

### 3.8 SUPPLEMENT

Table 3.7: The monthly mean AIRS-derived environmental lapse rate (ELR) in  $^{\circ}\text{C km}^{-1}$  for each of the CONUS basins and Africa sub-domains computed from the footprint-station (NCDC) matchups.

Basin/Domain	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Arkansas-Red	5.3	5.2	5.0	4.6	4.0	4.3	4.1	4.6	6.0	6.3	6.2	5.5
California	4.1	4.2	4.3	4.6	4.4	4.3	3.9	3.7	4.1	4.6	4.8	4.4
Colorado	6.1	6.6	6.9	6.8	6.9	7.2	6.7	7.1	7.2	7.2	6.8	6.3
Columbia	3.6	4.3	4.3	4.4	4.3	4.5	4.1	4.1	4.6	4.9	4.8	4.1
Mid-Atlantic	3.9	3.3	3.3	3.5	3.6	3.5	3.4	3.7	4.9	5.2	4.7	4.0
Great Lakes	3.0	2.8	3.4	3.9	4.1	4.5	4.9	5.5	5.9	5.9	4.7	3.2
Great	5.8	6.7	6.9	6.7	6.9	7.1	7.7	7.0	7.0	7.2	7.1	6.1
Texas-Gulf	5.3	4.9	4.1	3.6	3.1	3.4	3.3	3.9	4.6	5.4	5.9	5.7
Lower Mississippi	3.6	3.4	3.3	3.4	3.1	3.4	2.7	2.8	4.4	4.9	4.8	4.1
Upper Mississippi	3.0	2.9	3.5	4.0	4.2	4.7	4.8	5.2	5.8	6.0	4.6	3.3
Missouri	4.8	5.0	5.4	5.3	5.1	5.5	5.0	5.3	6.3	6.6	6.0	4.9
Ohio	4.7	4.4	4.4	4.5	4.8	4.9	4.7	5.1	6.2	6.5	5.7	4.8
Rio Grande	6.8	6.8	6.6	6.0	5.8	5.9	6.2	6.8	7.1	7.1	7.0	6.9
CONUS	4.5	4.2	4.1	4.2	4.1	4.3	4.3	4.6	5.5	5.7	5.2	4.6
Sahara (SAH)	4.4	4.3	4.3	4.4	4.5	4.6	4.4	4.5	4.6	4.8	4.7	4.6
West Africa (WAF)	3.9	3.8	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.2
East Africa (EAF)	5.3	5.4	5.7	5.7	5.7	6.1	5.9	5.8	5.7	5.7	5.6	5.5
South Africa (SAF)	5.6	5.7	5.8	6.0	6.1	6.1	5.9	5.7	5.3	5.3	5.4	5.5
AFRICA	4.6	4.6	4.8	4.9	4.9	4.9	4.9	5.0	4.9	4.8	4.9	4.7

Table 3.8: Mean pressure difference (mb) as a function of horizontal distance for each CONUS basin computed from footprint-station (NCDC) matchups.

Footprint-to-Station Distance (km)	<12.5	12.5 - 25.0	25.0 - 50.0	50.0 - 75.0	ALL (<75.0)
Arkansas-Red	7.1	7.8	9.2	11.8	10.5
California	18.1	22.7	35.0	48.7	41.2
Colorado	21.0	23.9	31.8	39.4	35.8
Pacific Northwest	20.6	23.0	31.5	41.2	36.0
Mid-Atlantic	7.0	7.4	8.6	10.4	9.5
Great Lakes	7.2	7.6	9.1	10.8	9.9
Great	23.4	25.9	30.2	35.7	32.9
Texas-Gulf	4.5	5.0	6.4	8.2	7.2
Lower Miss.	4.8	4.9	5.5	6.2	5.8
Upper Miss.	8.1	8.2	8.6	9.3	8.9
Missouri	8.2	9.4	12.5	16.0	14.1
Ohio	8.0	8.4	10.1	12.1	11.0
Rio Grande	13.3	15.7	21.3	27.1	24.0

Table 3.9: The 5-number summary and mean-value correspondent to each of the box plots in Figure 3.7 for  $T_s$ .

CONUS- Surface temp. ( $T_s$ ) Surface/atmospheric scene	Bias ( $^{\circ}\text{C}$ )					
	5	25	50	75	95	mean
all-season	-1.6	-0.2	1.1	4.3	8.1	2.2
warm-season	-1.6	-0.2	2.1	6.6	10.5	3.3
cold-season	-2.6	-0.7	0.9	2.8	7.0	1.4
snow-covered	-3.3	-1.4	0.1	1.9	5.4	0.4
$T_s \leq 0^{\circ}\text{C}$	-8.9	-6.9	-5.6	-4.4	-2.5	-5.6
$0^{\circ}\text{C} < T_s \leq 20^{\circ}\text{C}$	-3.9	-1.2	0.0	2.1	5.1	0.3
$20^{\circ}\text{C} < T_s \leq 30^{\circ}\text{C}$	-0.1	1.1	2.7	5.7	8.6	3.5
$T_s > 30^{\circ}\text{C}$	0.2	2.0	4.3	8.2	11.4	5.1
$\alpha_{\text{cloud}} \leq 0.05$	0.7	2.1	3.6	6.5	10.4	4.5
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	0.2	1.5	2.8	5.6	9.1	3.7
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	-1.6	-0.3	0.8	3.2	6.7	1.6
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	-4.7	-3.4	-2.3	-0.5	3.3	-1.7
$\alpha_{\text{cloud}} > 0.6$	-7.5	-6.4	-5.5	-3.7	0.6	-4.7
pwv $\leq 3.18$ (mm)	-7.9	-5.3	-2.5	1.6	7.4	-1.6
$3.18 < \text{pwv} \leq 6.00$ (mm)	-3.2	-1.0	1.0	4.3	8.7	1.8
$6.00 < \text{pwv} \leq 9.92$ (mm)	-1.2	0.9	2.9	5.4	8.6	3.2
$9.92 < \text{pwv} \leq 14.37$ (mm)	-0.8	0.9	2.6	5.6	9.2	3.3
$14.37 < \text{pwv} \leq 21.04$ (mm)	-1.1	0.3	1.8	5.9	9.5	3.1
$21.04 < \text{pwv} \leq 34.29$ (mm)	-2.1	-0.9	0.4	4.7	8.9	1.9
pwv $> 34.29$ (mm)	-2.9	-1.7	-0.5	1.4	6.5	0.3
elev $\leq 236$	-2.1	-0.8	-0.2	0.3	1.1	-0.3
$236 < \text{elev} \leq 418$	-1.6	-0.5	0.0	0.7	2.4	0.2
$418 < \text{elev} \leq 740$	-2.0	-0.6	0.4	2.4	5.1	1.0
$740 < \text{elev} \leq 1622$	-1.1	2.2	3.8	5.6	8.8	3.8
elev $> 1622$	0.0	3.0	5.2	7.1	8.9	4.9
vc $\leq 9.6$	-2.0	-0.8	-0.3	0.3	3.8	0.0
$9.6 < \text{vc} \leq 17.9$	-1.2	-0.3	0.4	2.0	5.2	1.1
$17.9 < \text{vc} \leq 36.4$	-1.3	0.1	1.8	4.0	7.2	2.3
$36.4 < \text{vc} \leq 108.1$	-1.9	0.2	3.4	6.3	8.9	3.3
vc $> 108.1$	-1.5	1.3	3.7	6.4	8.9	3.8
lc01	-2.4	-0.4	2.0	3.8	7.3	1.9
lc02	-1.6	-0.6	-0.2	0.1	0.9	-0.2
lc04	-2.0	-0.7	0.0	0.6	1.3	-0.1
lc05	-2.2	-1.2	-0.4	0.2	0.9	-0.5
lc06	5.0	6.5	7.6	8.5	10.4	7.5
lc07	2.9	5.6	7.1	8.2	9.7	6.8
lc08	-0.9	-0.2	0.3	1.4	6.1	1.1
lc09	-2.0	-1.0	0.0	1.2	4.5	0.5
lc10	0.7	2.5	3.6	4.7	6.6	3.6
lc12	-1.7	-0.6	0.0	0.6	2.7	0.1
lc13	-3.5	-1.6	-0.5	0.6	5.2	-0.1
lc16	1.2	3.1	4.7	5.7	7.5	4.4
LAI $< 0.43$	-2.8	-0.7	2.1	5.3	8.7	2.4
$0.43 < \text{LAI} < 0.79$	-2.5	0.2	2.0	5.2	8.5	2.6
$0.79 < \text{LAI} < 1.22$	-1.6	0.8	2.2	4.1	7.2	2.5
$1.22 < \text{LAI} < 2.01$	-1.8	0.2	1.4	2.5	6.5	1.6
LAI $> 2.01$	-2.5	-1.0	-0.4	0.4	4.3	-0.1

Table 3.9: *Continued*

CONUS- Surface temp. ( $T_s$ ) Surface/atmospheric scene	ubRMS ( $^{\circ}\text{C}$ )					mean
	5	25	50	75	95	
all-season	4.3	4.9	5.3	5.7	6.6	5.3
warm-season	3.5	4.0	4.4	4.8	5.3	4.4
cold-season	4.3	5.1	5.5	5.9	6.5	5.5
snow-covered	3.0	4.3	5.1	5.8	6.8	5.0
$T_s \leq 0^{\circ}\text{C}$	3.5	4.4	4.8	5.2	5.7	4.7
$0^{\circ}\text{C} < T_s \leq 20^{\circ}\text{C}$	4.0	4.7	5.4	5.9	6.5	5.3
$20^{\circ}\text{C} < T_s \leq 30^{\circ}\text{C}$	2.7	3.1	3.4	3.8	4.4	3.4
$T_s > 30^{\circ}\text{C}$	2.5	3.0	3.2	3.5	4.4	3.3
$\alpha_{\text{cloud}} \leq 0.05$	2.4	3.0	3.6	4.2	5.2	3.7
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	2.9	3.4	3.8	4.3	5.1	3.9
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	3.7	4.3	4.9	5.5	6.3	4.9
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	5.1	5.7	6.2	6.7	7.5	6.2
$\alpha_{\text{cloud}} > 0.6$	4.9	5.5	6.0	6.9	8.1	6.3
pwv $\leq$ 3.18 (mm)	3.8	4.6	5.4	6.1	6.9	5.4
$3.18 < \text{pwv} \leq 6.00$ (mm)	3.6	5.0	5.5	5.9	6.6	5.4
$6.00 < \text{pwv} \leq 9.92$ (mm)	3.6	4.6	5.1	5.5	6.0	5.0
$9.92 < \text{pwv} \leq 14.37$ (mm)	3.7	4.4	4.9	5.3	6.0	4.9
$14.37 < \text{pwv} \leq 21.04$ (mm)	3.6	4.3	4.8	5.2	5.9	4.8
$21.04 < \text{pwv} \leq 34.29$ (mm)	3.6	4.1	4.5	4.8	5.5	4.5
pwv $>$ 34.29 (mm)	2.9	3.3	3.7	4.1	4.8	3.7
elev $\leq$ 236	3.9	4.5	4.7	5.0	5.7	4.7
$236 < \text{elev} \leq 418$	4.7	5.0	5.3	5.6	6.0	5.3
$418 < \text{elev} \leq 740$	4.6	5.0	5.3	5.6	6.0	5.3
$740 < \text{elev} \leq 1622$	4.3	5.0	5.4	5.7	6.4	5.4
elev $>$ 1622	4.5	5.1	5.6	6.3	7.3	5.7
vc $\leq$ 9.6	3.9	4.5	5.1	5.6	6.0	5.0
$9.6 < \text{vc} \leq 17.9$	4.5	4.8	5.1	5.5	5.9	5.2
$17.9 < \text{vc} \leq 36.4$	4.6	5.0	5.3	5.7	6.3	5.4
$36.4 < \text{vc} \leq 108.1$	4.4	5.0	5.3	5.8	6.6	5.4
vc $>$ 108.1	4.3	4.8	5.4	6.2	7.3	5.6
lc01	4.4	4.9	5.5	6.4	7.5	5.7
lc02	4.2	4.4	4.6	4.7	4.9	4.6
lc04	4.7	5.0	5.2	5.4	5.8	5.2
lc05	4.5	4.7	5.1	5.5	6.0	5.1
lc06	4.2	4.5	4.7	4.9	5.3	4.7
lc07	4.1	4.7	5.1	5.6	6.7	5.2
lc08	4.2	4.5	4.6	4.9	5.3	4.7
lc09	3.9	4.1	4.4	4.7	5.5	4.5
lc10	4.9	5.2	5.6	6.0	6.8	5.6
lc12	4.2	4.8	5.2	5.6	6.1	5.2
lc13	3.9	4.6	4.9	5.2	5.6	4.9
lc16	4.0	4.4	5.2	5.6	6.0	5.1
LAI $<$ 0.43	4.3	5.2	5.6	6.0	6.7	5.6
$0.43 < \text{LAI} < 0.79$	4.1	4.8	5.3	5.8	6.6	5.3
$0.79 < \text{LAI} < 1.22$	3.9	4.5	5.0	5.7	6.6	5.1
$1.22 < \text{LAI} < 2.01$	3.6	4.3	4.8	5.4	6.3	4.8
LAI $>$ 2.01	3.3	3.9	4.2	4.5	4.9	4.2

Table 3.9: *Continued*

CONUS- Surface temp. ( $T_s$ ) Surface/atmospheric scene	Kendall's $\tau$					mean
	5	25	50	75	95	
all-season	0.65	0.73	0.77	0.80	0.83	0.76
warm-season	0.41	0.53	0.61	0.69	0.75	0.60
cold-season	0.52	0.64	0.69	0.73	0.76	0.67
snow-covered	0.19	0.34	0.46	0.57	0.69	0.45
$T_s \leq 0^\circ\text{C}$	0.02	0.14	0.22	0.29	0.37	0.21
$0^\circ\text{C} < T_s \leq 20^\circ\text{C}$	0.17	0.37	0.47	0.51	0.56	0.42
$20^\circ\text{C} < T_s \leq 30^\circ\text{C}$	0.34	0.39	0.43	0.46	0.50	0.43
$T_s > 30^\circ\text{C}$	0.15	0.31	0.50	0.64	0.71	0.47
$\alpha_{\text{cloud}} \leq 0.05$	0.67	0.76	0.80	0.82	0.85	0.78
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	0.68	0.75	0.80	0.82	0.85	0.78
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	0.58	0.68	0.74	0.77	0.80	0.72
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	0.50	0.60	0.66	0.70	0.75	0.65
$\alpha_{\text{cloud}} > 0.6$	0.47	0.62	0.66	0.70	0.75	0.65
pwv $\leq 3.18$ (mm)	0.00	0.19	0.32	0.50	0.75	0.35
$3.18 < \text{pwv} \leq 6.00$ (mm)	0.37	0.54	0.64	0.72	0.80	0.62
$6.00 < \text{pwv} \leq 9.92$ (mm)	0.62	0.70	0.75	0.79	0.82	0.74
$9.92 < \text{pwv} \leq 14.37$ (mm)	0.65	0.71	0.75	0.78	0.82	0.74
$14.37 < \text{pwv} \leq 21.04$ (mm)	0.58	0.65	0.69	0.74	0.80	0.69
$21.04 < \text{pwv} \leq 34.29$ (mm)	0.46	0.55	0.61	0.66	0.71	0.60
pwv $> 34.29$ (mm)	0.33	0.43	0.53	0.60	0.67	0.51
elev $\leq 236$	0.60	0.66	0.70	0.74	0.77	0.70
$236 < \text{elev} \leq 418$	0.68	0.73	0.75	0.77	0.79	0.75
$418 < \text{elev} \leq 740$	0.68	0.73	0.77	0.80	0.82	0.76
$740 < \text{elev} \leq 1622$	0.70	0.78	0.81	0.83	0.84	0.80
elev $> 1622$	0.67	0.77	0.79	0.81	0.83	0.78
vc $\leq 9.6$	0.60	0.69	0.75	0.77	0.81	0.73
$9.6 < \text{vc} \leq 17.9$	0.64	0.71	0.76	0.79	0.82	0.75
$17.9 < \text{vc} \leq 36.4$	0.67	0.73	0.77	0.82	0.83	0.77
$36.4 < \text{vc} \leq 108.1$	0.69	0.74	0.79	0.81	0.83	0.78
vc $> 108.1$	0.66	0.74	0.79	0.81	0.83	0.77
lc01	0.63	0.71	0.76	0.79	0.81	0.74
lc02	0.57	0.61	0.63	0.66	0.69	0.63
lc04	0.68	0.70	0.72	0.73	0.76	0.72
lc05	0.63	0.68	0.72	0.75	0.77	0.71
lc06	0.76	0.78	0.80	0.81	0.82	0.79
lc07	0.74	0.78	0.80	0.82	0.83	0.79
lc08	0.61	0.66	0.70	0.76	0.81	0.71
lc09	0.67	0.75	0.79	0.81	0.82	0.78
lc10	0.69	0.77	0.80	0.82	0.84	0.79
lc12	0.66	0.73	0.76	0.78	0.82	0.75
lc13	0.65	0.71	0.75	0.77	0.82	0.74
lc16	0.76	0.79	0.80	0.81	0.83	0.80
LAI $< 0.43$	0.43	0.65	0.74	0.79	0.82	0.70
$0.43 < \text{LAI} < 0.79$	0.44	0.60	0.67	0.73	0.79	0.65
$0.79 < \text{LAI} < 1.22$	0.46	0.56	0.63	0.69	0.76	0.62
$1.22 < \text{LAI} < 2.01$	0.43	0.52	0.59	0.65	0.72	0.58
LAI $> 2.01$	0.43	0.51	0.56	0.61	0.72	0.56

Table 3.10: As in Table 3.9, but for  $T_a$ .

CONUS- Air temperature ( $T_a$ ) Surface/atmospheric scene	Bias ( $^{\circ}\text{C}$ )					mean
	5	25	50	75	95	
all-season	-2.1	-1.5	-0.2	2.1	4.7	0.4
warm-season	-3.3	-1.8	-0.5	2.7	5.5	0.4
cold-season	-2.1	-1.1	0.1	1.8	4.2	0.5
snow-covered	-0.4	0.7	1.5	2.5	3.8	1.6
$T_a \leq 0^{\circ}\text{C}$	-5.4	-3.1	-2.2	-1.0	0.3	-2.2
$0^{\circ}\text{C} < T_a \leq 20^{\circ}\text{C}$	-2.1	-1.2	-0.1	1.5	3.4	0.2
$20^{\circ}\text{C} < T_a \leq 30^{\circ}\text{C}$	-2.2	-0.6	0.8	3.0	5.4	1.2
$T_a > 30^{\circ}\text{C}$	-2.4	-0.5	2.6	4.8	7.3	2.3
$\alpha_{\text{cloud}} \leq 0.05$	0.0	0.7	1.6	3.7	6.5	2.3
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	-0.9	0.0	1.0	2.9	5.5	1.6
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	-2.8	-1.8	-0.6	1.0	3.5	-0.3
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	-4.4	-3.6	-2.6	-1.0	1.1	-2.2
$\alpha_{\text{cloud}} > 0.6$	-6.0	-4.9	-4.1	-2.9	-1.0	-3.8
pwv $\leq$ 3.18 (mm)	-2.7	0.0	1.9	3.3	5.9	1.7
$3.18 < \text{pwv} \leq 6.00$ (mm)	-2.0	-1.0	0.4	2.3	5.2	0.8
$6.00 < \text{pwv} \leq 9.92$ (mm)	-1.8	-0.7	1.0	2.5	5.1	1.1
$9.92 < \text{pwv} \leq 14.37$ (mm)	-1.6	-0.6	0.7	2.4	5.1	1.1
$14.37 < \text{pwv} \leq 21.04$ (mm)	-1.9	-1.1	0.3	2.6	5.2	0.9
$21.04 < \text{pwv} \leq 34.29$ (mm)	-2.7	-1.5	-0.5	2.7	5.6	0.5
pwv $>$ 34.29 (mm)	-4.0	-2.8	-1.6	0.6	4.3	-0.9
elev $\leq$ 236	-2.6	-1.9	-1.6	-1.2	-0.1	-1.5
$236 < \text{elev} \leq 418$	-2.0	-1.6	-1.1	-0.4	0.6	-1.0
$418 < \text{elev} \leq 740$	-2.2	-1.7	-0.6	0.9	2.0	-0.3
$740 < \text{elev} \leq 1622$	-1.6	0.8	2.1	2.9	4.8	1.8
elev $>$ 1622	-1.8	1.2	2.9	4.2	6.1	2.6
vc $\leq$ 9.6	-2.4	-1.7	-1.2	-0.1	2.2	-0.8
$9.6 < \text{vc} \leq 17.9$	-2.1	-1.7	-0.9	0.8	2.9	-0.3
$17.9 < \text{vc} \leq 36.4$	-2.0	-1.5	0.0	2.0	3.8	0.4
$36.4 < \text{vc} \leq 108.1$	-2.1	-1.3	1.3	3.1	5.5	1.2
vc $>$ 108.1	-2.4	-0.5	1.8	3.5	5.6	1.6
lc01	-2.7	-1.8	-1.3	0.3	3.5	-0.5
lc02	-2.9	-2.4	-2.2	-2.0	-1.6	-2.2
lc04	-2.1	-1.7	-1.3	-0.9	-0.3	-1.2
lc05	-2.3	-1.9	-1.7	-1.3	-0.2	-1.4
lc06	1.6	2.5	3.3	4.7	5.8	3.6
lc07	-1.7	1.5	3.0	4.4	6.3	2.8
lc08	-2.3	-1.9	-1.1	2.1	5.6	0.1
lc09	-2.7	-1.3	-0.9	-0.3	2.0	-0.6
lc10	-0.7	1.1	2.1	2.9	4.2	2.0
lc12	-2.0	-1.4	-0.6	0.7	2.0	-0.3
lc13	-2.5	-1.7	-1.2	-0.5	2.8	-0.8
lc16	-1.2	0.4	1.9	3.5	5.4	2.0
LAI $<$ 0.43	-1.3	0.5	1.7	2.9	5.2	1.8
$0.43 < \text{LAI} < 0.79$	-1.9	-0.7	0.5	2.3	5.1	0.9
$0.79 < \text{LAI} < 1.22$	-2.3	-1.3	-0.3	1.2	4.1	0.2
$1.22 < \text{LAI} < 2.01$	-2.9	-1.7	-0.9	0.2	3.1	-0.6
LAI $>$ 2.01	-3.2	-2.3	-1.8	-1.0	1.9	-1.4

Table 3.10: *Continued*

CONUS- Air temperature ( $T_a$ ) Surface/atmospheric scene	ubRMS ( $^{\circ}\text{C}$ )					mean
	5	25	50	75	95	
all-season	3.2	3.5	3.7	3.8	4.1	3.7
warm-season	2.6	2.9	3.2	3.5	3.9	3.2
cold-season	3.0	3.5	3.8	4.0	4.4	3.7
snow-covered	2.0	2.3	2.5	2.8	3.1	2.5
$T_a \leq 0^{\circ}\text{C}$	3.2	3.8	4.2	4.8	5.4	4.3
$0^{\circ}\text{C} < T_a \leq 20^{\circ}\text{C}$	3.1	3.6	4.0	4.2	4.9	4.0
$20^{\circ}\text{C} < T_a \leq 30^{\circ}\text{C}$	2.0	2.3	2.6	2.9	3.4	2.6
$T_a > 30^{\circ}\text{C}$	1.6	2.0	2.3	2.6	3.0	2.3
$\alpha_{\text{cloud}} \leq 0.05$	1.9	2.2	2.4	2.7	3.1	2.5
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	2.2	2.5	2.8	3.0	3.3	2.8
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	2.8	3.2	3.4	3.7	4.1	3.4
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	3.4	3.8	4.0	4.4	4.9	4.1
$\alpha_{\text{cloud}} > 0.6$	3.6	4.0	4.3	4.7	5.3	4.4
pwv $\leq 3.18$ (mm)	2.1	2.4	2.7	3.1	3.8	2.8
$3.18 < \text{pwv} \leq 6.00$ (mm)	2.5	3.2	3.5	3.8	4.4	3.5
$6.00 < \text{pwv} \leq 9.92$ (mm)	2.5	3.2	3.5	3.8	4.1	3.4
$9.92 < \text{pwv} \leq 14.37$ (mm)	2.7	3.1	3.4	3.7	4.0	3.4
$14.37 < \text{pwv} \leq 21.04$ (mm)	2.7	3.1	3.3	3.6	4.1	3.4
$21.04 < \text{pwv} \leq 34.29$ (mm)	2.5	2.9	3.1	3.4	4.1	3.2
pwv $> 34.29$ (mm)	2.1	2.4	2.6	2.9	4.1	2.7
elev $\leq 236$	3.1	3.4	3.6	3.7	4.1	3.6
$236 < \text{elev} \leq 418$	3.4	3.6	3.8	3.9	4.1	3.8
$418 < \text{elev} \leq 740$	3.3	3.6	3.8	3.9	4.1	3.7
$740 < \text{elev} \leq 1622$	3.0	3.4	3.6	3.8	4.0	3.6
elev $> 1622$	3.1	3.5	3.7	3.9	4.3	3.7
vc $\leq 9.6$	3.2	3.5	3.7	3.9	4.1	3.7
$9.6 < \text{vc} \leq 17.9$	3.3	3.5	3.7	3.8	4.0	3.7
$17.9 < \text{vc} \leq 36.4$	3.3	3.6	3.7	3.9	4.1	3.7
$36.4 < \text{vc} \leq 108.1$	3.1	3.5	3.7	3.8	4.2	3.7
vc $> 108.1$	2.9	3.4	3.6	3.8	4.2	3.6
lc01	3.2	3.5	3.7	3.8	4.1	3.7
lc02	3.2	3.3	3.5	3.6	3.7	3.5
lc04	3.4	3.6	3.7	3.8	3.9	3.7
lc05	3.3	3.6	3.8	3.9	4.0	3.7
lc06	3.0	3.3	3.5	3.7	4.1	3.5
lc07	2.9	3.3	3.6	3.8	4.2	3.6
lc08	2.9	3.2	3.5	3.6	3.7	3.4
lc09	2.9	3.0	3.1	3.4	3.7	3.3
lc10	3.3	3.5	3.7	3.8	4.2	3.7
lc12	3.3	3.6	3.7	3.9	4.1	3.7
lc13	3.0	3.4	3.6	3.8	4.2	3.6
lc16	2.9	3.3	3.7	3.9	4.1	3.6
LAI $< 0.43$	3.0	3.5	3.8	4.1	4.5	3.8
$0.43 < \text{LAI} < 0.79$	3.0	3.5	3.8	4.1	4.5	3.8
$0.79 < \text{LAI} < 1.22$	2.9	3.3	3.6	3.9	4.4	3.6
$1.22 < \text{LAI} < 2.01$	2.6	3.0	3.4	3.9	4.3	3.5
LAI $> 2.01$	2.3	2.7	3.0	3.3	3.7	3.0

Table 3.10: *Continued*

CONUS- Air temperature ( $T_a$ ) Surface/atmospheric scene	Kendall's $\tau$					
	5	25	50	75	95	mean
all-season	0.70	0.79	0.81	0.83	0.84	0.80
warm-season	0.47	0.60	0.66	0.70	0.75	0.64
cold-season	0.64	0.70	0.73	0.75	0.78	0.72
snow-covered	0.61	0.72	0.78	0.83	0.86	0.76
$T_a \leq 0^\circ\text{C}$	0.08	0.25	0.43	0.57	0.70	0.41
$0^\circ\text{C} < T_a \leq 20^\circ\text{C}$	0.32	0.57	0.61	0.63	0.67	0.57
$20^\circ\text{C} < T_a \leq 30^\circ\text{C}$	0.41	0.49	0.53	0.55	0.60	0.52
$T_a > 30^\circ\text{C}$	0.20	0.34	0.44	0.52	0.60	0.42
$\alpha_{\text{cloud}} \leq 0.05$	0.73	0.83	0.86	0.88	0.90	0.84
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	0.75	0.83	0.85	0.86	0.88	0.84
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	0.63	0.75	0.79	0.82	0.84	0.77
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	0.57	0.69	0.74	0.77	0.80	0.72
$\alpha_{\text{cloud}} > 0.6$	0.55	0.67	0.70	0.73	0.77	0.69
pwv $\leq 3.18$ (mm)	0.34	0.51	0.63	0.73	0.81	0.61
$3.18 < \text{pwv} \leq 6.00$ (mm)	0.41	0.50	0.59	0.71	0.80	0.60
$6.00 < \text{pwv} \leq 9.92$ (mm)	0.62	0.67	0.71	0.77	0.82	0.72
$9.92 < \text{pwv} \leq 14.37$ (mm)	0.64	0.71	0.74	0.76	0.81	0.73
$14.37 < \text{pwv} \leq 21.04$ (mm)	0.52	0.65	0.69	0.73	0.78	0.68
$21.04 < \text{pwv} \leq 34.29$ (mm)	0.43	0.56	0.61	0.65	0.70	0.59
pwv $> 34.29$ (mm)	0.36	0.45	0.53	0.59	0.64	0.52
elev $\leq 236$	0.65	0.73	0.78	0.81	0.84	0.76
$236 < \text{elev} \leq 418$	0.75	0.80	0.82	0.83	0.84	0.81
$418 < \text{elev} \leq 740$	0.75	0.81	0.82	0.83	0.84	0.81
$740 < \text{elev} \leq 1622$	0.72	0.80	0.82	0.84	0.85	0.81
elev $> 1622$	0.66	0.79	0.81	0.82	0.84	0.79
vc $\leq 9.6$	0.67	0.79	0.82	0.84	0.84	0.80
$9.6 < \text{vc} \leq 17.9$	0.72	0.79	0.82	0.83	0.84	0.80
$17.9 < \text{vc} \leq 36.4$	0.74	0.79	0.82	0.83	0.84	0.81
$36.4 < \text{vc} \leq 108.1$	0.69	0.79	0.81	0.83	0.84	0.80
vc $> 108.1$	0.67	0.78	0.81	0.82	0.84	0.79
lc01	0.74	0.80	0.82	0.83	0.84	0.81
lc02	0.65	0.69	0.71	0.73	0.76	0.71
lc04	0.76	0.78	0.79	0.80	0.82	0.79
lc05	0.72	0.79	0.81	0.82	0.84	0.80
lc06	0.62	0.69	0.74	0.79	0.83	0.74
lc07	0.66	0.77	0.81	0.83	0.84	0.79
lc08	0.60	0.71	0.75	0.79	0.84	0.74
lc09	0.71	0.78	0.82	0.83	0.84	0.80
lc10	0.72	0.81	0.82	0.84	0.84	0.81
lc12	0.72	0.80	0.82	0.83	0.84	0.81
lc13	0.65	0.76	0.79	0.81	0.82	0.77
lc16	0.65	0.77	0.81	0.82	0.83	0.78
LAI $< 0.43$	0.58	0.70	0.77	0.81	0.83	0.74
$0.43 < \text{LAI} < 0.79$	0.56	0.65	0.70	0.75	0.80	0.69
$0.79 < \text{LAI} < 1.22$	0.54	0.64	0.69	0.73	0.78	0.68
$1.22 < \text{LAI} < 2.01$	0.53	0.62	0.67	0.71	0.78	0.66
LAI $> 2.01$	0.52	0.61	0.65	0.68	0.75	0.64

Table 3.11: As in Tables 3.9 - 3.10, but for  $q$ .

CONUS- Specific humidity ( $q$ ) Surface/atmospheric scene	Relative bias (%)					mean
	5	25	50	75	95	
all-season	-25	-21	-16	-5	9	-12
warm-season	-27	-22	-18	-6	8	-14
cold-season	-24	-18	-13	-3	18	-9
snow-covered	-23	-16	-12	-7	9	-10
$T_a \leq 0^\circ\text{C}$	-39	-30	-26	-22	-15	-26
$0^\circ\text{C} < T_a \leq 20^\circ\text{C}$	-26	-21	-16	-5	11	-13
$20^\circ\text{C} < T_a \leq 30^\circ\text{C}$	-25	-20	-15	-1	16	-10
$T_a > 30^\circ\text{C}$	-17	-10	-5	1	14	-4
$\alpha_{\text{cloud}} \leq 0.05$	-24	-16	-10	2	20	-6
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	-23	-17	-12	-1	15	-8
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	-27	-23	-19	-12	1	-17
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	-31	-27	-24	-18	-7	-22
$\alpha_{\text{cloud}} > 0.6$	-36	-32	-29	-24	-15	-28
pwv $\leq 3.18$ (mm)	-41	-34	-29	-20	6	-25
$3.18 < \text{pwv} \leq 6.00$ (mm)	-32	-26	-18	-3	32	-12
$6.00 < \text{pwv} \leq 9.92$ (mm)	-27	-19	-12	1	26	-8
$9.92 < \text{pwv} \leq 14.37$ (mm)	-27	-20	-14	-4	15	-11
$14.37 < \text{pwv} \leq 21.04$ (mm)	-29	-23	-18	-10	7	-15
$21.04 < \text{pwv} \leq 34.29$ (mm)	-25	-21	-17	-10	3	-15
pwv $> 34.29$ (mm)	-20	-16	-12	-2	16	-8
elev $\leq 236$	-26	-22	-20	-17	-10	-19
$236 < \text{elev} \leq 418$	-26	-23	-20	-18	-9	-20
$418 < \text{elev} \leq 740$	-25	-22	-19	-14	-3	-17
$740 < \text{elev} \leq 1622$	-21	-13	-6	1	9	-6
elev $> 1622$	-20	-8	-1	7	18	-1
vc $\leq 9.6$	-26	-22	-20	-17	-5	-19
$9.6 < \text{vc} \leq 17.9$	-25	-21	-18	-12	-1	-16
$17.9 < \text{vc} \leq 36.4$	-25	-21	-16	-7	4	-14
$36.4 < \text{vc} \leq 108.1$	-24	-20	-11	0	10	-9
vc $> 108.1$	-23	-12	-2	7	18	-2
lc01	-25	-20	-17	-5	13	-12
lc02	-24	-22	-20	-19	-17	-20
lc04	-25	-22	-20	-18	-13	-20
lc05	-24	-21	-19	-17	-12	-18
lc06	-15	-1	6	12	19	5
lc07	-24	-8	1	7	16	-1
lc08	-22	-18	-14	-1	15	-9
lc09	-19	-15	-12	-8	1	-11
lc10	-16	-10	-6	-2	5	-6
lc12	-26	-23	-20	-16	-9	-19
lc13	-27	-24	-21	-15	-3	-19
lc16	-21	-12	-2	5	17	-3
LAI $< 0.43$	-24	-16	-7	2	14	-6
$0.43 < \text{LAI} < 0.79$	-30	-21	-14	-6	9	-13
$0.79 < \text{LAI} < 1.22$	-30	-22	-16	-10	5	-15
$1.22 < \text{LAI} < 2.01$	-27	-22	-17	-12	1	-16
LAI $> 2.01$	-27	-24	-21	-18	-4	-20

Table 3.11: *Continued*

CONUS- Specific humidity ( $q$ ) Surface/atmospheric scene	ubRMSP (%)					mean
	5	25	50	75	95	
all-season	21	25	28	30	33	27
warm-season	16	18	21	25	31	22
cold-season	25	28	30	32	34	30
snow-covered	18	21	25	28	32	25
$T_a \leq 0^\circ\text{C}$	23	28	33	35	39	32
$0^\circ\text{C} < T_a \leq 20^\circ\text{C}$	26	29	32	35	39	32
$20^\circ\text{C} < T_a \leq 30^\circ\text{C}$	16	18	20	26	34	22
$T_a > 30^\circ\text{C}$	12	15	19	24	32	20
$\alpha_{\text{cloud}} \leq 0.05$	19	22	24	27	33	25
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	19	23	26	28	31	25
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	17	24	27	30	33	26
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	21	25	29	31	35	28
$\alpha_{\text{cloud}} > 0.6$	22	26	29	31	35	29
pwv $\leq 3.18$ (mm)	27	32	38	43	49	38
$3.18 < \text{pwv} \leq 6.00$ (mm)	26	29	32	35	39	32
$6.00 < \text{pwv} \leq 9.92$ (mm)	24	27	29	32	35	29
$9.92 < \text{pwv} \leq 14.37$ (mm)	24	26	28	30	34	28
$14.37 < \text{pwv} \leq 21.04$ (mm)	20	22	24	26	29	24
$21.04 < \text{pwv} \leq 34.29$ (mm)	16	18	19	20	26	20
pwv $> 34.29$ (mm)	12	14	15	17	24	16
elev $\leq 236$	19	21	23	27	30	24
$236 < \text{elev} \leq 418$	23	25	27	29	31	27
$418 < \text{elev} \leq 740$	23	26	28	29	31	27
$740 < \text{elev} \leq 1622$	24	26	27	29	34	28
elev $> 1622$	27	29	30	32	35	31
vc $\leq 9.6$	19	23	27	29	31	26
$9.6 < \text{vc} \leq 17.9$	21	23	26	28	30	26
$17.9 < \text{vc} \leq 36.4$	22	25	27	29	32	27
$36.4 < \text{vc} \leq 108.1$	24	27	29	31	34	29
vc $> 108.1$	24	27	30	32	35	30
lc01	24	28	30	31	33	29
lc02	20	21	21	22	23	21
lc04	23	24	25	27	29	25
lc05	22	25	28	29	31	27
lc06	26	29	31	33	36	31
lc07	24	28	30	33	36	30
lc08	21	22	24	30	33	26
lc09	22	26	28	29	32	27
lc10	21	24	27	29	32	27
lc12	21	24	26	28	29	26
lc13	20	23	25	27	32	25
lc16	25	31	34	38	43	34
LAI $< 0.43$	26	29	31	33	35	31
$0.43 < \text{LAI} < 0.79$	20	23	27	31	34	27
$0.79 < \text{LAI} < 1.22$	17	20	25	30	33	25
$1.22 < \text{LAI} < 2.01$	15	18	22	27	32	23
LAI $> 2.01$	14	17	18	20	25	18

Table 3.11: *Continued*

CONUS- Specific humidity ( $q$ ) Surface/atmospheric scene	Kendall's $\tau$					
	5	25	50	75	95	mean
all-season	0.44	0.60	0.71	0.76	0.79	0.67
warm-season	0.33	0.43	0.55	0.62	0.66	0.52
cold-season	0.32	0.46	0.63	0.67	0.73	0.57
snow-covered	0.36	0.55	0.71	0.78	0.82	0.65
$T_a \leq 0^\circ\text{C}$	0.24	0.38	0.47	0.58	0.68	0.47
$0^\circ\text{C} < T_a \leq 20^\circ\text{C}$	0.28	0.40	0.53	0.59	0.64	0.49
$20^\circ\text{C} < T_a \leq 30^\circ\text{C}$	0.24	0.43	0.56	0.60	0.66	0.51
$T_a > 30^\circ\text{C}$	0.28	0.42	0.50	0.56	0.63	0.48
$\alpha_{\text{cloud}} \leq 0.05$	0.41	0.60	0.75	0.81	0.86	0.70
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	0.48	0.62	0.74	0.79	0.83	0.70
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	0.45	0.59	0.68	0.76	0.81	0.66
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	0.41	0.55	0.67	0.72	0.76	0.63
$\alpha_{\text{cloud}} > 0.6$	0.40	0.55	0.65	0.69	0.73	0.61
pwv $\leq 3.18$ (mm)	0.15	0.36	0.54	0.62	0.68	0.48
$3.18 < \text{pwv} \leq 6.00$ (mm)	0.12	0.26	0.39	0.52	0.61	0.38
$6.00 < \text{pwv} \leq 9.92$ (mm)	0.16	0.29	0.41	0.49	0.55	0.38
$9.92 < \text{pwv} \leq 14.37$ (mm)	0.15	0.29	0.42	0.51	0.58	0.39
$14.37 < \text{pwv} \leq 21.04$ (mm)	0.20	0.34	0.41	0.47	0.53	0.39
$21.04 < \text{pwv} \leq 34.29$ (mm)	0.22	0.33	0.38	0.44	0.50	0.38
pwv $> 34.29$ (mm)	0.05	0.15	0.20	0.26	0.33	0.20
elev $\leq 236$	0.57	0.68	0.72	0.76	0.81	0.71
$236 < \text{elev} \leq 418$	0.67	0.74	0.77	0.79	0.80	0.75
$418 < \text{elev} \leq 740$	0.54	0.74	0.76	0.78	0.79	0.74
$740 < \text{elev} \leq 1622$	0.42	0.57	0.65	0.71	0.75	0.63
elev $> 1622$	0.37	0.48	0.55	0.60	0.64	0.54
vc $\leq 9.6$	0.61	0.71	0.75	0.79	0.81	0.74
$9.6 < \text{vc} \leq 17.9$	0.64	0.71	0.75	0.77	0.79	0.73
$17.9 < \text{vc} \leq 36.4$	0.51	0.67	0.73	0.77	0.79	0.70
$36.4 < \text{vc} \leq 108.1$	0.40	0.53	0.63	0.76	0.78	0.63
vc $> 108.1$	0.38	0.50	0.56	0.61	0.72	0.55
lc01	0.47	0.57	0.63	0.79	0.80	0.66
lc02	0.57	0.65	0.67	0.69	0.73	0.67
lc04	0.71	0.73	0.75	0.77	0.78	0.75
lc05	0.65	0.75	0.77	0.78	0.80	0.75
lc06	0.45	0.50	0.55	0.60	0.64	0.55
lc07	0.36	0.49	0.58	0.64	0.79	0.57
lc08	0.37	0.51	0.66	0.70	0.73	0.60
lc09	0.32	0.37	0.39	0.44	0.81	0.46
lc10	0.43	0.55	0.65	0.71	0.74	0.62
lc12	0.64	0.72	0.75	0.76	0.79	0.73
lc13	0.43	0.59	0.72	0.76	0.78	0.67
lc16	0.32	0.43	0.50	0.54	0.64	0.49
LAI $< 0.43$	0.36	0.50	0.58	0.64	0.70	0.56
$0.43 < \text{LAI} < 0.79$	0.32	0.51	0.59	0.64	0.71	0.56
$0.79 < \text{LAI} < 1.22$	0.33	0.51	0.59	0.64	0.73	0.56
$1.22 < \text{LAI} < 2.01$	0.29	0.48	0.57	0.62	0.72	0.54
LAI $> 2.01$	0.30	0.51	0.56	0.59	0.65	0.53

Table 3.12: As in Tables 3.9 - 3.11, but for RH.

CONUS- Relative humidity (RH)	Relative bias (%)					mean
	5	25	50	75	95	
Surface/atmospheric scene						
all-season	-19	-13	-8	0	15	-6
warm-season	-21	-12	-7	0	12	-6
cold-season	-21	-15	-8	0	22	-6
snow-covered	-31	-25	-17	-11	5	-16
$T_a \leq 0^\circ\text{C}$	-25	-20	-17	-13	-4	-16
$0^\circ\text{C} < T_a \leq 20^\circ\text{C}$	-16	-9	-4	3	22	-2
$20^\circ\text{C} < T_a \leq 30^\circ\text{C}$	-20	-12	-6	5	26	-2
$T_a > 30^\circ\text{C}$	-23	-11	-3	4	16	-3
$\alpha_{\text{cloud}} \leq 0.05$	-24	-16	-9	0	21	-7
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	-21	-13	-7	1	19	-5
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	-18	-12	-7	-1	10	-6
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	-18	-12	-8	-2	10	-6
$\alpha_{\text{cloud}} > 0.6$	-19	-13	-10	-5	5	-9
$\text{pww} \leq 3.18$ (mm)	-29	-24	-21	-15	14	-16
$3.18 < \text{pww} \leq 6.00$ (mm)	-25	-19	-14	-2	44	-6
$6.00 < \text{pww} \leq 9.92$ (mm)	-21	-13	-7	3	25	-4
$9.92 < \text{pww} \leq 14.37$ (mm)	-19	-12	-5	1	18	-4
$14.37 < \text{pww} \leq 21.04$ (mm)	-20	-13	-8	-3	12	-7
$21.04 < \text{pww} \leq 34.29$ (mm)	-21	-12	-7	-2	7	-7
$\text{pww} > 34.29$ (mm)	-9	-3	2	7	14	2
$\text{elev} \leq 236$	-18	-13	-7	-2	3	-7
$236 < \text{elev} \leq 418$	-18	-15	-12	-8	0	-11
$418 < \text{elev} \leq 740$	-22	-15	-11	-8	5	-10
$740 < \text{elev} \leq 1622$	-17	-9	-2	5	21	-1
$\text{elev} > 1622$	-15	-8	-1	7	24	1
$\text{vc} \leq 9.6$	-21	-16	-13	-7	2	-11
$9.6 < \text{vc} \leq 17.9$	-20	-14	-10	-3	6	-8
$17.9 < \text{vc} \leq 36.4$	-18	-13	-9	-2	13	-6
$36.4 < \text{vc} \leq 108.1$	-16	-10	-5	3	20	-2
$\text{vc} > 108.1$	-15	-8	-1	6	23	0
lc01	-16	-13	-9	-1	11	-6
lc02	-10	-5	-3	0	3	-3
lc04	-12	-9	-7	-4	3	-6
lc05	-14	-11	-9	-4	3	-7
lc06	-28	-10	5	25	41	6
lc07	-18	-8	2	12	27	3
lc08	-8	-3	0	4	20	2
lc09	-15	-8	1	7	12	0
lc10	-14	-9	-3	2	12	-3
lc12	-22	-16	-13	-8	0	-12
lc13	-20	-14	-8	-3	10	-7
lc16	-24	-12	4	11	21	1
$\text{LAI} < 0.43$	-23	-17	-8	3	22	-6
$0.43 < \text{LAI} < 0.79$	-24	-17	-11	-3	13	-9
$0.79 < \text{LAI} < 1.22$	-24	-16	-11	-4	9	-9
$1.22 < \text{LAI} < 2.01$	-20	-12	-7	-2	9	-7
$\text{LAI} > 2.01$	-18	-12	-7	-3	5	-7

Table 3.12: *Continued*

CONUS- Relative humidity (RH) Surface/atmospheric scene	ubRMSP (%)					mean
	5	25	50	75	95	
all-season	19	21	25	32	41	27
warm-season	16	19	22	29	38	25
cold-season	19	22	25	31	41	27
snow-covered	13	16	19	24	32	20
$T_a \leq 0^\circ\text{C}$	17	18	20	23	27	21
$0^\circ\text{C} < T_a \leq 20^\circ\text{C}$	21	23	25	31	38	27
$20^\circ\text{C} < T_a \leq 30^\circ\text{C}$	16	19	22	31	42	25
$T_a > 30^\circ\text{C}$	15	19	23	30	38	25
$\alpha_{\text{cloud}} \leq 0.05$	18	21	24	32	44	27
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	18	21	24	31	39	26
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	18	20	23	29	36	25
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	19	21	23	28	35	25
$\alpha_{\text{cloud}} > 0.6$	17	20	21	24	32	23
pwv $\leq 3.18$ (mm)	14	16	18	24	42	22
$3.18 < \text{pwv} \leq 6.00$ (mm)	16	19	25	33	47	27
$6.00 < \text{pwv} \leq 9.92$ (mm)	19	22	25	33	40	27
$9.92 < \text{pwv} \leq 14.37$ (mm)	20	22	25	30	37	27
$14.37 < \text{pwv} \leq 21.04$ (mm)	19	21	24	28	35	25
$21.04 < \text{pwv} \leq 34.29$ (mm)	16	18	20	23	32	21
pwv $> 34.29$ (mm)	14	16	17	19	28	18
elev $\leq 236$	18	20	21	23	28	22
$236 < \text{elev} \leq 418$	19	21	22	23	26	22
$418 < \text{elev} \leq 740$	19	21	22	25	30	23
$740 < \text{elev} \leq 1622$	21	27	30	35	42	31
elev $> 1622$	25	31	35	39	43	35
vc $\leq 9.6$	18	20	22	24	30	23
$9.6 < \text{vc} \leq 17.9$	19	21	22	25	33	24
$17.9 < \text{vc} \leq 36.4$	20	21	23	29	39	26
$36.4 < \text{vc} \leq 108.1$	19	21	30	37	42	30
vc $> 108.1$	21	27	32	37	43	32
lc01	20	21	25	31	37	26
lc02	18	19	19	20	21	19
lc04	18	20	21	22	23	21
lc05	19	20	21	22	26	21
lc06	29	34	39	44	47	39
lc07	20	31	37	40	44	35
lc08	19	20	22	34	42	27
lc09	21	28	31	32	36	30
lc10	23	26	30	33	38	30
lc12	19	21	23	25	29	23
lc13	19	21	22	25	38	25
lc16	23	37	41	43	47	39
LAI $< 0.43$	18	24	29	35	43	30
$0.43 < \text{LAI} < 0.79$	17	22	24	27	35	25
$0.79 < \text{LAI} < 1.22$	18	20	22	25	32	23
$1.22 < \text{LAI} < 2.01$	17	20	22	24	30	22
LAI $> 2.01$	15	17	19	20	27	19

Table 3.12: *Continued*

CONUS- Relative humidity (RH) Surface/atmospheric scene	Kendall's $\tau$					mean
	5	25	50	75	95	
all-season	0.33	0.43	0.49	0.54	0.61	0.48
warm-season	0.33	0.43	0.48	0.53	0.62	0.48
cold-season	0.08	0.27	0.42	0.48	0.55	0.37
snow-covered	-0.05	0.06	0.13	0.21	0.34	0.14
$T_a \leq 0^\circ\text{C}$	-0.03	0.04	0.08	0.16	0.34	0.11
$0^\circ\text{C} < T_a \leq 20^\circ\text{C}$	0.26	0.37	0.44	0.49	0.54	0.43
$20^\circ\text{C} < T_a \leq 30^\circ\text{C}$	0.22	0.35	0.43	0.49	0.56	0.42
$T_a > 30^\circ\text{C}$	0.22	0.35	0.44	0.52	0.62	0.43
$\alpha_{\text{cloud}} \leq 0.05$	0.27	0.40	0.49	0.55	0.62	0.47
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	0.31	0.40	0.46	0.53	0.61	0.46
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	0.22	0.31	0.40	0.49	0.57	0.40
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	0.11	0.22	0.32	0.41	0.54	0.32
$\alpha_{\text{cloud}} > 0.6$	0.04	0.14	0.23	0.32	0.51	0.24
pwv $\leq 3.18$ (mm)	-0.13	-0.05	0.03	0.16	0.40	0.07
$3.18 < \text{pwv} \leq 6.00$ (mm)	0.08	0.20	0.35	0.45	0.57	0.33
$6.00 < \text{pwv} \leq 9.92$ (mm)	0.32	0.44	0.51	0.57	0.64	0.50
$9.92 < \text{pwv} \leq 14.37$ (mm)	0.35	0.46	0.53	0.57	0.63	0.51
$14.37 < \text{pwv} \leq 21.04$ (mm)	0.35	0.43	0.48	0.53	0.63	0.48
$21.04 < \text{pwv} \leq 34.29$ (mm)	0.30	0.39	0.46	0.53	0.61	0.46
pwv $> 34.29$ (mm)	0.23	0.34	0.42	0.50	0.60	0.42
elev $\leq 236$	0.39	0.45	0.48	0.52	0.56	0.48
$236 < \text{elev} \leq 418$	0.38	0.42	0.47	0.50	0.55	0.46
$418 < \text{elev} \leq 740$	0.32	0.40	0.47	0.54	0.58	0.47
$740 < \text{elev} \leq 1622$	0.35	0.46	0.52	0.57	0.62	0.51
elev $> 1622$	0.28	0.46	0.52	0.58	0.63	0.50
vc $\leq 9.6$	0.38	0.44	0.49	0.52	0.56	0.48
$9.6 < \text{vc} \leq 17.9$	0.38	0.45	0.49	0.53	0.57	0.49
$17.9 < \text{vc} \leq 36.4$	0.37	0.44	0.49	0.55	0.61	0.49
$36.4 < \text{vc} \leq 108.1$	0.32	0.43	0.49	0.56	0.63	0.49
vc $> 108.1$	0.27	0.41	0.49	0.56	0.63	0.48
lc01	0.27	0.36	0.41	0.46	0.55	0.41
lc02	0.42	0.47	0.49	0.51	0.52	0.48
lc04	0.39	0.42	0.44	0.46	0.50	0.44
lc05	0.36	0.40	0.43	0.46	0.52	0.43
lc06	0.27	0.39	0.46	0.49	0.54	0.44
lc07	0.30	0.46	0.51	0.57	0.63	0.50
lc08	0.41	0.46	0.49	0.52	0.61	0.50
lc09	0.36	0.46	0.56	0.59	0.60	0.52
lc10	0.47	0.52	0.56	0.59	0.63	0.55
lc12	0.44	0.47	0.51	0.54	0.58	0.51
lc13	0.32	0.46	0.49	0.52	0.57	0.48
lc16	0.22	0.36	0.55	0.62	0.66	0.49
LAI $< 0.43$	0.18	0.42	0.49	0.54	0.62	0.46
$0.43 < \text{LAI} < 0.79$	0.07	0.37	0.48	0.54	0.60	0.43
$0.79 < \text{LAI} < 1.22$	0.09	0.35	0.47	0.53	0.60	0.42
$1.22 < \text{LAI} < 2.01$	0.25	0.40	0.47	0.52	0.59	0.45
LAI $> 2.01$	0.32	0.40	0.44	0.48	0.53	0.43

Table 3.13: The 5-number summary and mean-value correspondent to each of the box plots in Figure 3.11 for  $T_s$ .

Africa- Surface temp. ( $T_s$ ) Surface/atmospheric scene	Bias ( $^{\circ}\text{C}$ )					
	5	25	50	75	95	mean
QC1- AIRS Qual_Surf < 2	-2.7	-0.8	0.5	3.0	6.4	1.1
QC2- SEVIRI RMS < 2.0 $^{\circ}\text{C}$	-2.6	-1.1	-0.1	1.2	4.9	0.3
$\alpha_{\text{cloud}} \leq 0.05$	-3.2	-1.4	-0.1	2.2	5.9	0.5
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	-2.6	-0.8	0.5	3.2	6.6	1.2
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	-2.1	-0.6	0.5	1.7	4.2	0.7
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	-3.3	-1.7	-0.6	1.2	4.2	-0.1
pwv $\leq 6.34$ (mm)	-3.2	-1.7	-0.9	0.0	1.7	-0.8
$6.34 < \text{pwv} \leq 11.37$ (mm)	-4.0	-2.2	-1.4	-0.5	1.1	-1.4
$11.37 < \text{pwv} \leq 17.49$ (mm)	-3.4	-1.6	-0.4	1.5	5.3	0.1
$17.49 < \text{pwv} \leq 25.20$ (mm)	-3.3	-1.7	-0.7	0.3	2.2	-0.6
$25.20 < \text{pwv} \leq 35.41$ (mm)	-3.3	-1.3	-0.2	0.8	3.2	-0.2
$35.41 < \text{pwv} \leq 46.35$ (mm)	-2.7	-0.7	0.7	3.1	6.2	1.2
pwv > 46.35 (mm)	-3.2	-0.6	1.3	3.9	7.1	1.6
elev $\leq 284$	-2.4	-0.4	1.4	3.8	6.9	1.8
$284 < \text{elev} \leq 436$	-3.3	-1.1	-0.3	1.0	4.5	0.1
$436 < \text{elev} \leq 640$	-3.5	-1.6	-0.5	0.2	2.4	-0.6
$640 < \text{elev} \leq 1063$	-3.2	-1.8	-0.8	0.2	1.9	-0.8
elev > 1063	-2.9	-1.6	-0.8	0.0	1.7	-0.7
vc $\leq 7.2$	-2.5	-0.4	1.9	4.5	7.7	2.2
$7.2 < \text{vc} \leq 14.4$	-1.9	-0.3	1.7	4.1	7.4	2.0
$14.4 < \text{vc} \leq 25.6$	-2.3	-0.9	0.2	2.5	5.6	0.9
$25.6 < \text{vc} \leq 58.6$	-3.1	-1.2	-0.2	1.2	4.4	0.1
vc > 58.6	-3.6	-1.3	0.1	1.7	4.7	0.3
lc02	-1.5	-0.7	-0.2	0.3	2.5	0.0
lc04	-1.7	-0.7	-0.2	0.3	1.6	-0.1
lc06	-1.8	0.6	1.7	2.6	4.1	1.5
lc07	-3.1	-1.0	0.5	2.3	4.8	0.7
lc08	-2.4	-1.2	-0.5	0.2	1.8	-0.4
lc09	-3.0	-1.6	-0.8	0.1	1.7	-0.8
lc10	-2.8	-0.7	0.5	1.5	3.9	0.5
lc12	-2.5	-1.0	0.0	0.9	3.5	0.1
lc13	-5.3	-2.0	-0.6	2.0	4.9	0.0
lc16	-2.6	1.3	3.3	4.9	7.8	3.0
LAI < 0.33	-3.6	-1.4	0.1	1.7	4.0	0.1
$0.33 < \text{LAI} < 0.60$	-3.8	-1.8	-0.7	0.4	2.4	-0.7
$0.60 < \text{LAI} < 0.95$	-3.1	-1.4	-0.5	0.5	2.3	-0.4
$0.95 < \text{LAI} < 1.74$	-2.5	-1.1	-0.3	0.5	2.1	-0.3
LAI > 1.74	-2.0	-0.9	-0.3	0.4	1.9	-0.2

Table 3.13: *Continued*

Africa- Surface temp. ( $T_s$ ) Surface/atmospheric scene	ubRMS ( $^{\circ}\text{C}$ )					mean
	5	25	50	75	95	
QC1- AIRS Qual_Surf < 2	3.1	3.5	3.9	4.4	5.4	4.1
QC2- SEVIRI RMS < 2.0 $^{\circ}\text{C}$	3.1	3.5	3.9	4.4	5.3	4.0
$\alpha_{\text{cloud}} \leq 0.05$	2.8	3.3	3.7	4.3	5.2	3.9
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	2.6	3.2	3.7	4.4	5.4	3.8
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	3.5	4.1	4.5	5.1	6.1	4.6
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	4.1	4.7	5.2	5.7	6.5	5.3
pwv $\leq$ 6.34 (mm)	1.4	1.8	2.1	2.6	3.6	2.3
6.34 < pwv $\leq$ 11.37 (mm)	1.5	1.9	2.2	2.8	4.0	2.4
11.37 < pwv $\leq$ 17.49 (mm)	1.9	2.5	3.2	3.9	4.9	3.3
17.49 < pwv $\leq$ 25.20 (mm)	2.6	3.2	3.7	4.2	5.0	3.8
25.20 < pwv $\leq$ 35.41 (mm)	2.9	3.6	4.1	4.7	5.8	4.2
35.41 < pwv $\leq$ 46.35 (mm)	2.9	3.5	3.9	4.5	5.6	4.1
pwv > 46.35 (mm)	3.0	3.5	4.0	4.5	5.6	4.1
elev $\leq$ 284	3.2	3.6	4.1	4.6	5.5	4.2
284 < elev $\leq$ 436	3.3	3.5	3.9	4.6	5.8	4.2
436 < elev $\leq$ 640	3.2	3.4	3.7	4.1	5.2	3.9
640 < elev $\leq$ 1063	3.1	3.4	3.7	4.0	4.8	3.8
elev > 1063	3.0	3.3	3.6	3.9	4.7	3.7
vc $\leq$ 7.2	3.1	3.7	4.1	4.6	5.4	4.2
7.2 < vc $\leq$ 14.4	3.1	3.5	3.9	4.4	5.2	4.0
14.4 < vc $\leq$ 25.6	3.1	3.5	3.8	4.2	5.1	3.9
25.6 < vc $\leq$ 58.6	3.1	3.5	3.8	4.3	5.4	4.0
vc > 58.6	3.2	3.7	4.1	4.7	5.9	4.3
lc02	3.1	3.4	3.5	3.8	4.4	3.6
lc04	2.6	2.9	3.2	3.9	4.7	3.4
lc06	3.8	4.1	4.4	4.7	5.1	4.4
lc07	3.3	3.7	4.3	4.9	5.9	4.4
lc08	3.0	3.3	3.6	3.9	4.4	3.6
lc09	3.2	3.6	3.9	4.2	5.0	4.0
lc10	3.5	4.2	4.5	4.8	5.5	4.5
lc12	3.4	4.0	4.3	4.6	5.5	4.3
lc13	3.0	3.4	4.2	4.8	6.1	4.3
lc16	3.1	3.6	4.1	4.6	5.8	4.2
LAI < 0.33	2.9	3.7	4.3	4.8	5.8	4.3
0.33 < LAI < 0.60	2.6	3.4	4.0	4.5	5.4	4.0
0.60 < LAI < 0.95	2.6	3.3	3.8	4.2	5.1	3.8
0.95 < LAI < 1.74	2.7	3.2	3.6	4.0	4.7	3.6
LAI > 1.74	2.8	3.2	3.5	3.8	4.5	3.5

Table 3.13: *Continued*

Africa-Surface temp. ( $T_s$ ) Surface/atmospheric scene	Kendall's $\tau$					mean
	5	25	50	75	95	
QC1- AIRS Qual_Surf < 2	0.37	0.59	0.68	0.74	0.82	0.65
QC2- SEVIRI RMS < 2.0°C	0.36	0.55	0.64	0.71	0.80	0.62
$\alpha_{\text{cloud}} \leq 0.05$	0.39	0.58	0.66	0.72	0.79	0.64
$0.05 < \alpha_{\text{cloud}} \leq 0.2$	0.36	0.58	0.68	0.75	0.81	0.65
$0.2 < \alpha_{\text{cloud}} \leq 0.4$	0.26	0.39	0.51	0.61	0.73	0.50
$0.4 < \alpha_{\text{cloud}} \leq 0.6$	0.17	0.30	0.37	0.44	0.56	0.37
pwv $\leq$ 6.34 (mm)	0.67	0.77	0.81	0.84	0.87	0.79
$6.34 < \text{pwv} \leq 11.37$ (mm)	0.63	0.77	0.82	0.84	0.87	0.79
$11.37 < \text{pwv} \leq 17.49$ (mm)	0.46	0.66	0.75	0.80	0.84	0.71
$17.49 < \text{pwv} \leq 25.20$ (mm)	0.47	0.61	0.68	0.72	0.77	0.66
$25.20 < \text{pwv} \leq 35.41$ (mm)	0.26	0.43	0.53	0.61	0.69	0.51
$35.41 < \text{pwv} \leq 46.35$ (mm)	0.33	0.52	0.63	0.74	0.83	0.61
pwv > 46.35 (mm)	0.32	0.53	0.64	0.72	0.79	0.61
elev $\leq$ 284	0.38	0.60	0.68	0.75	0.82	0.66
$284 < \text{elev} \leq 436$	0.32	0.40	0.54	0.69	0.77	0.54
$436 < \text{elev} \leq 640$	0.34	0.39	0.48	0.65	0.76	0.52
$640 < \text{elev} \leq 1063$	0.42	0.58	0.68	0.73	0.82	0.65
elev > 1063	0.49	0.63	0.69	0.73	0.80	0.67
vc $\leq$ 7.2	0.41	0.61	0.69	0.74	0.81	0.66
$7.2 < \text{vc} \leq 14.4$	0.38	0.61	0.70	0.76	0.82	0.67
$14.4 < \text{vc} \leq 25.6$	0.38	0.61	0.69	0.74	0.82	0.66
$25.6 < \text{vc} \leq 58.6$	0.37	0.56	0.66	0.73	0.81	0.63
vc > 58.6	0.36	0.53	0.64	0.73	0.81	0.62
lc02	0.30	0.35	0.39	0.44	0.58	0.41
lc04	0.46	0.63	0.65	0.67	0.71	0.64
lc06	0.55	0.61	0.63	0.65	0.69	0.63
lc07	0.41	0.58	0.70	0.78	0.83	0.67
lc08	0.43	0.58	0.64	0.68	0.72	0.62
lc09	0.50	0.63	0.69	0.72	0.75	0.66
lc10	0.49	0.57	0.61	0.66	0.80	0.62
lc12	0.47	0.60	0.64	0.69	0.77	0.64
lc13	0.34	0.53	0.71	0.77	0.82	0.65
lc16	0.49	0.66	0.73	0.78	0.83	0.71
LAI < 0.33	0.35	0.52	0.60	0.73	0.83	0.61
$0.33 < \text{LAI} < 0.60$	0.35	0.49	0.57	0.67	0.77	0.57
$0.60 < \text{LAI} < 0.95$	0.34	0.49	0.57	0.64	0.73	0.56
$0.95 < \text{LAI} < 1.74$	0.31	0.43	0.52	0.60	0.69	0.51
LAI > 1.74	0.25	0.34	0.40	0.48	0.63	0.42

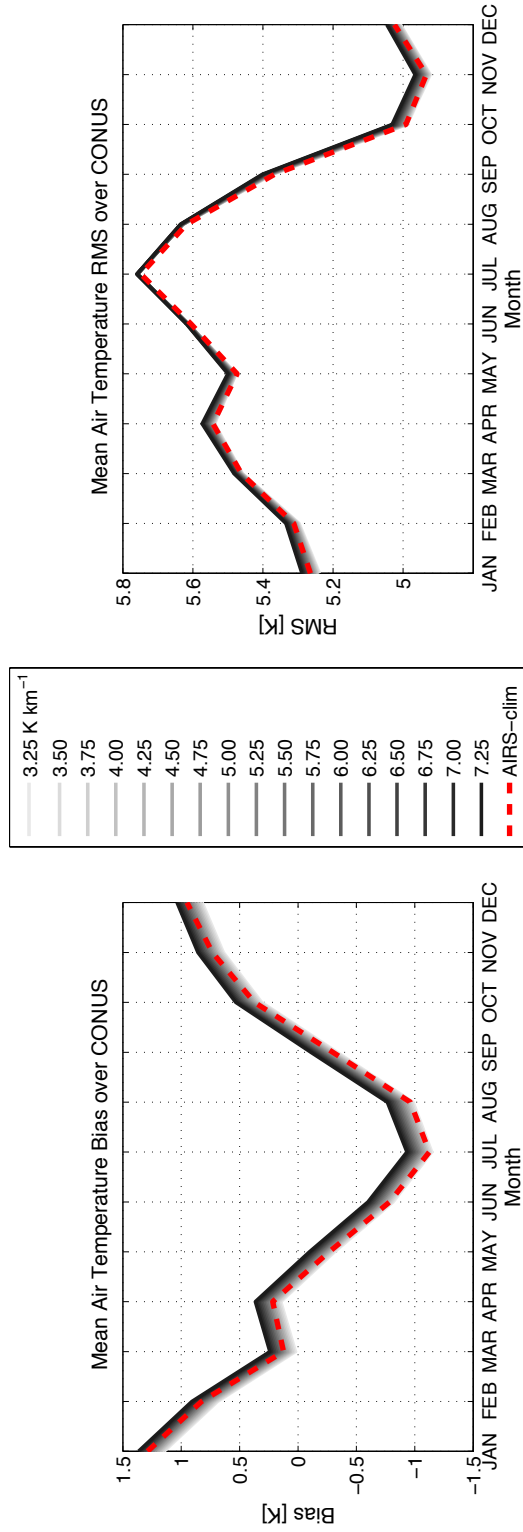


Figure 3.14: The sensitivity of AIRS  $T_a$  to the environmental lapse rate (ELR) constant applied in elevation correction computed from footprint-station (NCDC) matchups over CONUS. The red dashed line denotes the error properties of footprint retrievals that were corrected using AIRS-derived ELR computed on-the-fly.

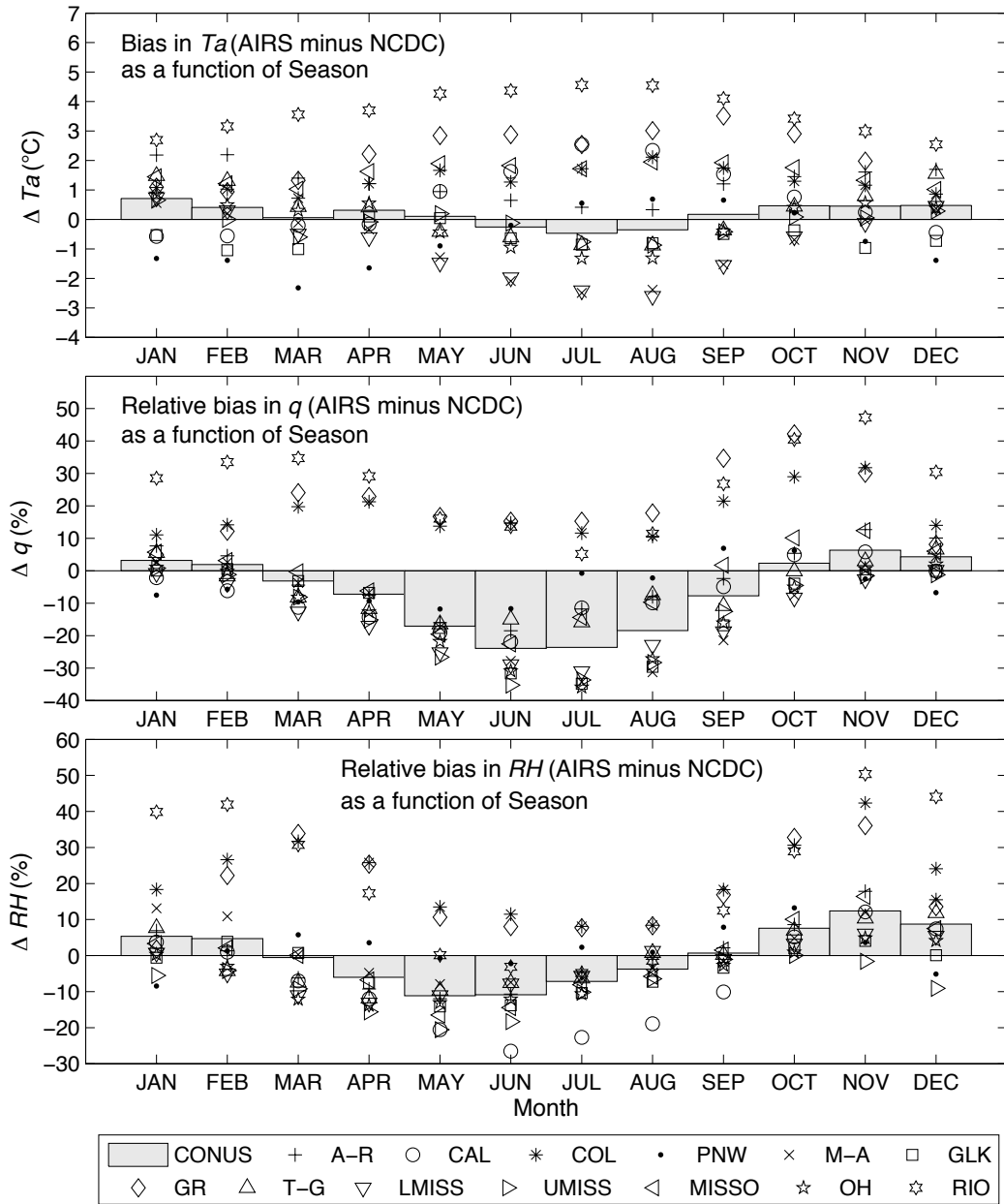


Figure 3.15: As in Figure 3.13, but for seasons.

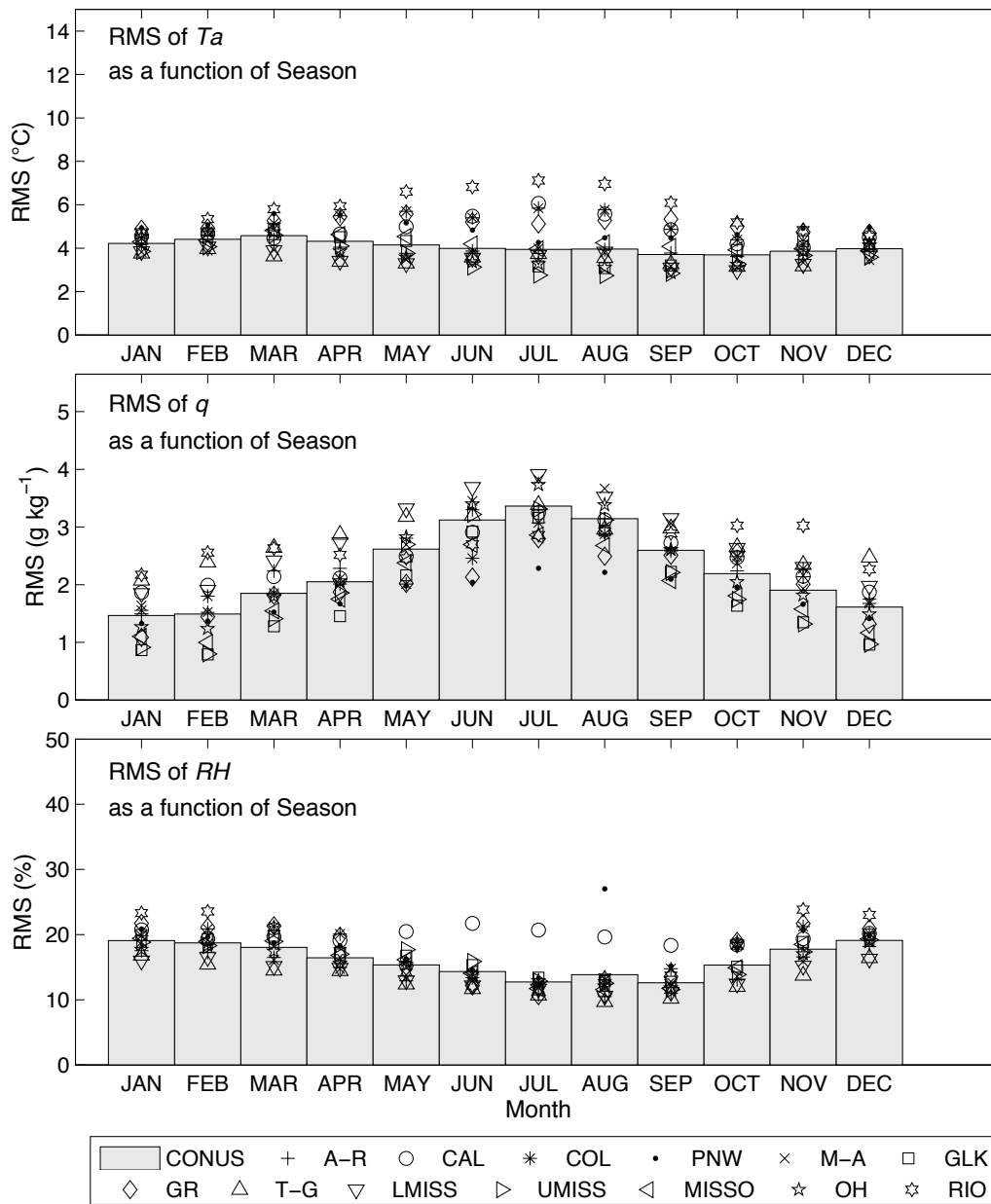


Figure 3.15: *Continued*

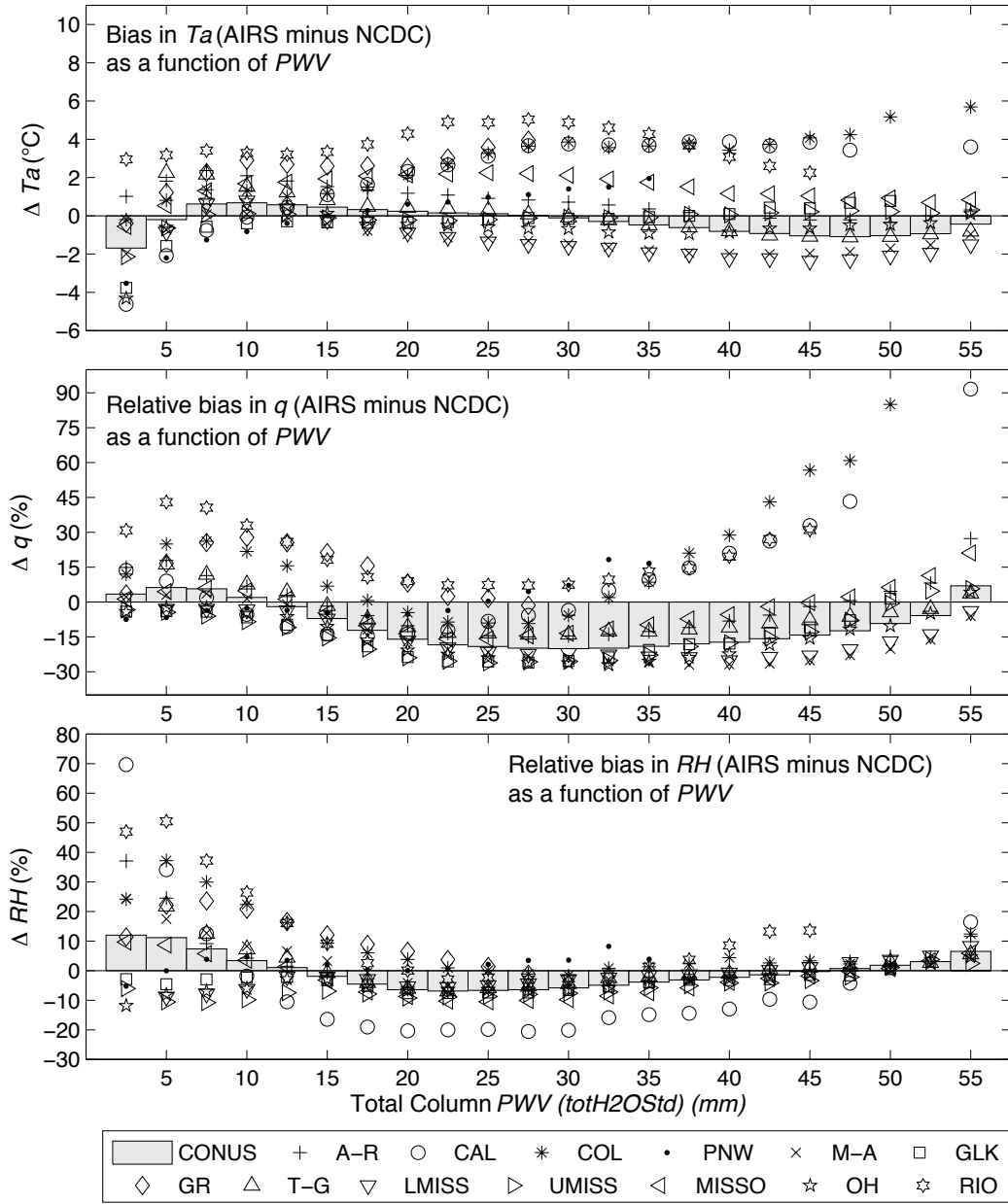


Figure 3.16: As in Figure 3.13, but for AIRS pwv.

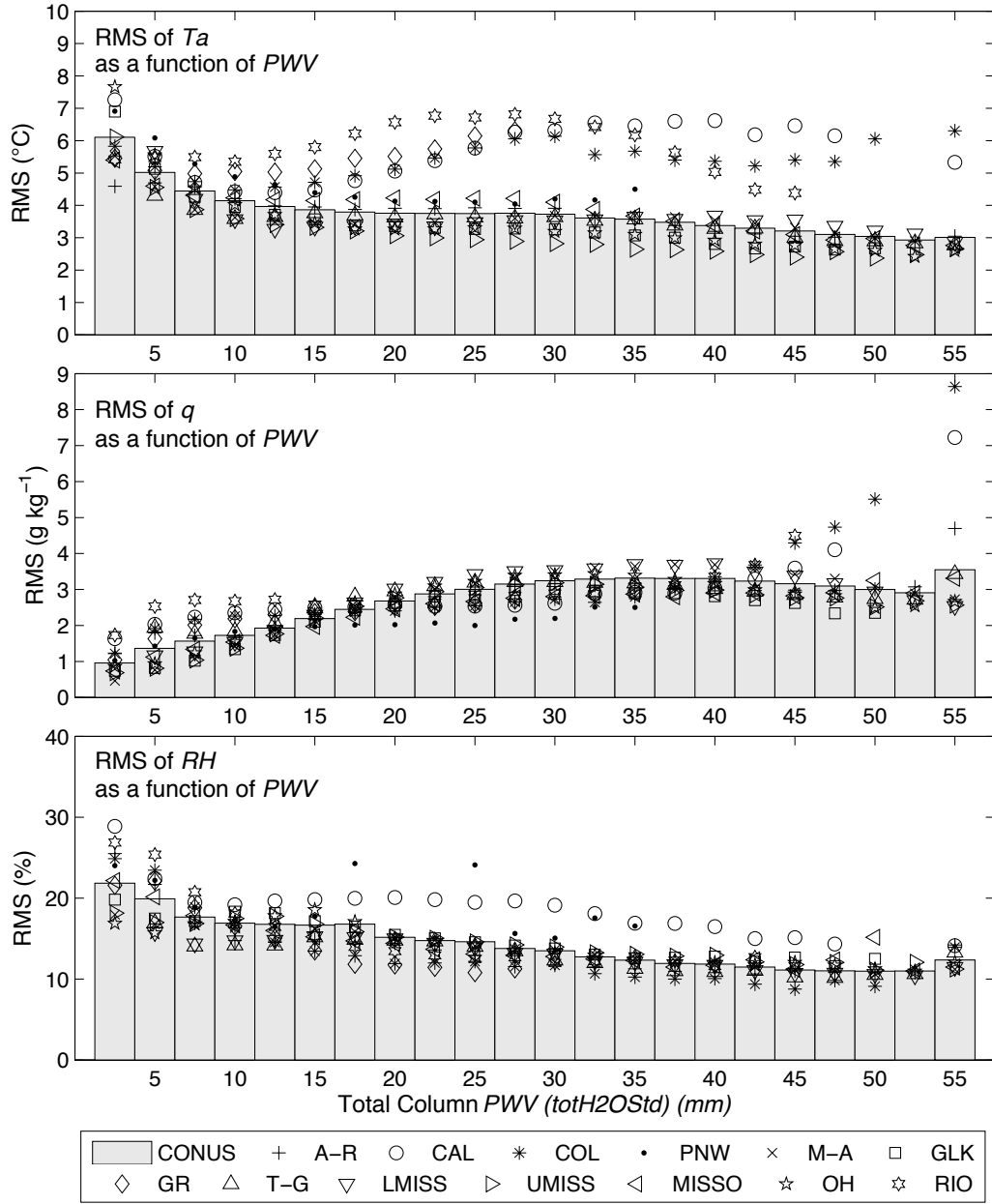


Figure 3.16: *Continued*

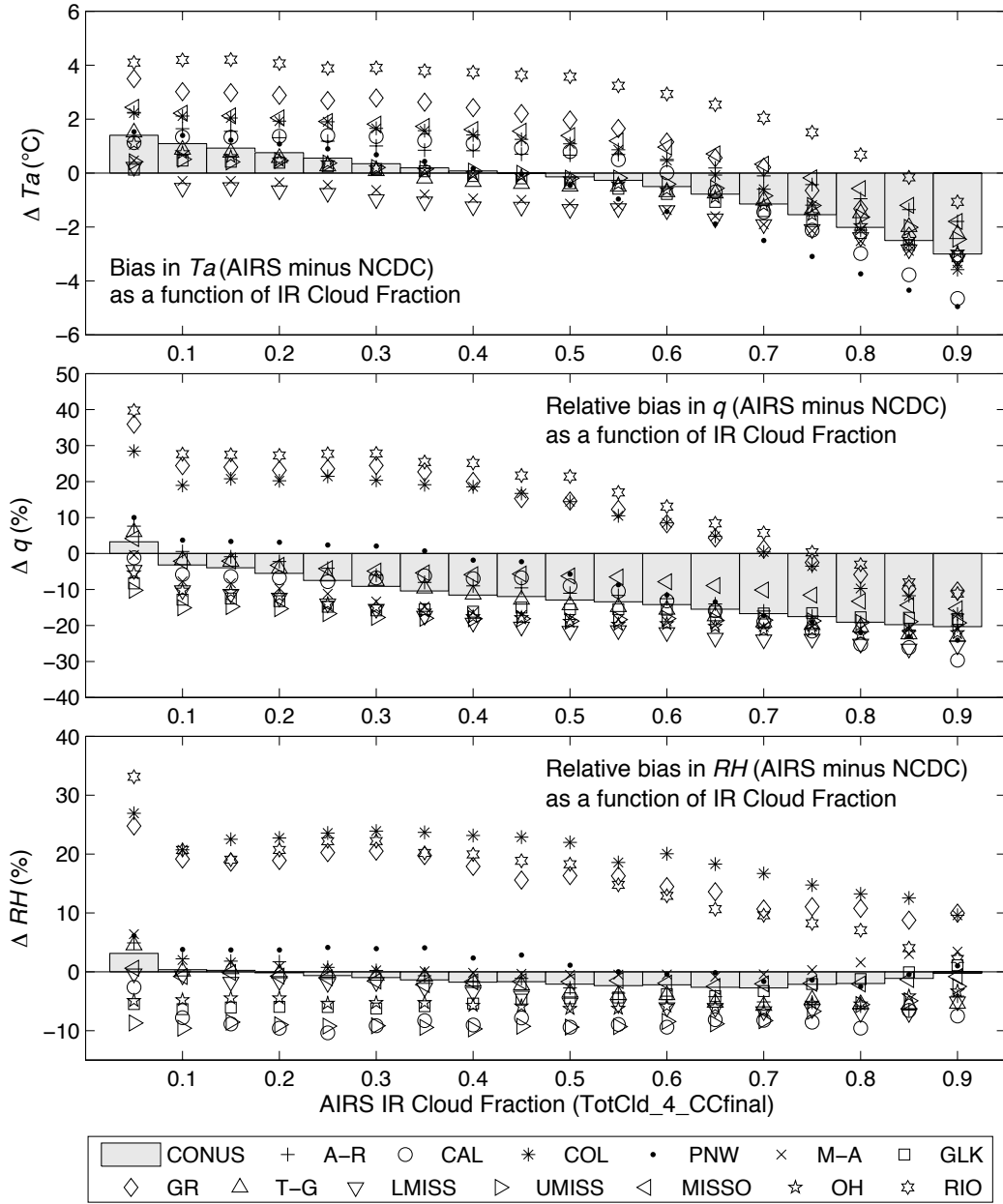


Figure 3.17: As in Figure 3.13, but for AIRS TIR cloud fraction.

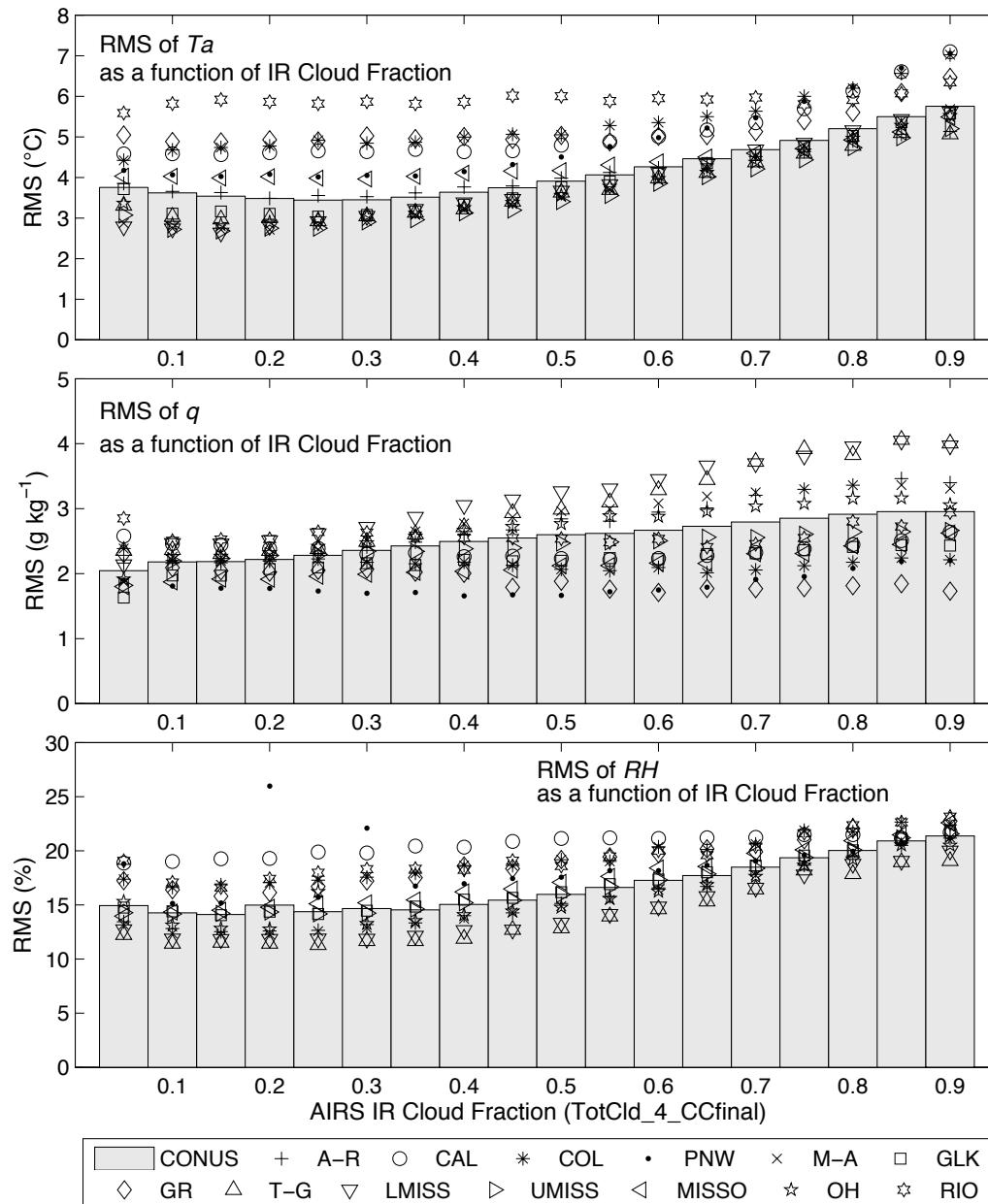


Figure 3.17: *Continued*

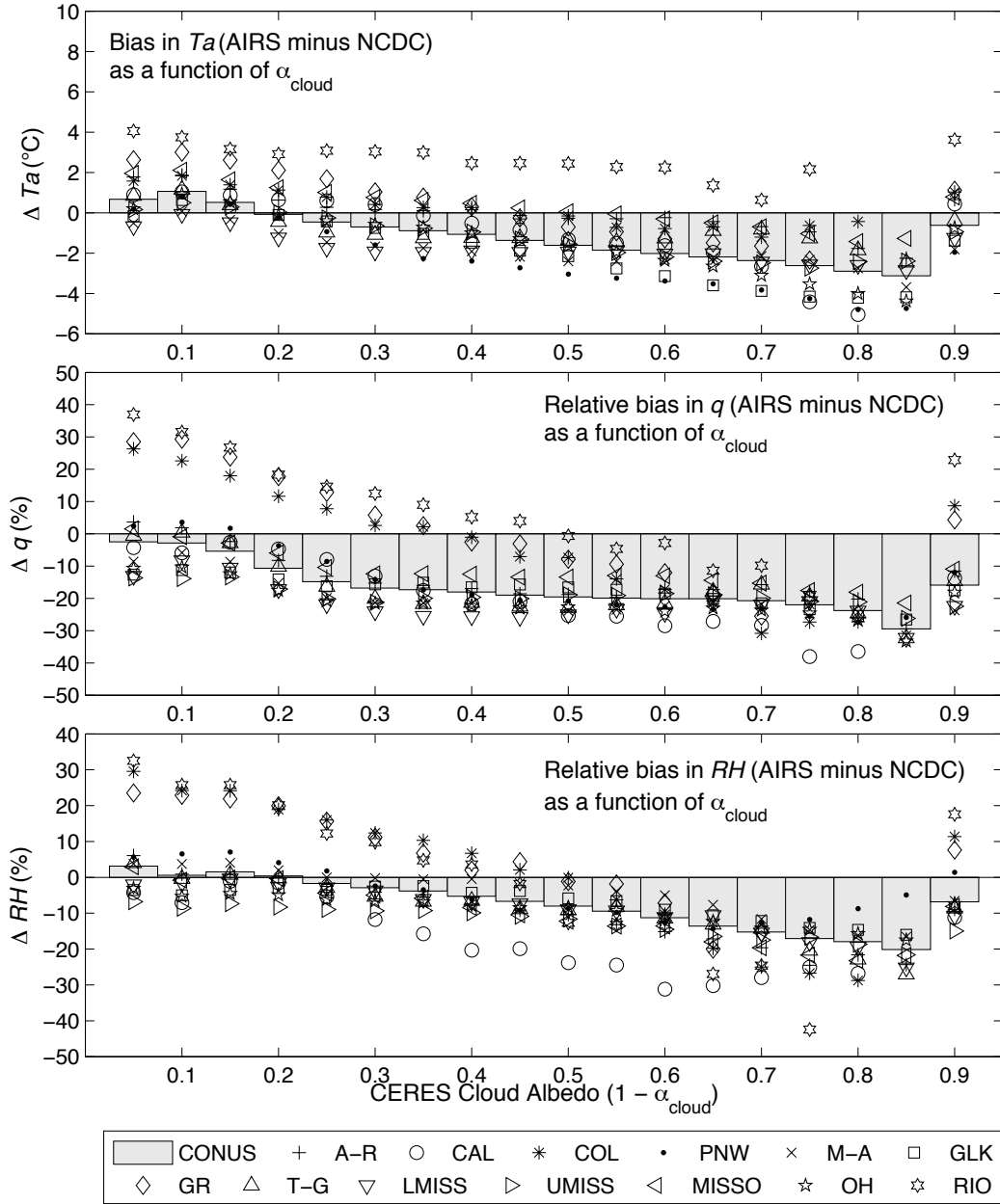


Figure 3.18: As in Figure 3.13, but for CERES  $\alpha_{\text{cloud}}$ .

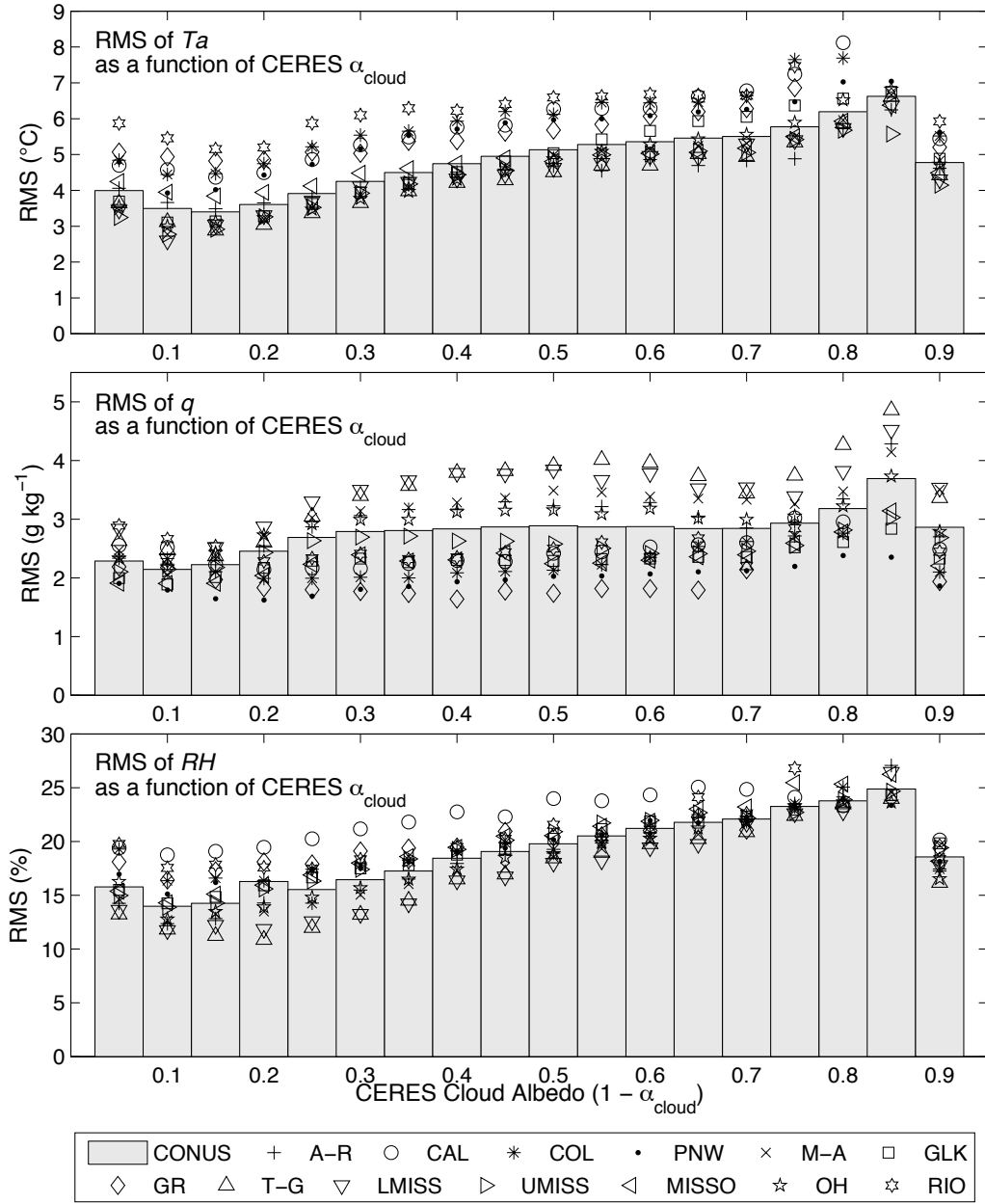


Figure 3.18: *Continued*