APPENDIX AVAILABLE ON THE HEI WEB SITE

Research Report 179

Development and Application of an Aerosol Screening Model for Size-Resolved Urban Aerosols

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Appendix D. Description of Modeled Meteorologic Data and Development of Test Cases

Note: Appendices available only on the Web have been reviewed solely for spelling, grammar, and cross-references to the main text. They have not been formatted or fully edited by HEI.

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This document was reviewed by the HEI Health Review Committee.

Appendix D. Description of Modeled Meteorologic Data and Development of Test Cases

Representative meteorologic periods were desired for sensitivity simulations. The distribution of meteorologic parameters in the WRF output (and thus the input to the ASM model) were examined and values were selected to represent stable and unstable periods under high and low wind speeds.

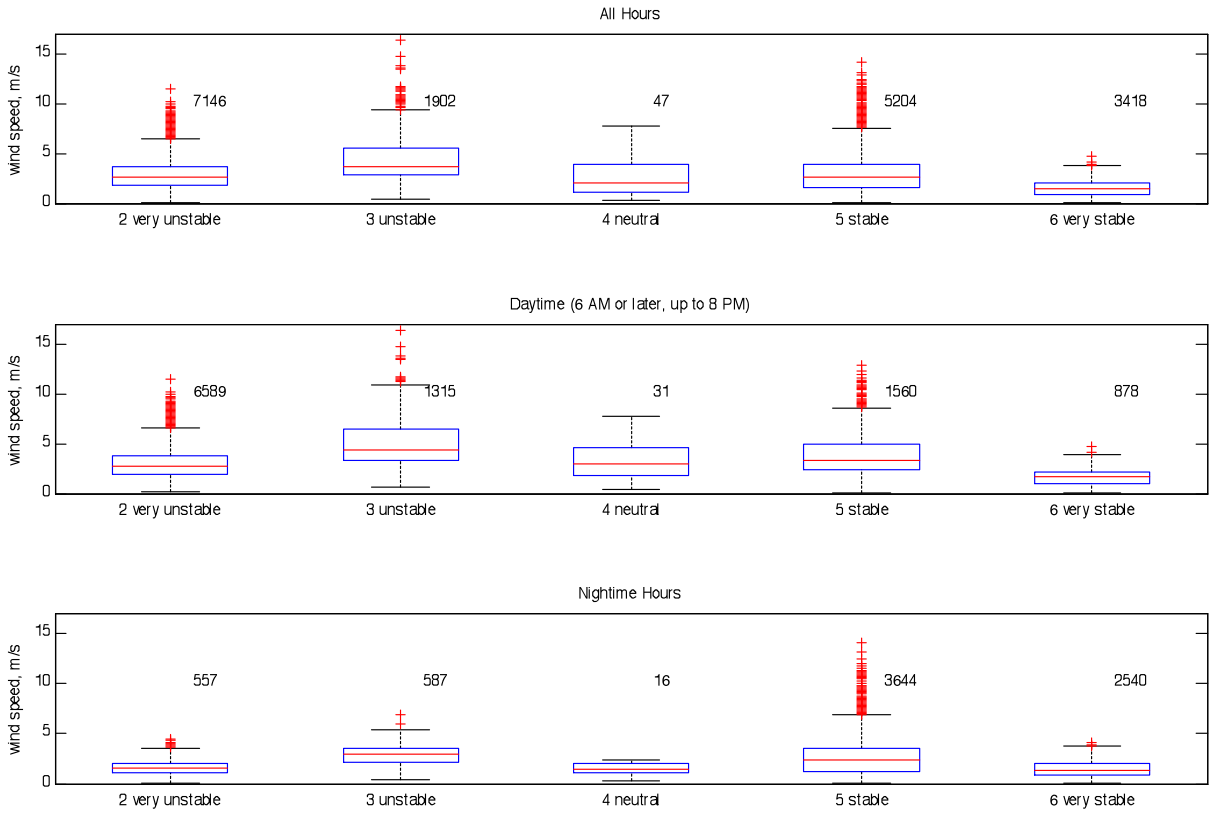

Figure D.1. Distribution of wind speeds during the different classes of meteorologic stability. Numbers above each plot indicate the number of modeled hours with the associated meteorology. Boxes have a line at the median and boxes end at 25th and 75th percentiles. Whiskers extend to 1.5 interquartile ranges and + symbols denote outliers.

Table D.1. Median Values of Key Meteorologic Variables for Different Periods, Classified by Stability, Time of Day, and Wind Speed (Column headings refer to very unstable (VU), unstable (U), neutral (N), stable (S), and very stable (VS) conditions as determined by the WRF-reported Monin–Obhukov length using thresholds in Table 1.)

Variable (all values are medians)	**All hours**									
	VU	U	N	S	VS					
n	7146	1902	47	5204	3418					
Windspeed (m/sec)	2.60	3.72	2.04	2.64	1.41					
Friction velocity (m/sec)	0.56	0.55	0.31	0.24	0.10					
Mixing height (m)	555	185	96.6	174	27.3					
K_{yy} (m^2/sec)	133	51.5	28.0	36.2	19.4					
K_{zz}, surface layer (m^2/sec)	1.58	0.44	0.11	0.17	0.01					
K_{zz}, all layers (m^2/sec)	25.1	4.15	1.01	1.50	0.42					
Temperature (degrees C)	20.0	17.2	20.0	16.5	11.7					
	Low Windspeed Hours (<2.5 m/sec in model)					**High Windspeed Hours (>2.5 m/sec in model)**				
	VU	U	N	S	VS	VU	U	N	S	VS
n	3369	321	28	2378	2913	3777	1581	19	2826	505
Windspeed (m/sec)	1.70	2.01	1.44	1.39	1.27	3.56	4.08	4.57	3.81	3.01
Friction velocity (m/sec)	0.45	0.33	0.23	0.10	0.10	0.70	0.59	0.47	0.39	0.12
Mixing height (m)	480.84	108.79	68.68	112.86	27.18	636.52	189.54	129.08	215.43	96.36
K_{yy} (m^2/sec)	99.52	27.50	19.72	19.08	17.47	155.28	57.15	62.58	52.23	41.24
K_{zz}, surface layer (m^2/sec)	1.46	0.24	0.08	0.08	0.01	1.67	0.50	0.29	0.29	0.06
K_{zz}, all layers (m^2/sec)	21.20	1.82	0.74	0.61	0.21	27.35	4.51	4.03	2.66	0.50
Temperature (degrees C)	20.85	18.78	19.04	17.16	12.71	21.70	17.01	21.61	15.77	7.61
	Daytime Hours					**Nighttime Hours**				
	VU	U	N	S	VS	VU	U	N	S	VS
n	6589	1315	31	1560	878	557	587	16	3644	2540
Windspeed (m/sec)	2.70	4.41	3.00	3.34	1.64	1.53	2.91	1.44	2.36	1.36
Friction velocity (m/sec)	0.58	0.60	0.36	0.33	0.10	0.28	0.44	0.23	0.21	0.10
Mixing height (m)	598	206	129	208	27.1	115	110	68.7	148	27
K_{yy} (m^2/sec)	145.1	62.1	41.1	45.8	22.4	22.2	39.9	19.7	32.3	18.7
K_{zz}, surface layer (m^2/sec)	1.65	0.53	0.28	0.25	0.01	0.25	0.30	0.09	0.14	0.01
K_{zz}, all layers	26.75	5.04	2.41	2.18	0.32	1.78	2.58	0.74	1.15	0.26

(m^2/sec)										
Temperature (degrees C)	21.7	17.0	20.4	15.7	10.1	15.8	17.5	18.1	16.8	12.7

	Important Meteorologic Cases				
	High Wind Unstable[1]	High Wind Stable	Low Wind Unstable	Low Wind Stable[2]	Significant Stagnation[3]
n	5358	3331	3690	5291	728
Windspeed (m/sec)	3.71	3.69	1.73	1.33	0.79
Friction velocity (m/sec)	0.67	0.35	0.44	0.10	0.10
Mixing height (m)	504.6	197.4	448.5	65.7	26.6
K_{yy} (m^2/sec)	126.3	50.6	93.3	18.2	10.8
K_{zz}, surface layer (m^2/sec)	1.33	0.26	1.35	0.04	0.01
K_{zz}, all layers (m^2/sec)	20.6	2.33	19.5	0.39	0.08
Temperature (degrees C)	20.3	14.5	20.7	14.7	9.1

[1]Most representative of typical daytime hours.
[2]Most representative of typical nighttime conditions.
[3]Not representative of mean conditions, but often the purpose of dispersion modeling is to focus on periods of stagnation. Taken from the 25th percentile of model variables during the low wind periods with very stable stability classification

K_{zz} as a function of height is shown in Figure D.2. Note that is the final model run, all K_{zz} values lower than 0.3 m^2/sec were coerced to a value of 0.3.

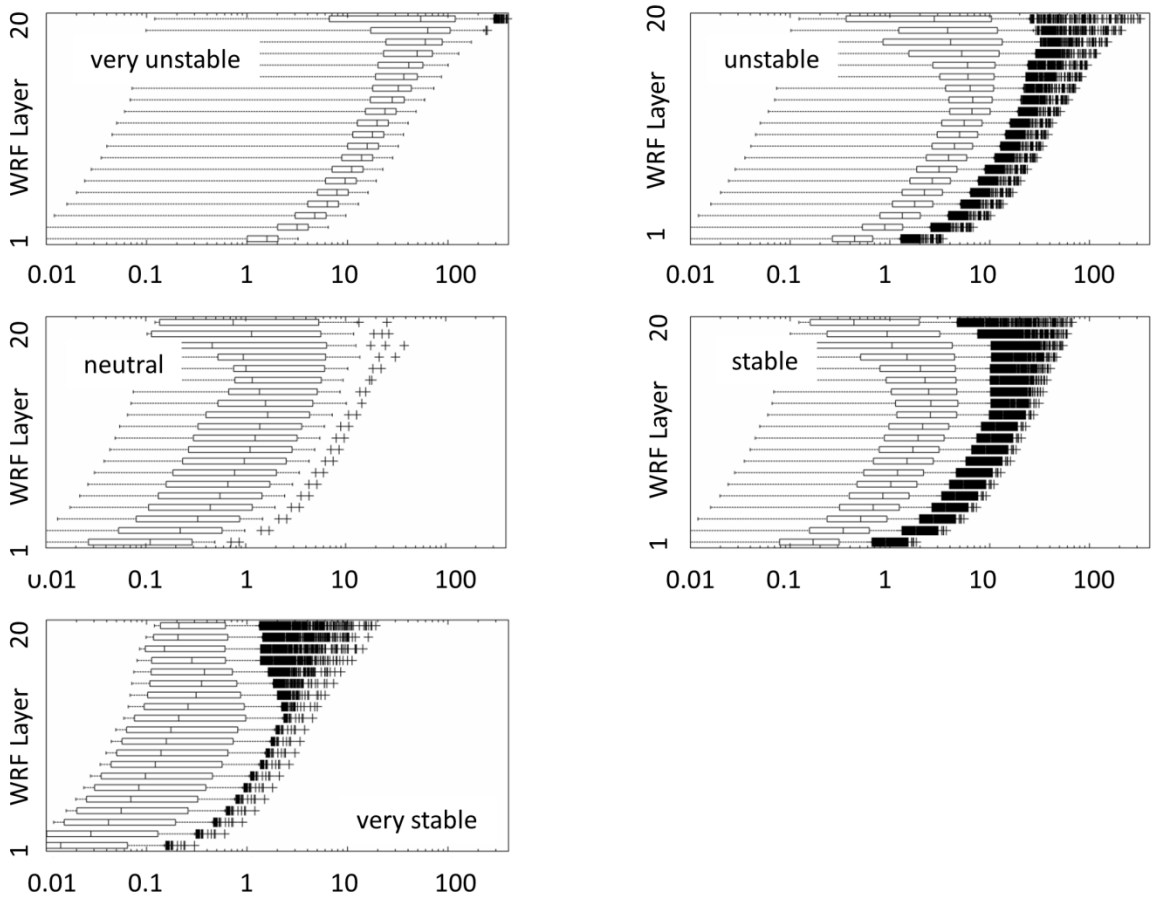

Figure D.2. K_{zz} in the 20 WRF layers. Boxes have a line at the median and boxes end at 25th and 75th percentiles. Whiskers extend to 1.5 interquartile ranges and + symbols denote outliers.