Auxiliary Material for Paper 2011GB004246

A meta-analysis of water vapor deuterium-excess in the mid-latitude atmospheric surface layer

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Introduction: This auxiliary material contains supporting figures and tables described below.

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Figure S1. Afternoon mean dv versus afternoon mean water vapor mixing ratio

in the summer.

2. 2011GB004246-fs02.pdf
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Table S1. Monthly mean observations at each site.

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Table S3. The contribution of the non-linearity of the delta-notation to the diurnal amplitude of dv.

Figure S1: Afternoon (12:00-18:00 local time) mean d_v versus afternoon mean water vapor mixing ratio in the summer (June – August). Fit statistics summarized in Table 2.

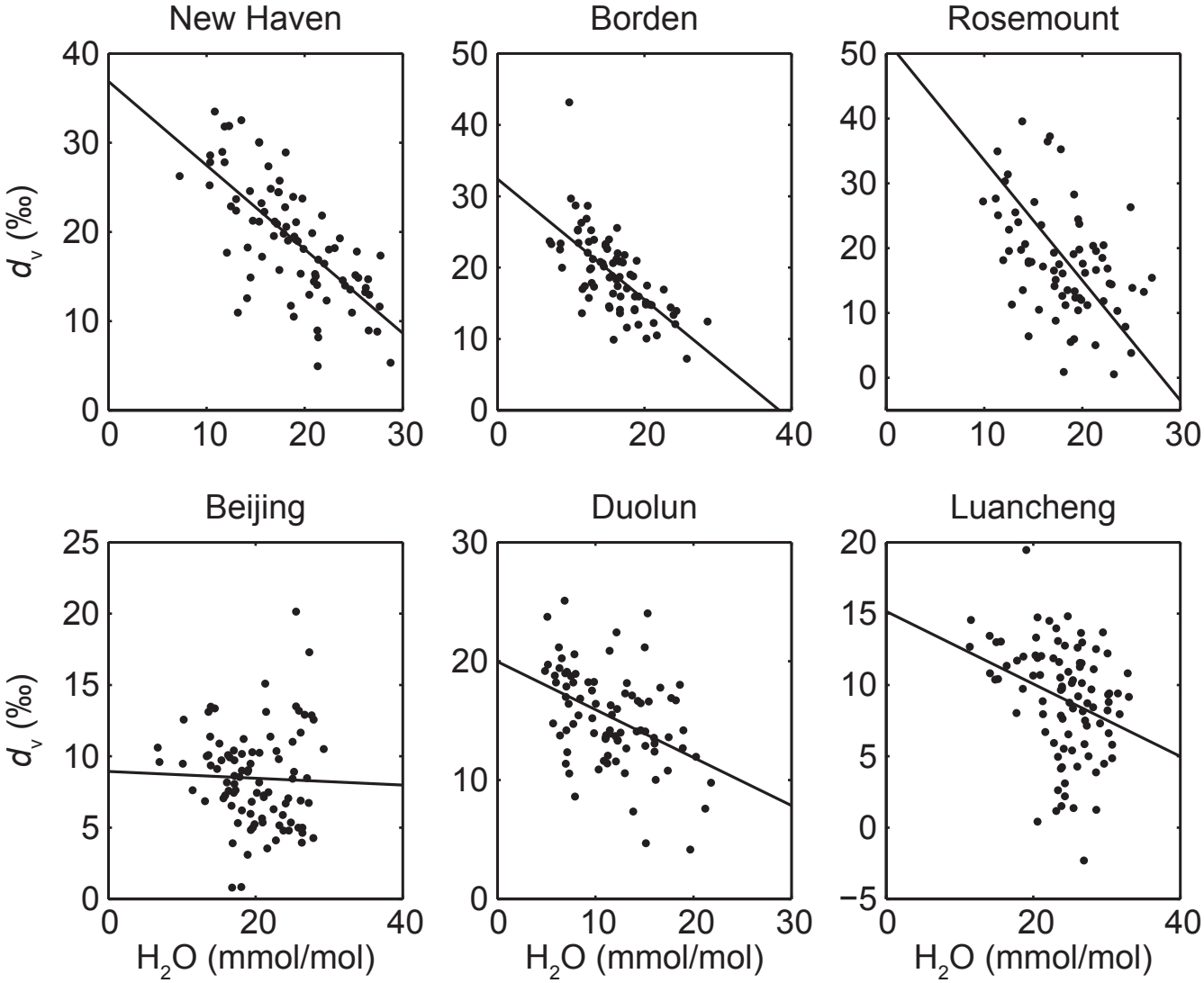

Figure S2: Profiles of the *d* of water vapor in a PBL simulated with the isotopic large-eddy simulation model (ISOLES). The evolution of the PBL was forced by a time-varying solar radiation, a prescribed initial specific humidity profile in the early morning [Lee et al., 2012] and initial profiles of $^{18}O/^{16}O$ and D/H ratios according to the observed relationships between these ratios and specific humidity [Wen et al., 2010]. The *d* of the surface water vapor flux was held at a constant equal to the initial surface layer d_v value. The geostrophic was 5 m s^{-1} and the surface roughness was 0.5 m.

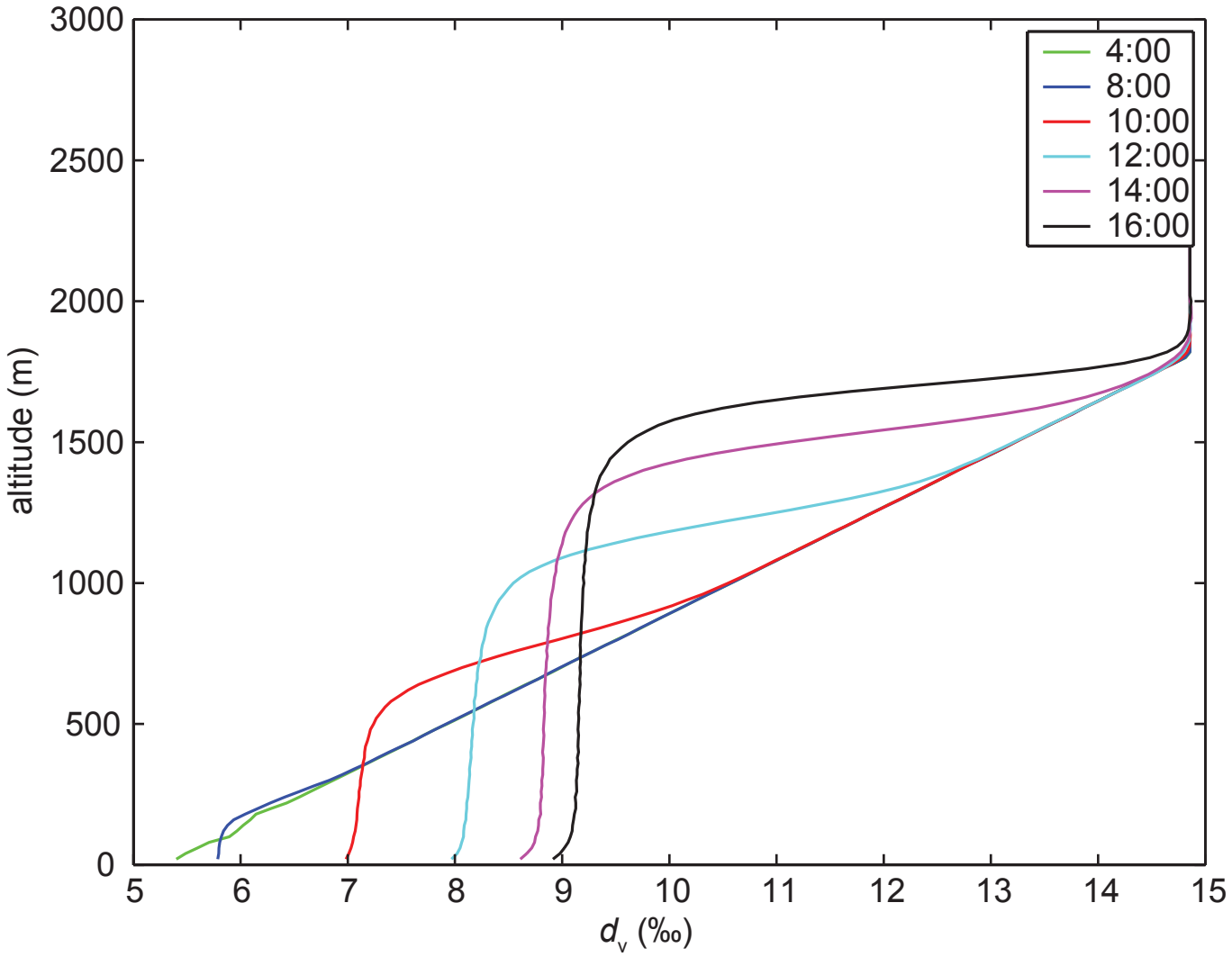

Table S1: Monthly mean observations at each site. Italics indicate partial coverage of that month. Units: H_2O (mmol/mol), $\delta^{18}O$ (‰), δD (‰), d_v (‰), Temp (°C), h (%), PPT (precipitation amount, mm).

New Haven

Mon	Year	H_2O	$\delta^{18}O$	δD	d_v	Temp	h	PPT
Mar	*2007*	*2.35*	*-25.59*	*-206.7*	*-2.02*	*7.76*	*31.20*	*0.0*
Apr	|	7.45	-21.46	-152.0	19.65	7.94	65.85	27.9
May	|	11.84	-17.86	-125.1	17.83	15.41	64.57	10.4
Jun	|	17.46	-16.45	-117.6	14.08	19.56	72.32	16.5
Jul	|	20.28	-16.32	-115.8	14.75	22.21	73.55	16.8
Aug	|	19.14	-16.85	-117.4	17.37	22.12	73.27	23.9
Sep	|	16.30	-16.85	-118.6	16.15	19.27	71.29	3.6
Oct	|	14.95	-16.74	-116.8	17.16	15.76	76.02	22.4
Nov	|	6.80	-21.78	-152.6	21.70	6.51	65.01	15.0
Dec	|	4.45	-24.61	-180.3	16.57	1.13	69.76	38.9
Jan	2008	4.15	-24.75	-190.5	7.48	0.72	62.76	10.9
Feb	|	4.79	-23.86	-172.5	18.38	0.45	69.26	20.8
Mar	|	4.81	-23.61	-174.8	14.08	4.15	59.74	30.0
Apr	|	6.98	-17.49	-136.7	3.26	10.13	64.02	39.1
May	|	8.42	-18.29	-137.1	9.23	13.93	63.74	33.8

Borden

Mon	Year	H_2O	$\delta^{18}O$	δD	d_v	Temp	h	PPT
May	*2009*	*11.37*	*-19.95*	*-146.0*	*13.60*	*13.24*	*58.12*	*87.0*
Jun	|	13.49	-19.61	-142.9	14.01	16.85	70.53	65.0
Jul	|	15.52	-20.81	-150.4	16.06	18.59	71.67	105.8
Aug	|	*17.94*	*-17.75*	*-128.1*	*13.88*	*20.09*	*71.69*	*80.4*

Rosemount

Mon	Year	H_2O	$\delta^{18}O$	δD	d_v	Temp	h	PPT
Jun	*2009*	*20.65*	*-17.28*	*-126.4*	*11.57*	*-12.95*	*68.06*	*0.0*
Jul	|	16.57	-18.97	-138.6	12.61	-9.72	70.17	11.3
Aug	|	16.57	-17.81	-126.8	15.04	-4.81	67.91	16.0
Sep	|	*14.16*	*-14.92*	*-99.3*	*13.02*	*4.95*	*69.26*	*23.8*

Beijing

Mon	Year	H_2O	$\delta^{18}O$	δD	d_v	Temp	h	PPT
Dec	*2006*	*2.09*	*-28.25*	*-215.7*	*10.30*			
Jan	2007	1.32	-30.35	-224.1	18.78			0.0
Feb	|	3.03	-24.34	-180.9	13.81	4.67	39.54	0.0
Mar	|	4.62	-22.27	-158.6	19.61	7.08	49.75	32.4
Apr	|	5.30	-23.35	-171.5	15.28	15.75	32.73	7.0
May	|	8.53	-17.09	-129.4	7.35	22.93	34.42	43.0
Jun	|	17.82	-13.97	-106.0	5.75	26.41	54.49	26.3
Jul	|	23.45	-15.80	-118.3	8.06	26.95	68.76	69.0

Aug	|	21.69	-17.13	-129.3	7.78	26.95	62.10	57.3
Sep	|	15.45	-15.23	-115.4	6.45	22.70	59.64	42.5
Oct	|	8.49	-20.89	-153.6	13.57	14.23	55.53	69.6
Nov	|	4.23	-23.70	-174.6	15.01	5.72	46.10	2.0
Dec	|	*2.71*	*-27.37*	*-204.5*	*14.40*	*1.58*	*40.98*	*0.0*

Duolun

Mon	Year	H_2O	$\delta^{18}O$	δD	d_v	Temp	*h*	PPT
Jun	2009	10.17	-20.73	-155.8	10.06	15.28	51.90	33.0
Jul	|	14.64	-17.78	-133.2	9.11	18.32	62.76	63.8
Aug	|	11.92	-17.92	-132.7	10.66	17.55	56.66	43.5
Sep	|	*9.19*	*-19.10*	*-136.2*	*16.58*	*12.67*	*55.78*	*7.2*

Luangcheng

Mon	Year	H_2O	$\delta^{18}O$	δD	d_v	Temp	*h*	PPT
Apr	2008	10.98	-14.75	-110.0	7.97	13.95	66.27	39.0
May	|	16.19	-11.86	-86.0	8.90	19.23	67.81	56.4
Jun	|	19.97	-15.96	-120.3	7.42	22.86	70.11	95.4
Jul	|	26.43	-16.16	-125.7	3.58	25.80	76.69	93.8
Aug	|	26.30	-15.81	-119.8	6.71	24.47	83.00	178.2
Sep	|	*19.82*	*-14.94*	*-113.9*	*5.60*	*21.62*	*76.82*	*35.1*

Beijing

Mon	Year	H_2O	$\delta^{18}O$	δD	d_v	Temp	*h*	PPT
Dec	*2006*	*2.09*	*-28.3*	*-215.7*	*10.30*			
Jan	2007	1.32	-30.4	-224.1	18.78			0.0
Feb	|	3.03	-24.3	-180.9	13.81	4.67	39.54	0.0
Mar	|	4.62	-22.3	-158.6	19.61	7.08	49.75	32.4
Apr	|	5.30	-23.4	-171.5	15.28	15.75	32.73	7.0
May	|	8.53	-17.1	-129.4	7.35	22.93	34.42	43.0
Jun	|	17.82	-14.0	-106.0	5.75	26.41	54.49	26.3
Jul	|	23.45	-15.8	-118.3	8.06	26.95	68.76	69.0
Aug	|	21.69	-17.1	-129.3	7.78	26.95	62.10	57.3
Sep	|	15.45	-15.2	-115.4	6.45	22.70	59.64	42.5
Oct	|	8.49	-20.9	-153.6	13.57	14.23	55.53	69.6
Nov	|	4.23	-23.7	-174.6	15.01	5.72	46.10	2.0
Dec	|	*2.71*	*-27.4*	*-204.5*	*14.40*	*1.58*	*40.98*	*0.0*

Duolun

Mon	Year	H_2O	$\delta^{18}O$	δD	d_v	Temp	*h*	PPT
Jun	2009	10.17	-20.7	-155.8	10.06	15.28	51.90	33.0
Jul	|	14.64	-17.8	-133.2	9.11	18.32	62.76	63.8
Aug	|	11.92	-17.9	-132.7	10.66	17.55	56.66	43.5
Sep	|	*9.19*	*-19.1*	*-136.2*	*16.58*	*12.67*	*55.78*	*7.2*

Luangcheng

Mon	Year	H_2O	$\delta^{18}O$	δD	d_v	Temp	*h*	PPT
Apr	2008	10.98	-14.8	-110.0	7.97	13.95	66.27	39.0
May	|	16.19	-11.9	-86.0	8.90	19.23	67.81	56.4
Jun	|	19.97	-16.0	-120.3	7.42	22.86	70.11	95.4
Jul	|	26.43	-16.2	-125.7	3.58	25.80	76.69	93.8
Aug	|	26.30	-15.8	-119.8	6.71	24.47	83.00	178.2
Sep	|	*19.82*	*-14.9*	*-113.9*	*5.60*	*21.62*	*76.82*	*35.1*

Table S2: d_v versus h correlations relative to buoy temperatures. Local relative humidity was adjusted to either the water temperature or air temperature just above the water in Long Island Sound for the case of New Haven, or Lake Ontario for the case of Borden. No time lags were used between the time of isotope observation and the buoy measurements. The afternoon slopes for d_v versus h were then recalculated.

New Haven	**slope (‰/%)**	**r**
h local	-0.3632	-0.7371
h relative to water temp	-0.3163	-0.7059
h relative to air temp above water	-0.2916	-0.6649

Borden Forest	**slope (‰/%)**	**r**
h local	-0.2179	-0.5656
h relative to water temp	-0.1081	-0.4841
h relative to air temp above water	-0.1309	-0.5179

Table S3: The contribution of the non-linearity of the delta-notation to the diurnal amplitude of d_v. Here we compare the diurnal amplitudes calculated using the more rigorous lambda-notation and show that the errors using the delta-notation are 11% or less.

Site	δ-notation amplitude (‰)	λ-notation amplitude (‰)	error (%)
New Haven	9.8	9.6	2
Borden	10.0	10.7	-6
Rosemount	16.4	17.9	-10
Beijing	3.5	3.1	11
Duolun	14.7	15.0	-2
Luancheng	7.7	8.1	-6