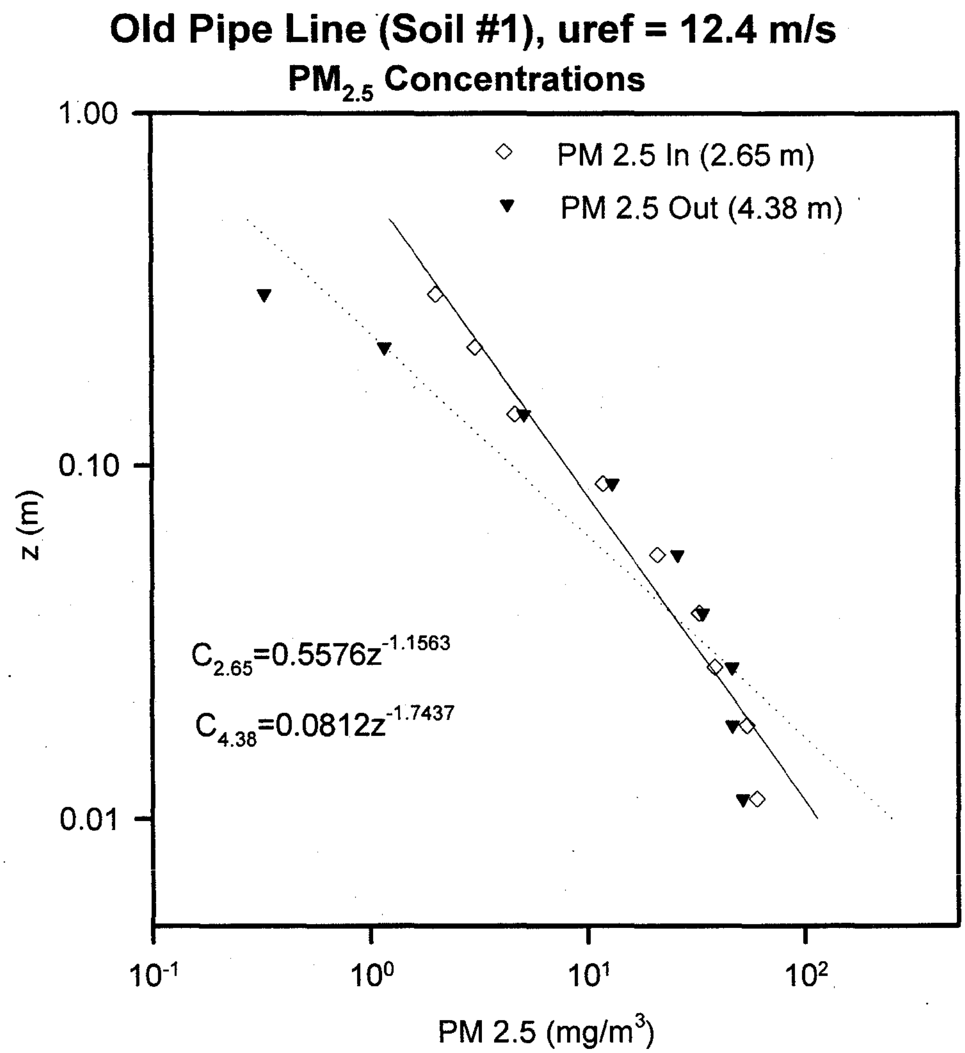
z, Height (m)	IN $PM_{2.5}$ (mg/m^3)	Out $PM_{2.5}$ (mg/m^3)
6.4000e-3	3.0787	5.9258
0.0114	1.7412	5.7350
0.0183	1.1428	6.3633
0.0267	1.1145	4.9635
0.0381	0.6118	3.1528
0.0559	0.6340	2.4417
0.0889	0.3445	0.8208
0.1397	0.2510	0.3470
0.2159	0.1352	0.1375
0.3048	0.1312	0.1530

Old Pipe Line (Soil #1), uref = 11.3 m/s

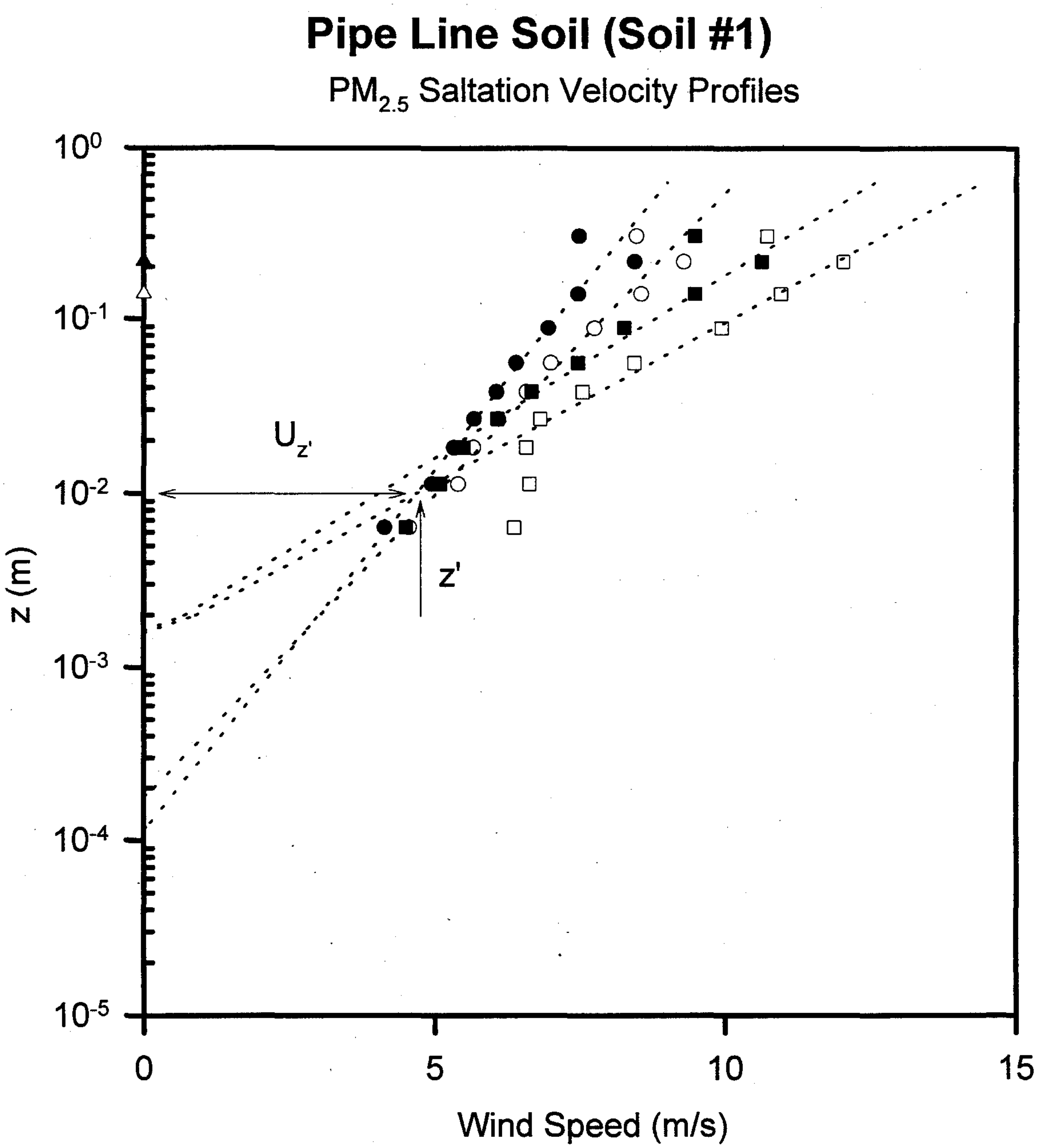
$PM_{2.5}$ Concentrations



z, Height (m)	IN $PM_{2.5}$ (mg/m^3)	Out $PM_{2.5}$ (mg/m^3)
6.4000e-3		
0.0114	34.9403	22.5098
0.0183	38.2895	28.2342
0.0267	31.4648	26.9688
0.0381	26.1910	22.2578
0.0559	15.3653	13.0180
0.0889	7.7365	6.8495
0.1397	2.5337	2.5058
0.2159	0.9068	0.7313
0.3048		0.3610

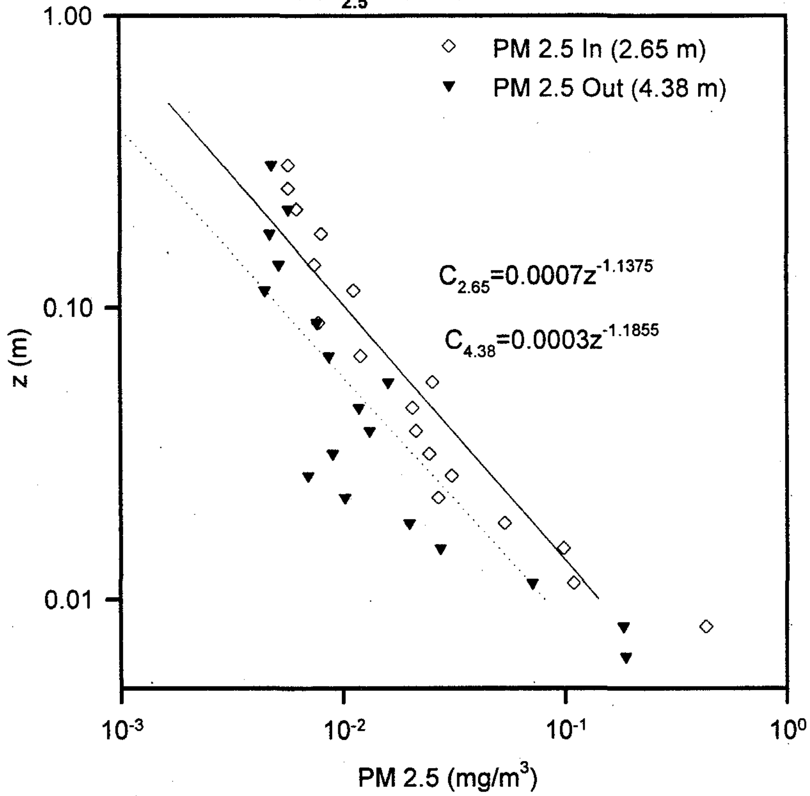


z, Height (m)	IN $PM_{2.5}$ (mg/m^3)	Out $PM_{2.5}$ (mg/m^3)
6.4000e-3		
0.0114	59.4900	51.1940
0.0183	53.8145	46.2382
0.0267	38.2092	45.8965
0.0381	32.5972	33.7972
0.0559	20.9163	25.8642
0.0889	11.8188	13.0515
0.1397	4.6498	5.1162
0.2159	3.0510	1.1725
0.3048	2.0215	0.3298

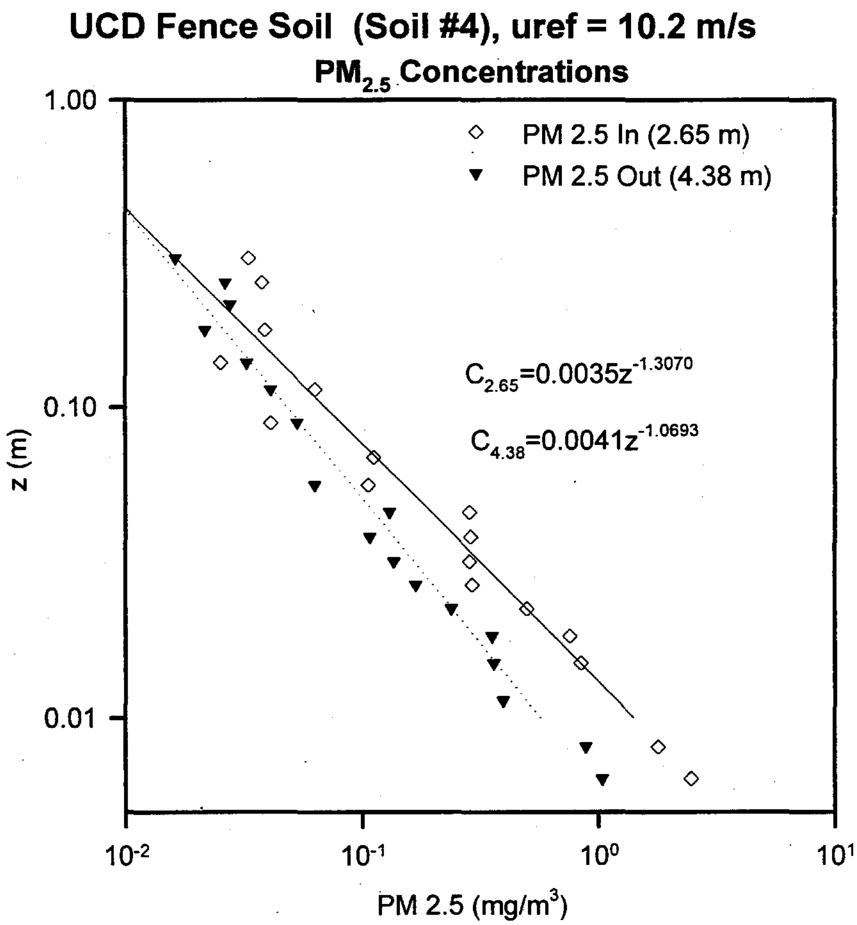

Pipe Line Soil (Soil #1)
PM2.5 Saltation Velocity Profiles
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
z (m)
U_z'
z'
0
5
10
15
Wind Speed (m/s)

UCD Fence Soil (Soil #4), uref = 8.1 m/s

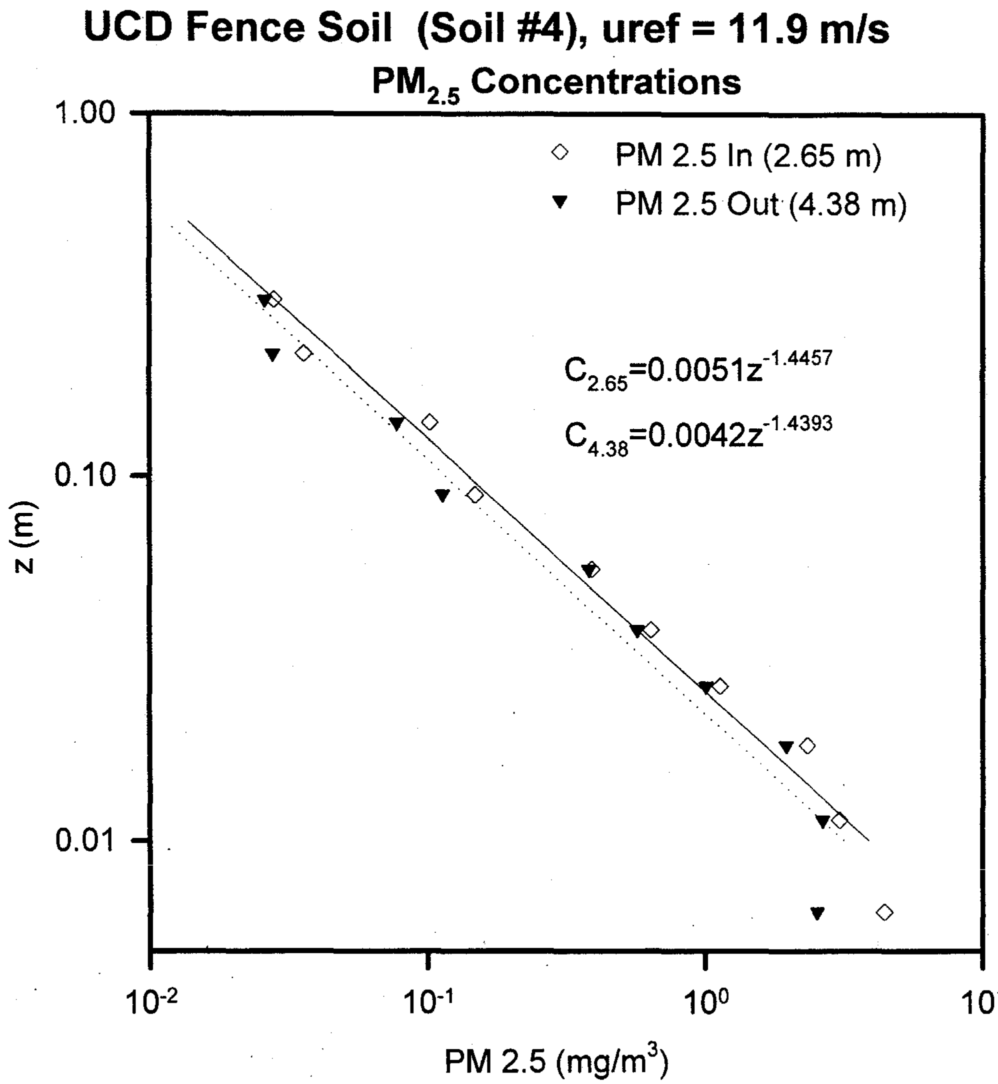
$PM_{2.5}$ Concentrations



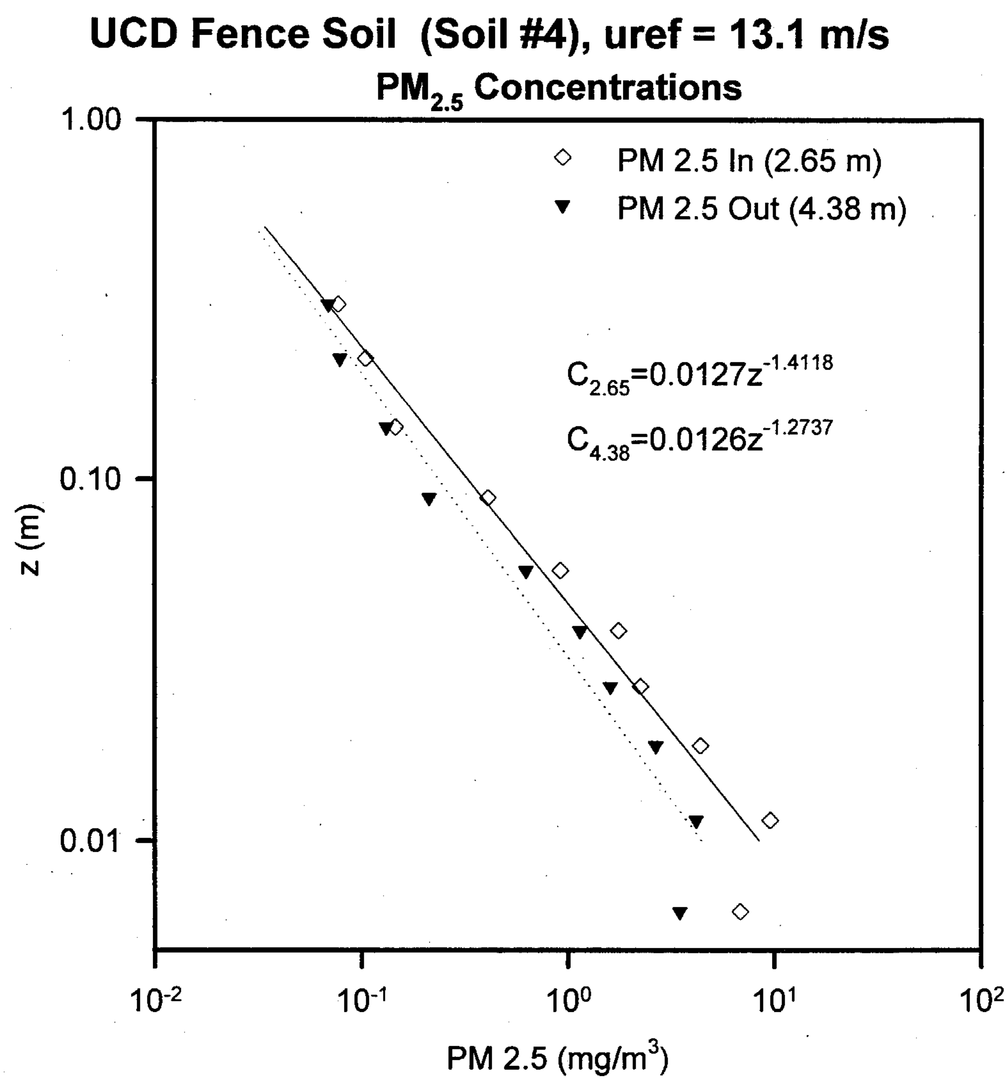
z, Height (m)	IN $PM_{2.5}$ (mg/m^3)	Out $PM_{2.5}$ (mg/m^3)
6.4000e-3		0.1875
8.1000e-3	0.4315	0.1832
0.0114	0.1092	0.0712
0.0150	0.0978	0.0273
0.0183	0.0530	0.0198
0.0224	0.0267	0.0102
0.0267	0.0307	7.0000e-3
0.0318	0.0243	9.0000e-3
0.0381	0.0213	0.0132
0.0457	0.0205	0.0118
0.0559	0.0252	0.0160
0.0686	0.0120	8.7000e-3
0.0889	7.8000e-3	7.7000e-3
0.1143	0.0112	4.5000e-3
0.1397	7.5000e-3	5.2000e-3
0.1778	8.0000e-3	4.7000e-3
0.2159	6.2000e-3	5.7000e-3
0.2540	5.7000e-3	
0.3048	5.7000e-3	4.8000e-3



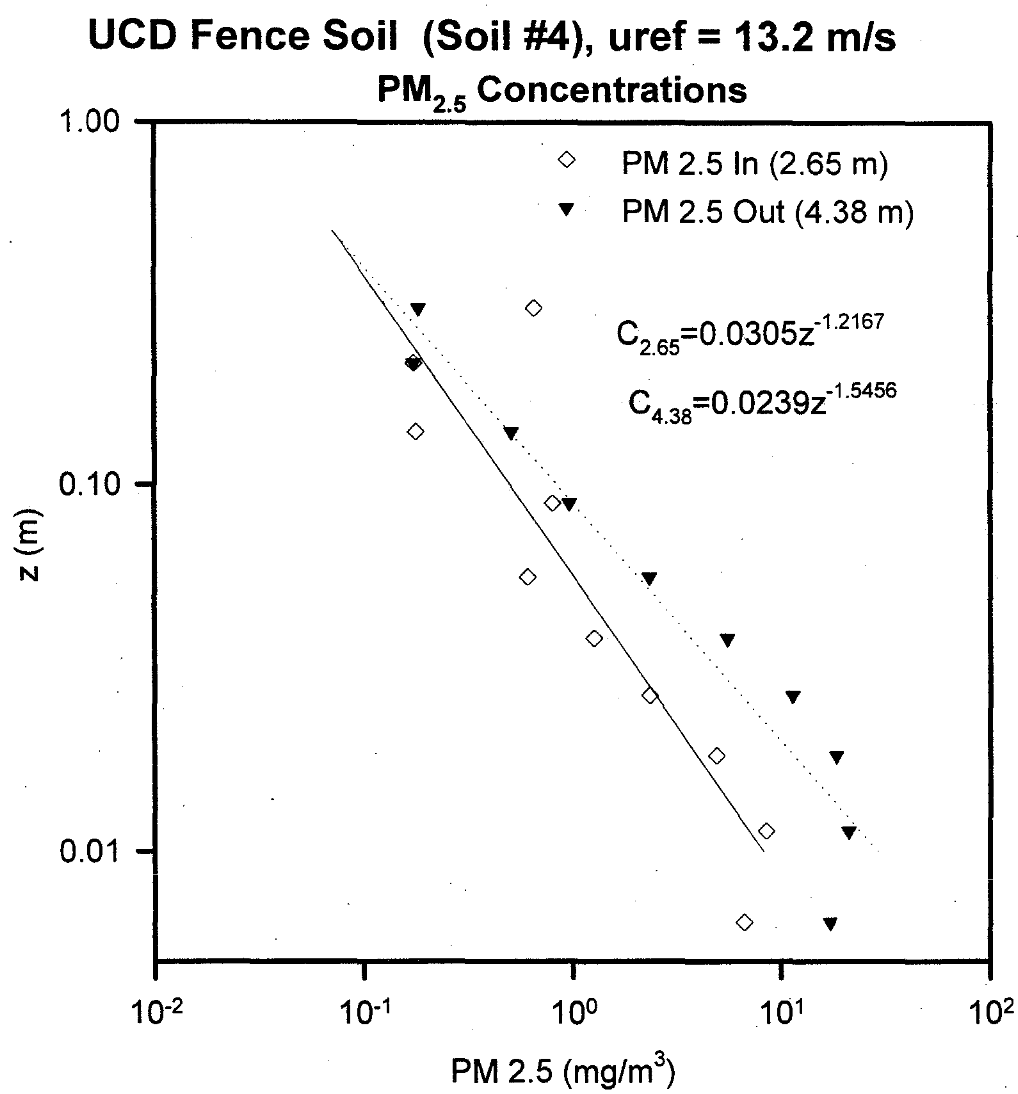
z, Height (m)	IN $PM_{2.5}$ (mg/m³)	Out $PM_{2.5}$ (mg/m³)
6.4000e-3	2.4767	1.0393
8.1000e-3	1.7935	0.8840
0.0114		0.3930
0.0150	0.8413	0.3587
0.0183	0.7552	0.3538
0.0224	0.4955	0.2375
0.0267	0.2905	0.1683
0.0318	0.2832	0.1362
0.0381	0.2857	0.1073
0.0457	0.2830	0.1303
0.0559	0.1060	0.0630
0.0686	0.1118	
0.0889	0.0412	0.0533
0.1143	0.0635	0.0413
0.1397	0.0252	0.0325
0.1778	0.0388	0.0217
0.2159		0.0277
0.2540	0.0378	0.0265
0.3048	0.0332	0.0163



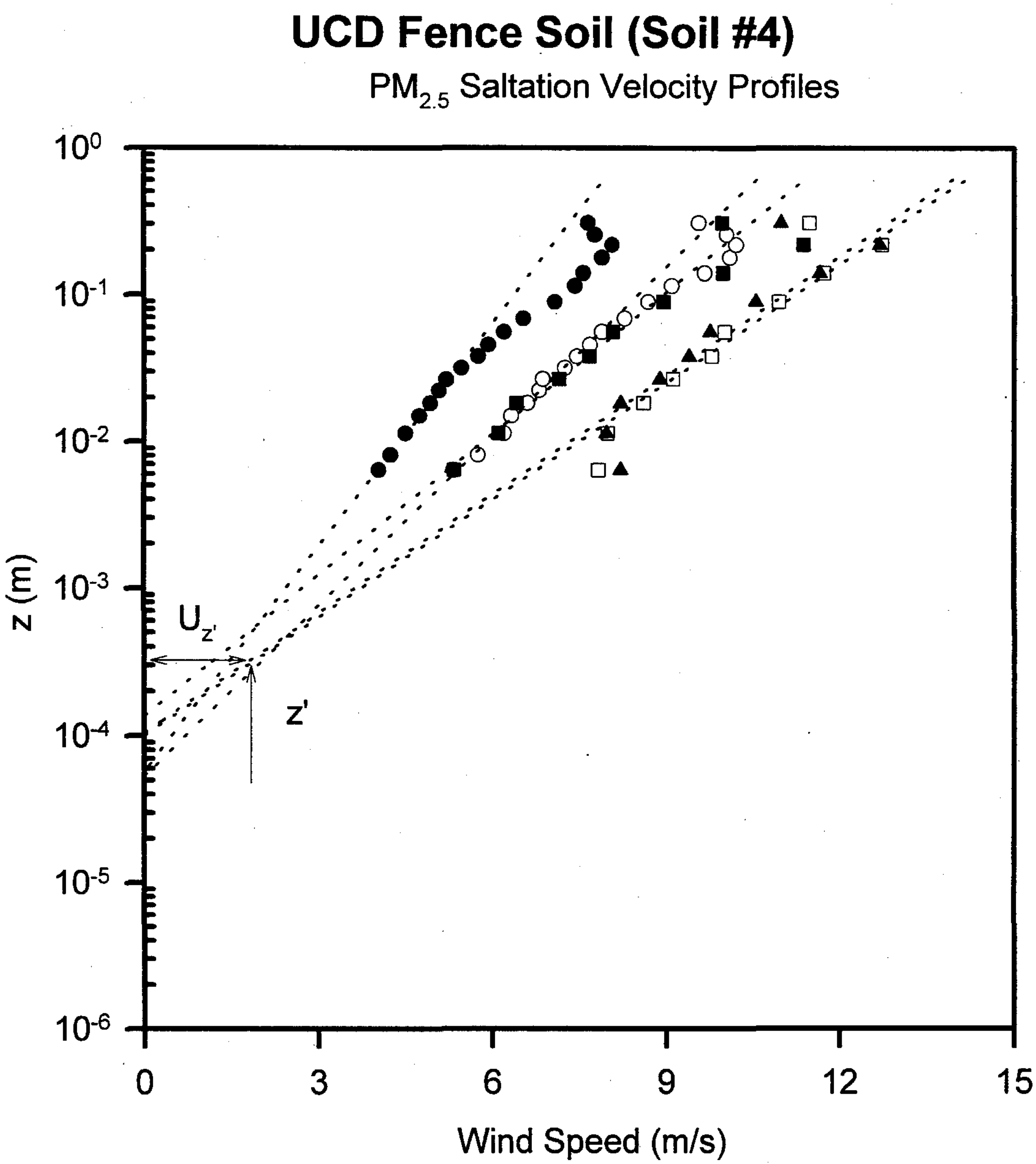
z, Height (m)	IN $PM_{2.5}$ (mg/m^3)	Out $PM_{2.5}$ (mg/m^3)
6.4000e-3	4.4442	2.5425
0.0114	3.0768	2.6735
0.0183	2.3363	1.9623
0.0267	1.1292	1.0077
0.0381	0.6397	0.5705
0.0559	0.3905	0.3817
0.0889	0.1497	0.1140
0.1397	0.1022	0.0777
0.2159	0.0358	0.0277
0.3048	0.0280	0.0260



z, Height (m)	IN $PM_{2.5}$ (mg/m^3)	Out $PM_{2.5}$ (mg/m^3)
6.4000e-3	6.8390	3.4812
0.0114	9.5715	4.1877
0.0183	4.3832	2.6720
0.0267	2.2472	1.6103
0.0381	1.7633	1.1485
0.0559	0.9208	0.6297
0.0889	0.4102	0.2132
0.1397	0.1458	0.1320
0.2159	0.1043	0.0783
0.3048	0.0767	0.0688



z, Height (m)	IN $PM_{2.5}$ (mg/m^3)	Out $PM_{2.5}$ (mg/m^3)
6.4000e-3	6.6543	17.1958
0.0114	8.5108	21.3933
0.0183	4.9290	18.5415
0.0267	2.3393	11.3940
0.0381	1.2712	5.5602
0.0559	0.6088	2.3360
0.0889	0.8048	0.9697
0.1397	0.1780	0.5105
0.2159	0.1733	0.1735
0.3048	0.6555	0.1835


UCD Fence Soil (Soil #4)
PM2.5 Saltation Velocity Profiles
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
z (m)
U_z'
z'
0
3
6
9
12
15
Wind Speed (m/s)

Appendix F:

Wallace Laboratories Chemical Analysis

WALLACE LABORATORIES
365 Coral Circle
El Segundo, CA 90245
phone (310) 615-0116 fax (310) 640-6863

October 10, 1998

fax 213/367-1128
Ray Prittie
DWP, Room 1469
PO Box 111
Los Angeles, CA 90051

RE: analyses of soils with GPS coordinates from Bruce White
Soil ID Number 98-279-17 to 98-279-20
Soil analyses dated Oct. 8, 1998

Dear Ray,

Four samples were analyzed:

#1 9-10a.m. 36° 28.808 N 117° 54.649W
#2 10-11a.m. 36° 29.194 N 117° 54.655W
#3 2-3p.m. 36° 20.391N 117° 57.681 W
#4 3-4 p.m. 36° 21.411 N 117° 57.467 W

Satu ation Extract data for soluble salts:

sample	pH	ECe dS/m	percent chloride	percent carbonates	percent sulfates
No. 1	11.05	85.5	55%	30%	13%
No. 2	11.70	38.9	58%	32%	9%
No. 3	11.10	37.5	32%	56%	10%
No. 4	10.75	89.6	34%	55%	9%

Samples 1 and 4 have values of salinity that are about twice sea water while samples 2 and 3 are similar to sea water. There are differences in the composition of the soluble salts. Samples 1 and 2 are mostly chloride based salts while samples 3 and 4 are mostly carbonates (bicarbonate and carbonate) based salts. The highest sulfate is in sample 1 while the lowest is in sample 2. The actual total sulfate content is about four times higher in sample 1 than sample 2 on a dry weight total basis.

Sample 1 has the highest amount of available arsenic at 14.96 parts per million on a dry weight basis while sample 2 has the lowest at 1.85 parts per million.

Samples 2 and 3 are sands. Sample 1 is a loamy sand. Sample 4 is a sandy loam.

Soil Analvses Plant Analvses Water Analvses

WALLACE LABS
365 Coral Circle
El Segundo, CA 90245
(310) 615-0116

SOILS REPORT

October 8, 1998

Location: Owens Lake
Requester: Bruce White

Sample ID Number	98-279s-17		98-279s-18		98-279s-19		98-279s-20	
	#1 36° 28.808 N 117° 54.649W		#2 36° 29.194 N 117° 54.655W		#3 36° 20.391N 117° 57.681 W		#4 36° 21.411 N 117° 57.467 W	
Saturation Extract								
pH value	11.05		11.70		11.10		10.75	
ECe (milli-mho/cm)	85.50		38.90		37.50		89.60	
		millieq/l		millieq/l		millieq/l		millieq
calcium	8.7	0.4	6.7	0.3	7.0	0.4	17.4	0.9
magnesium	2.1	0.2	2.0	0.2	2.1	0.2	2.8	0.2
sodium	23,563.0	1,024.5	11,289.6	490.9	10,171.6	442.2	28,842.4	1,254.0
lithium	1.95	0.3	1.31	0.2	1.04	0.2	0.70	0.1
strontium	n d	0.0	0.12	0.0	0.23	0.0	0.77	0.0
potassium	1951.1	49.9	837.7	21.4	611.0	15.6	2292.1	58.6
cation sum		1075.3		513.0		458.5		1313.9
chloride	21,066	593.4	10,954	308.6	6,118	172.3	13,250	373.2
nitrate as N	283.9	20.3	96.7	6.9	71.1	5.1	238.1	17.0
bicarbonate as C	470.4	39.2	61.1	5.1	198.2	16.5	1,589.4	132.5
carbonate as C	1,669.2	278.2	969.2	161.5	1,710.0	285.0	2,826.4	471.1
phosphorus as P	47.8	1.5	7.5	0.2	8.3	0.3	36.5	1.2
sulfate as S	2,237.3	139.8	744.3	46.5	880.5	55.0	1,522.3	95.1
anion sum		1072.5		528.9		534.2		1090.1
boron as B	667.29		265.81		314.10		506.82	
iron	0.43		0.34		0.31		0.32	
manganese	n d		n d		n d		n d	
zinc	n d		n d		n d		n d	
copper	n d		n d		n d		n d	
molybdenum	1.17		0.40		1.25		2.26	
aluminum	0.50		0.53		0.44		0.91	
arsenic	25.71		4.77		7.22		19.95	
barium	0.07		0.05		0.07		0.35	
cadmium	n d		n d		n d		0.06	
chromium	n d		n d		n d		0.05	
cobalt	n d		n d		n d		n d	
lead	n d		n d		n d		n d	
mercury	0.11		n d		n d		n d	
nickel	n d		0.08		0.07		n d	
selenium	n d		n d		0.70		n d	
silicon	54.82		53.03		42.21		54.03	
silver	0.34		0.25		n d		0.36	
tin	n d		n d		0.11		n d	
vanadium	1.07		0.60		1.21		2.44	
SAR	1,860.0		983.9		867.5		1,691.0	
relative infiltration rate	good		good		good		good	
estimated soil texture	loamy sand		sand		sand		sandy loam	
lime (calcium carbonate)	yes		yes		yes		yes	
organic matter	low		low		low		low	
moisture content of soil	20.5%		2.5%		1.3%		15.0%	
half saturation percentage	19.7%		13.0%		16.7%		23.0%	

Elements are expressed as mg/l.

pH and ECe are measured in a saturation extract. nd means not detected.

Appendix G:

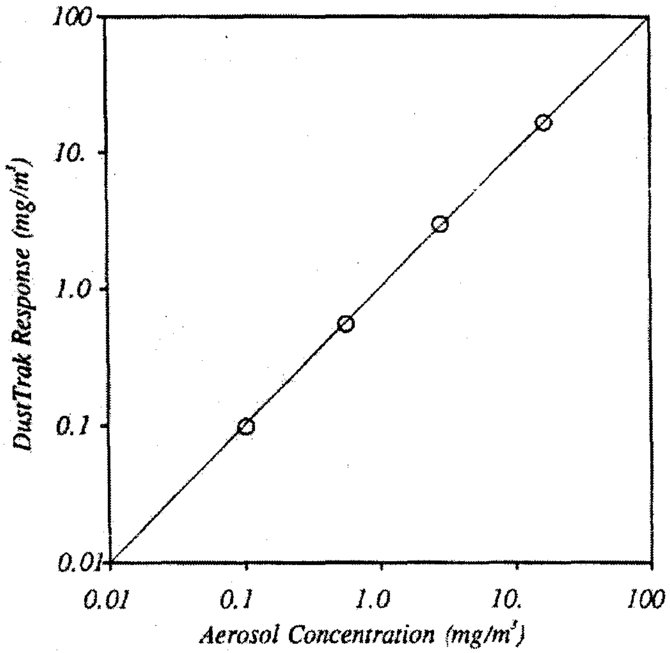
Calibration Certificates for the DustTraks™

CERTIFICATE OF CALIBRATION AND TESTING

TSI Model **8520 DustTrak™** TSI Serial No. **15033**

Description **Aerosol Monitor**

DustTrak™ Linearity Plot



Zero Stability Results	
Average	0.000 :mg/m³
Minimum	-.001 :mg/m³
Maximum	0.001 :mg/m³
Time	16 :Hrs

TSI Incorporated does hereby certify that all materials, components, and workmanship used in the manufacture of this equipment are in strict accordance with the applicable specifications agreed upon by TSI and the customer and with all published specifications. All performance and acceptance tests required under this contract were successfully conducted according to required specifications.
There is no NIST standard for optical mass measurements. Calibration of this instrument performed by TSI has been done using emery oil aerosol and has been nominally adjusted to respirable mass of standard ISO 12103-1, A1 test dust (Arizona test dust.) Our calibration ratio is greater than 1.2:1.

W. Kayser
Calibrated by

☑ Final
Function Check

AUG 4, 1998
Calibration Date

TSI Incorporated
Health & Safety
Instruments Division

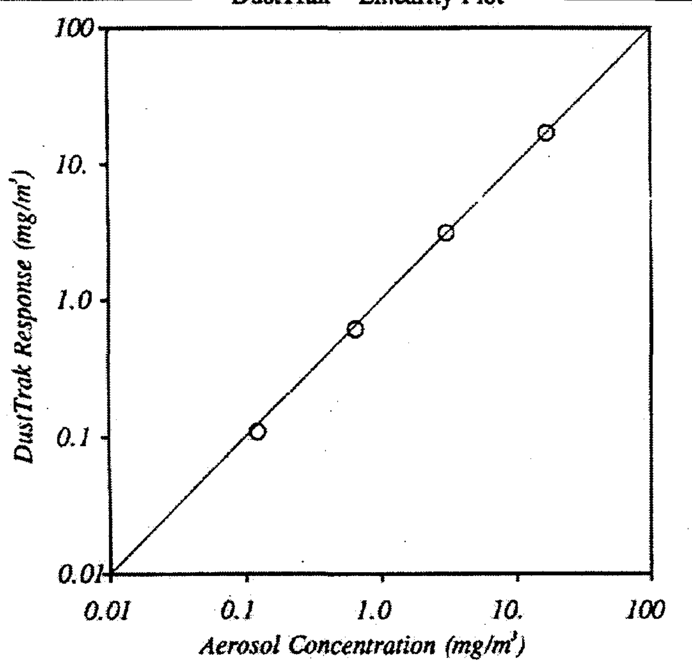
Mailing Address: P.O. Box 64394 St. Paul, MN 55164 USA
Shipping Address: 500 Cardigan Road St. Paul, MN 55126 USA
Phone: (800) 926-8378 or (651) 490-2760 **Fax:** (651) 490-2704

CERTIFICATE OF CALIBRATION AND TESTING

TSI Model **8520 DustTrak™** TSI Serial No. **15034**

Description **Aerosol Monitor**

DustTrak™ Linearity Plot



Zero Stability Results	
Average	0.000 :mg/m³
Minimum	0.000 :mg/m³
Maximum	0.001 :mg/m³
Time	16 :Hrs

TSI Incorporated does hereby certify that all materials, components, and workmanship used in the manufacture of this equipment are in strict accordance with the applicable specifications agreed upon by TSI and the customer and with all published specifications. All performance and acceptance tests required under this contract were successfully conducted according to required specifications. There is no NIST standard for optical mass measurements. Calibration of this instrument performed by TSI has been done using emery oil aerosol and has been nominally adjusted to respirable mass of standard ISO 12103-1, A1 test dust (Arizona test dust.) Our calibration ratio is greater than 1.2:1.

W. Kayser
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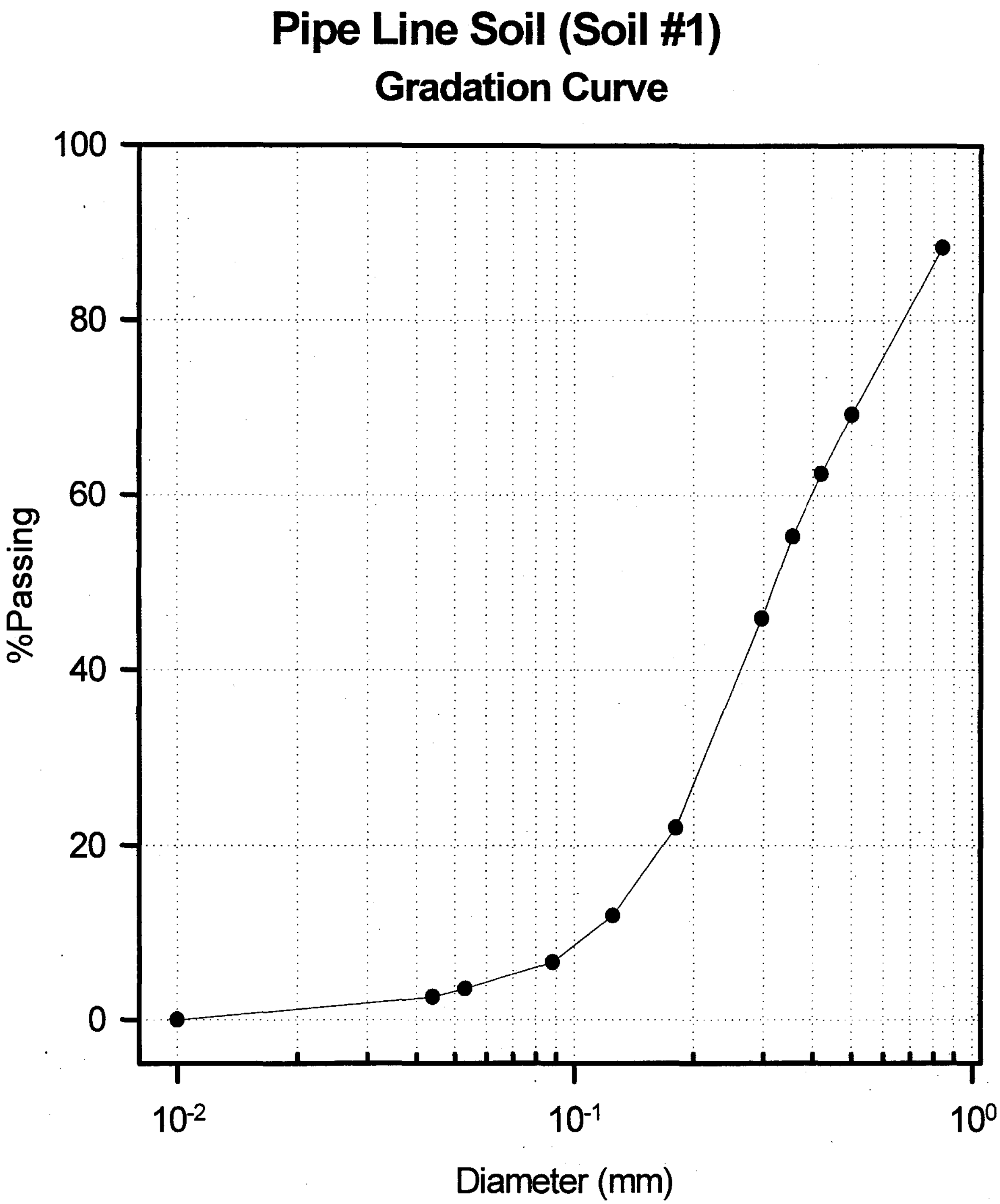
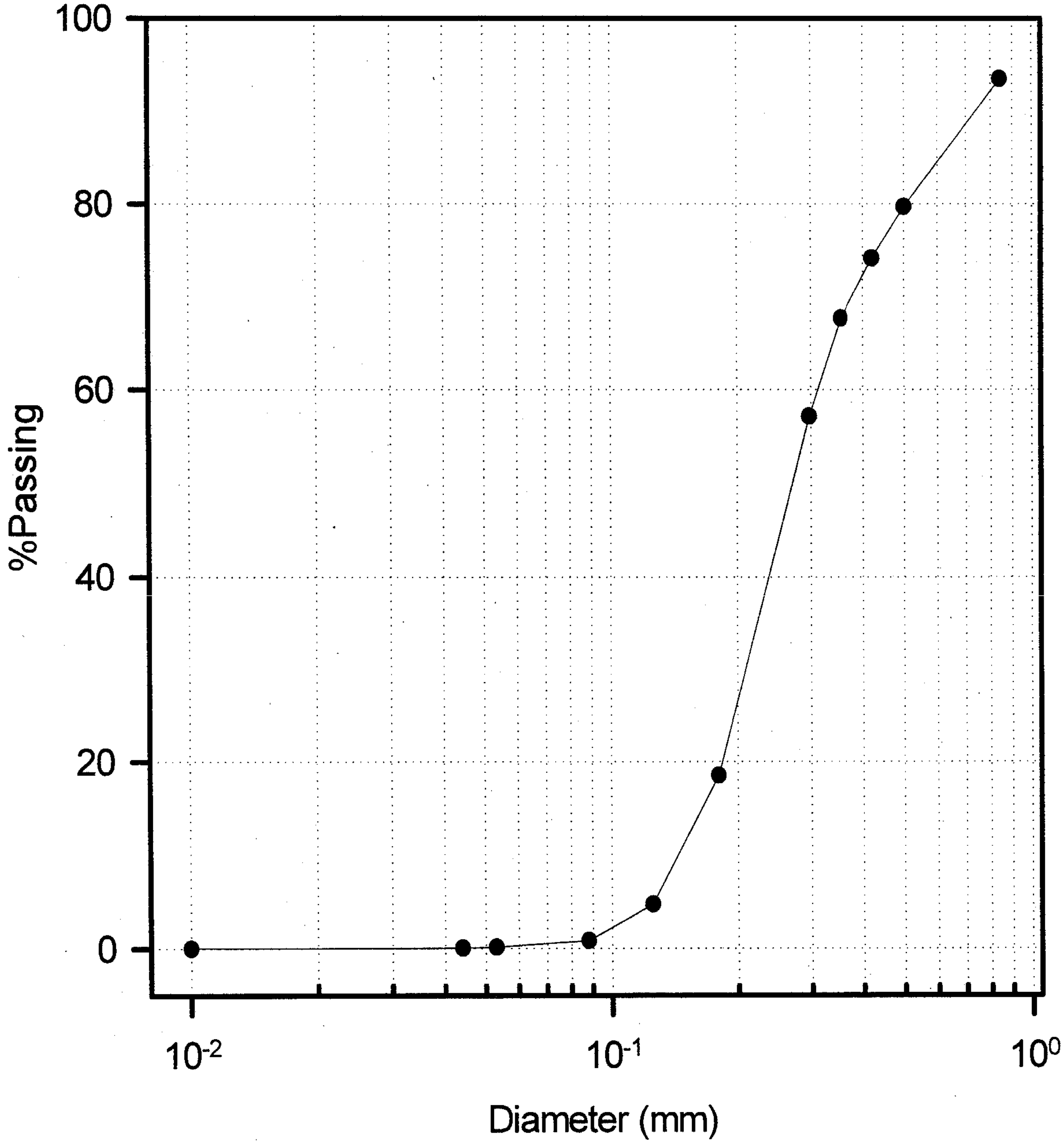
Phone: (800) 926-8378 or (651) 490-2760 **Fax:** (651) 490-2704

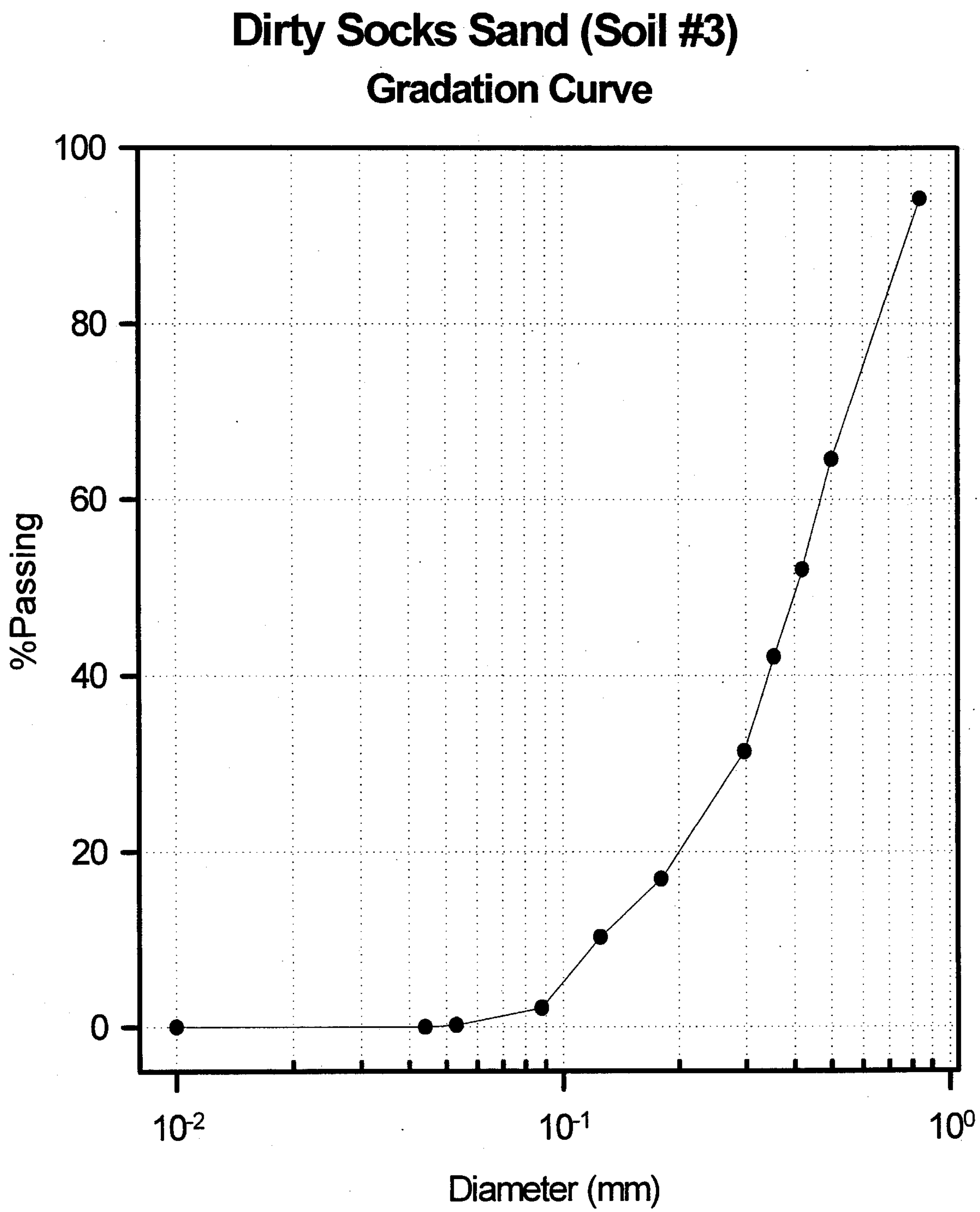
Appendix H:

Individual Soil Gradation Curves


Pipe Line Soil (Soil #1)
Gradation Curve
%Passing
0
20
40
60
80
100
10^{-2}
10^{-1}
10^{0}
Diameter (mm)

North Sand (Soil #2)
Gradation Curve





Dirty Socks Sand (Soil #3)
Gradation Curve
%Passing
100
80
60
40
20
0
10^{-2}
10^{-1}
10^{0}
Diameter (mm)

UCD Fence Soil (Soil #4)

Gradation Curve