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SUBTASK MEMORANDUM

Task: 1.3 Adequacy and validity of meteorological measurements

Subtask: 6 Assess the impact of the RASS range gate coverage by comparing to rawinsonde data

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Date: 10/24/02

True collocated rawinsonde/RASS data were not available on a routine basis from any of the CRPAQS sites. Thus, the subtask was addressed by reviewing audit data obtained from 11 CRPAQS sites during January and February 2000. Thirty-nine rawinsonde/RASS comparisons were available for review, representing a wide range of meteorological conditions. Five of the RASS units were set to use 60-meter range gates and six were set to 105-meter range gates, providing additional insight into the role of range gate distance. Plots of these comparisons are presented in **Figures 1 – 11**.

From these available soundings, 35 inversions were identified where the rawinsonde and RASS data could be compared. The reported strengths of the inversions were calculated for each method, and are presented in **Table 1**. Basic comparison statistics are presented in **Table 2**.

Not surprisingly, limitations with the RASS data are immediately apparent. First, the RASS appears to systematically underestimate inversion strength (lapse rate). As shown in Table 2, inversion strengths recorded by the RASS are on average 67% lower than actual strengths as reported by the rawinsondes. The primary reason for this underestimating appears to be due to the RASS's inability to accurately measure inversion thickness, being limited to increments of the range gate. This is demonstrated by comparing results for the two different range gates distances. RASS units with 60-meter range gates showed only a 54% underestimation versus a 76% underestimation for those with 105-meter range gates, due to the finer resolution of 60-meter RASS units. In fact, comparing the average reported thickness for the RASS and rawinsonde data shows that inversion thicknesses reported by the RASS are on average 54%, 79%, and 70% higher than the rawinsonde inversion thicknesses when comparing the 60-meter, 105-meter, and combined datasets, respectively. These values match almost exactly the underestimation of the inversion strength.

This limitation is graphically demonstrated well by the 13:00 sounding at Goleta and the 17:00 sounding at Los Banos. Due to the averaging occurring at each range gate, the RASS fails to catch the magnitude of key portions of the inversion structure, resulting in a weaker inversion profile.

The separation between range gates has a tendency to smooth out profiles in general, resulting in the loss of profile structural detail. This results in instance where inversions

and other significant characteristics simply are not identified by the RASS. Soundings that demonstrate this include:

- Edison – 12:00 hr
- Lost Hills – 10:00 hr
- Mojave – 12:00 hr
- Travis – 10:00 hr
- Trimmer – 16:00 hr

Of the 35 inversions identified by the rawinsondes and included in this comparison, 9 were not in evidence in the RASS measurements (lapse rates less than or equal to zero). This approximately 25% miss rate was essentially identical for both RASS units with 60-meter gates and those with 105-meter gates.

In conclusion, the RASS range gates have a significant effect on the RASS's ability to accurately characterize inversions within the soundings. Of the 35 soundings examined, the RASS did not identify about a quarter of the inversions identified by the rawinsonde. When inversions were identified, their strengths, measured by the lapse rate, were on the order of 67% lower for the RASS measurements than for the rawinsonde measurements, due primarily to the RASS's range gate limitation in quantifying the thickness of the inversion layer Some improvement occurs when 60-m gates are used instead of 105-m gates.

Table 1. Rawinsonde/RASS Comparison Inversion Data

Site	Gate	Time	Audit		RASS		Inversion Strength (°C)		
			dT (°C)	Thickness (m)	dT (°C)	Thickness (m)	Audit (°C/100m)	RASS (°C/100m)	% Diff.
Angiola	60m	10:00	1.2	46	0.5	180	2.61	0.28	-89%
		12:00	0.2	12	0.0	60	1.67	0.00	-100%
		14:00	0.3	45	0.3	120	0.67	0.25	-63%
Edison	60m	12:00	0.5	39	-0.3	60	1.28	-0.50	-139%
		12:00	0.4	36	0.1	60	1.11	0.17	-85%
Lost Hills	60m	10:00	0.5	41	0.0	60	1.22	0.00	-100%
		12:00	0.2	22	0.2	60	0.91	0.33	-63%
Monterey	60m	14:00	1.1	39	0.6	60	2.82	1.00	-65%
Stevenson	60m	10:00	1.0	43	0.4	60	2.33	0.67	-71%
		12:00	0.8	180	1.8	240	0.44	0.75	69%
		12:00	1.5	75	0.5	60	2.00	0.83	-58%
		15:00	1.1	126	1.1	120	0.87	0.92	5%
		15:00	1.3	81	2.0	120	1.60	1.67	4%
Visalia	60m	11:00	1.1	136	1.1	120	0.81	0.92	13%
		15:00	0.7	53	0.4	120	1.32	0.33	-75%
Goleta	105m	9:00	2.5	171	1.8	210	1.46	0.86	-41%
		12:00	2.2	85	2.0	210	2.59	0.95	-63%
		13:00	2.2	89	1.1	210	2.47	0.52	-79%
		16:00	1.0	74	1.1	210	1.35	0.52	-61%
Los Banos	105m	12:00	0.7	91	0.4	105	0.77	0.38	-50%
		14:00	1.9	108	1.4	210	1.76	0.67	-62%
		17:00	0.5	75	0.2	105	0.67	0.19	-71%
Mojave	105m	10:00	0.3	67	-0.1	105	0.45	-0.10	-121%
		10:00	0.4	25	0.0	105	1.60	0.00	-100%
		10:00	0.3	29	-0.1	105	1.03	-0.10	-109%
		10:00	0.8	51	0.6	105	1.57	0.57	-64%
		12:00	0.8	44	0.0	105	1.82	0.00	-100%
		16:00	0.3	64	0.1	105	0.47	0.10	-80%
Travis	105m	14:00	1.7	186	1.6	210	0.91	0.76	-17%
		14:00	2.3	204	1.9	315	1.13	0.60	-47%
		17:00	1.0	50	0.4	105	2.00	0.38	-81%
		17:00	1.2	121	0.7	105	0.99	0.67	-33%
Trimmer	105m	11:00	0.3	29	-0.2	105	1.03	-0.19	-118%
		11:00	0.4	40	-0.4	105	1.00	-0.38	-138%
		16:00	0.5	42	0.3	105	1.19	0.29	-76%

Table 2. Inversion Comparison Summary

Sites	Inversions (N)	Average Inversion Strength Audit (°C/100 m)	Average Inversion Strength RASS (°C/100 m)	Average Percent Difference
All	35	1.37	0.41	-67%
Sites with 60 m gate	15	1.44	0.51	-54%
Sites with 105m gate	20	1.31	0.33	-76%

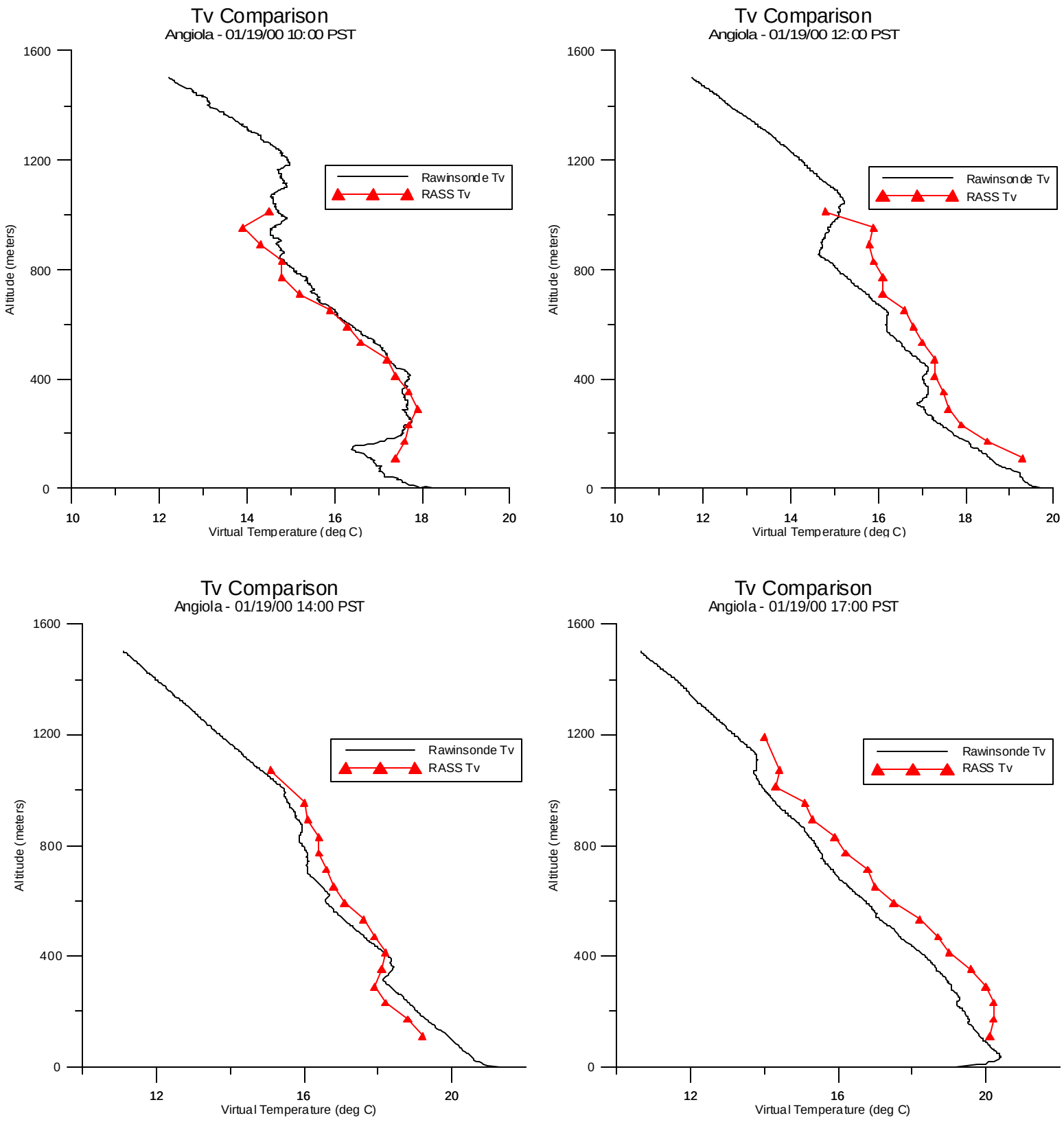

Figure 1. RASS / Rawinsonde Comparison - Angiola

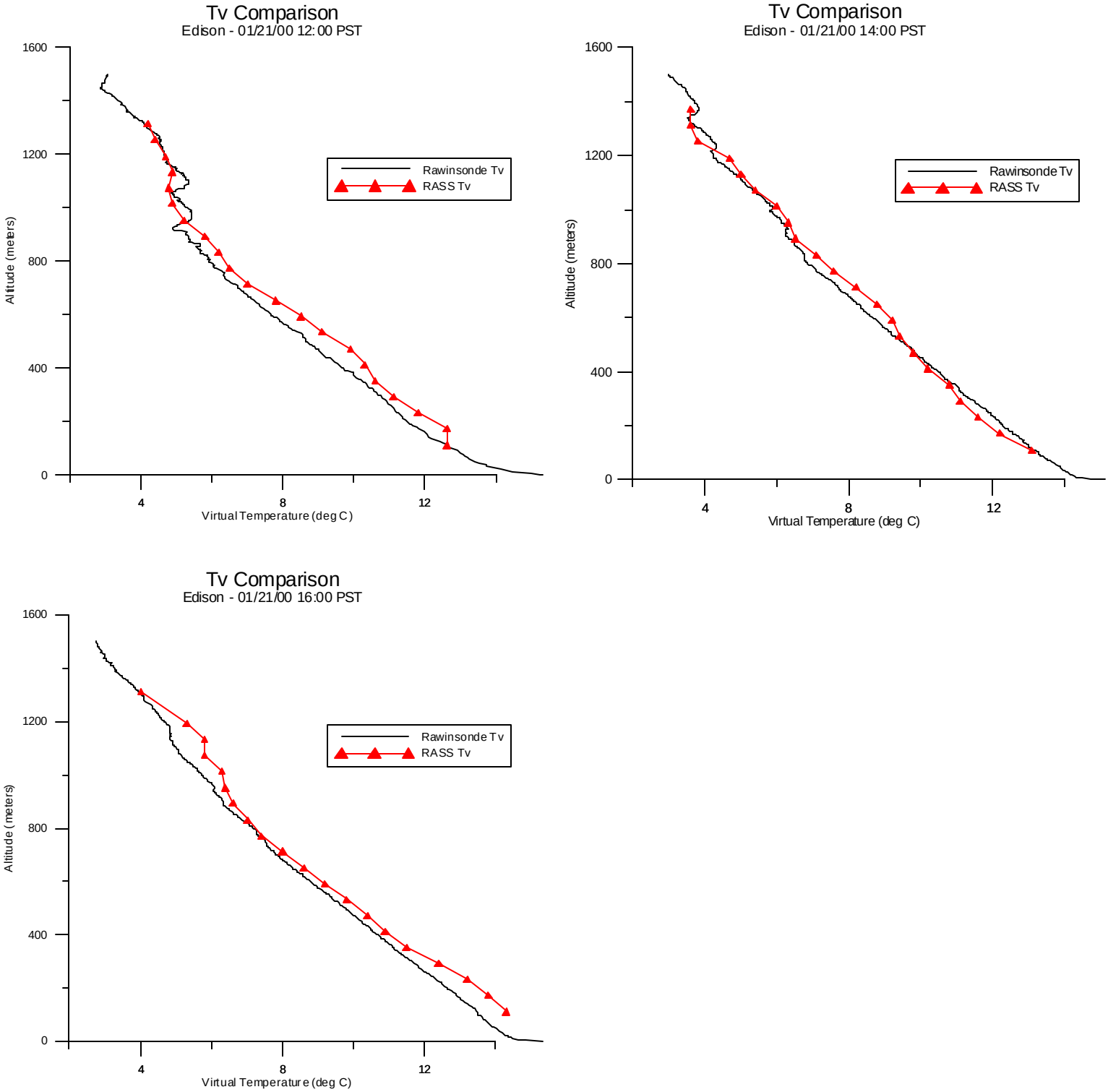

Figure 2. RASS / Rawinsonde Comparison - Edison

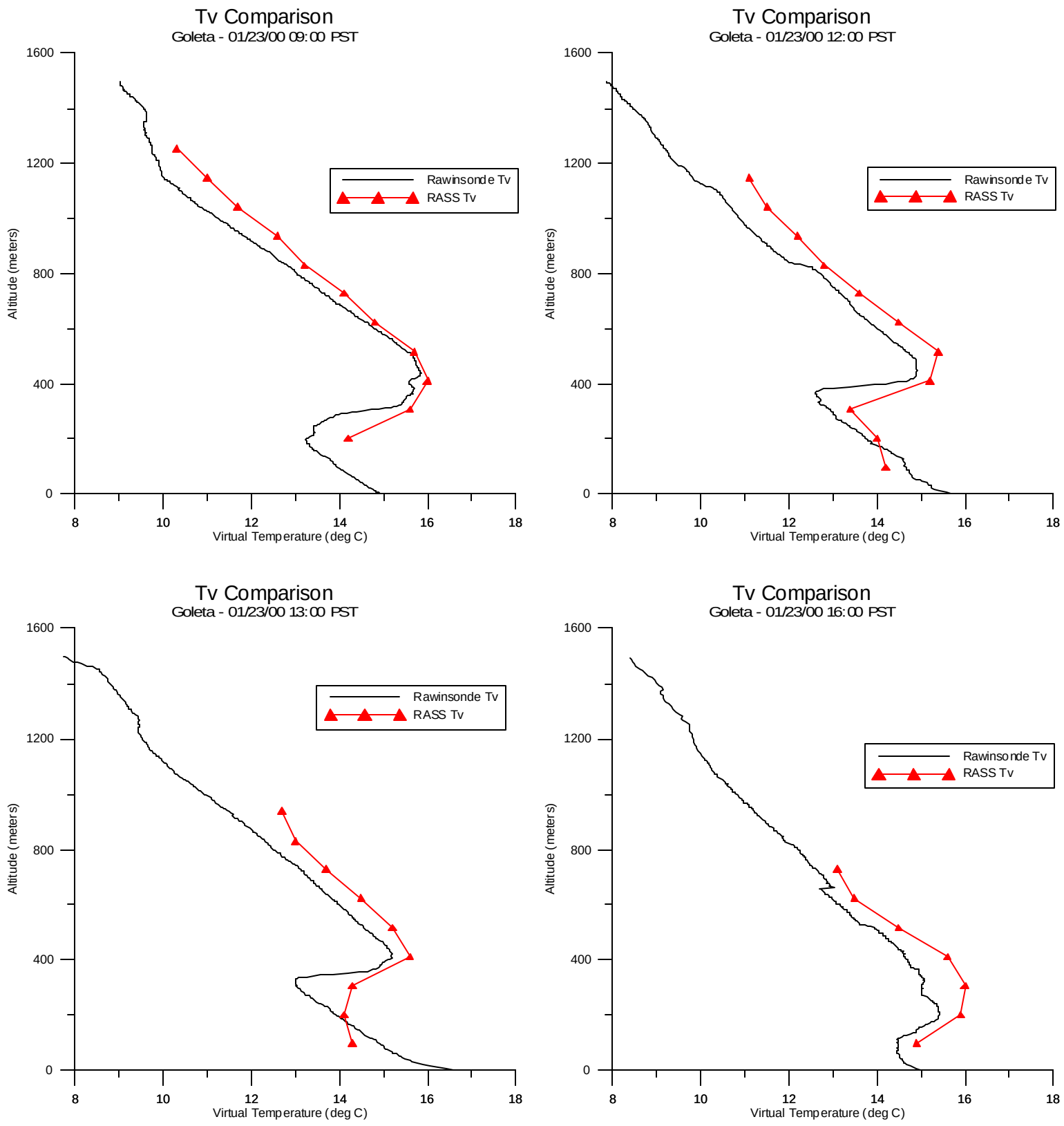

Figure 3. RASS / Rawinsonde Comparison - Goleta

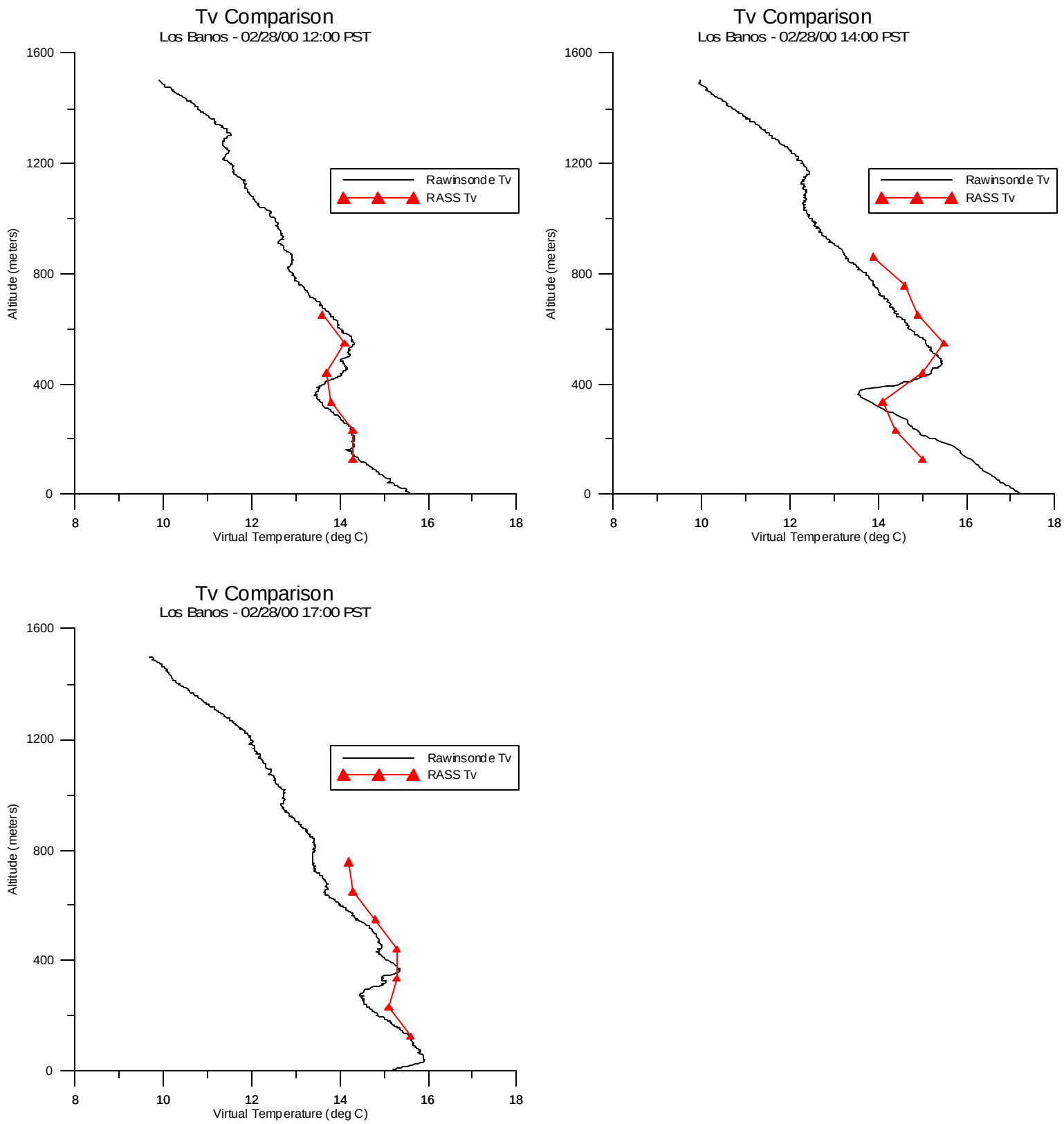

Figure 4. RASS / Rawinsonde Comparison – Los Banos

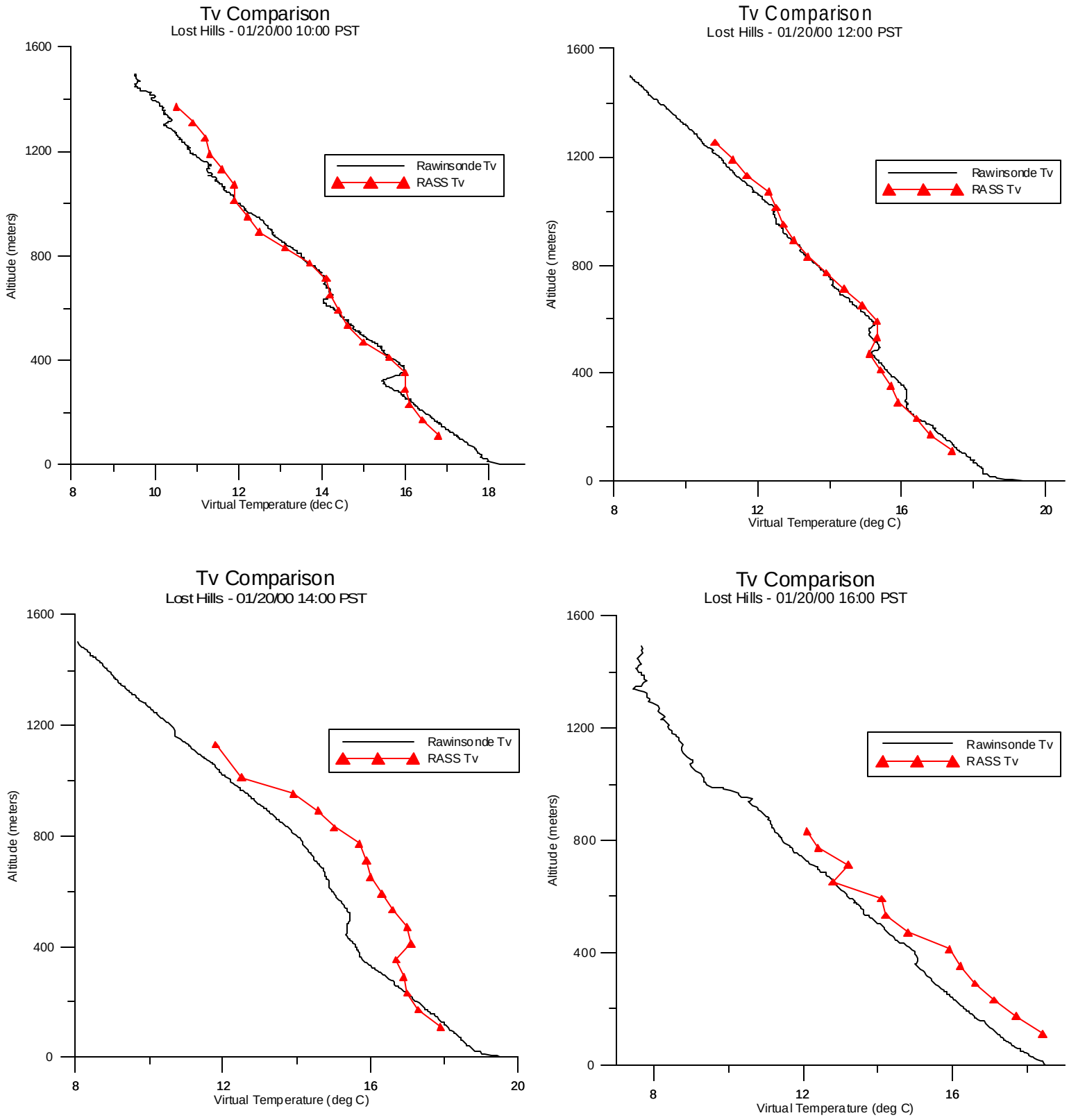

Figure 5. RASS / Rawinsonde Comparison – Lost Hills

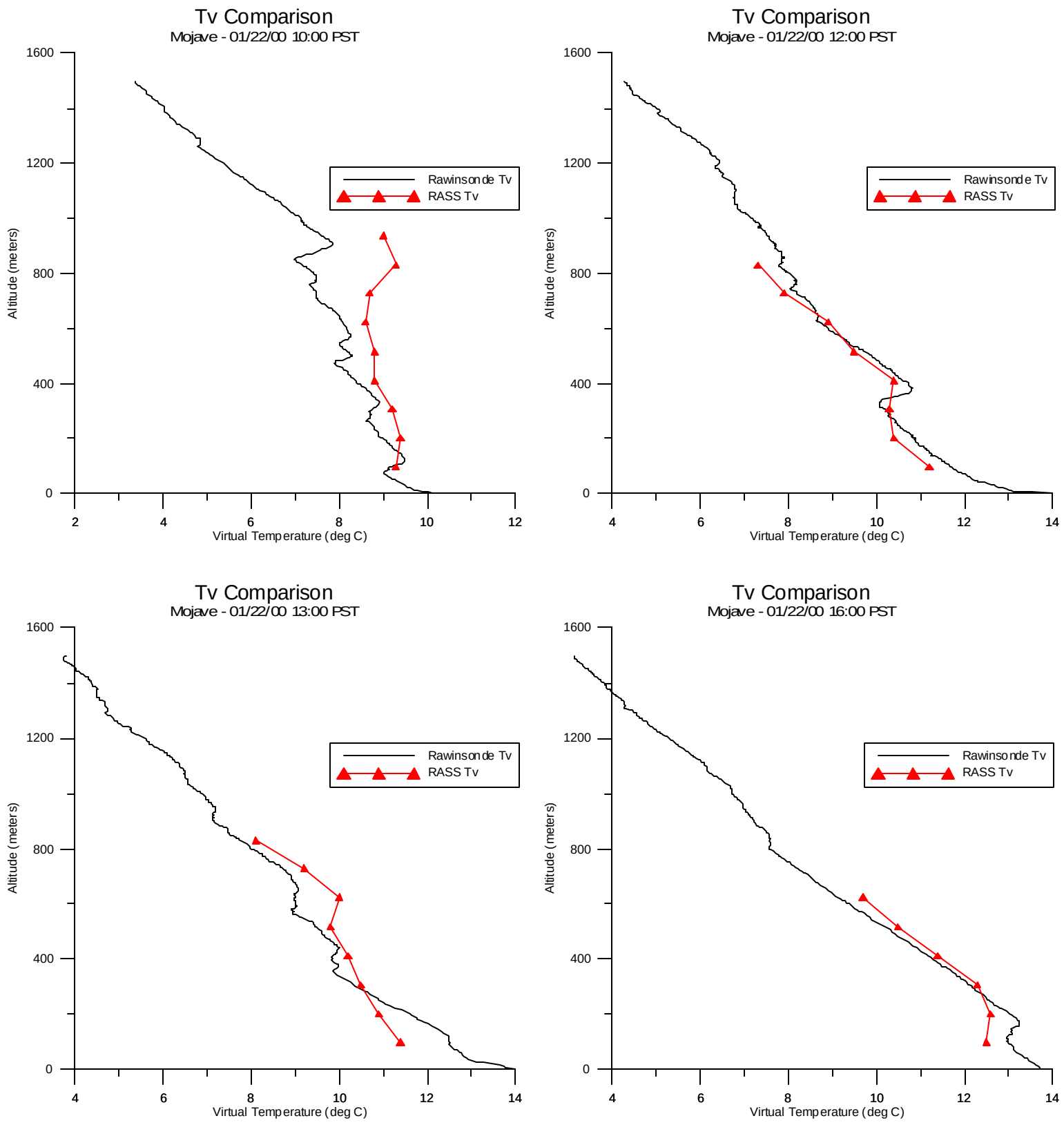

Figure 6. RASS / Rawinsonde Comparison - Mojave

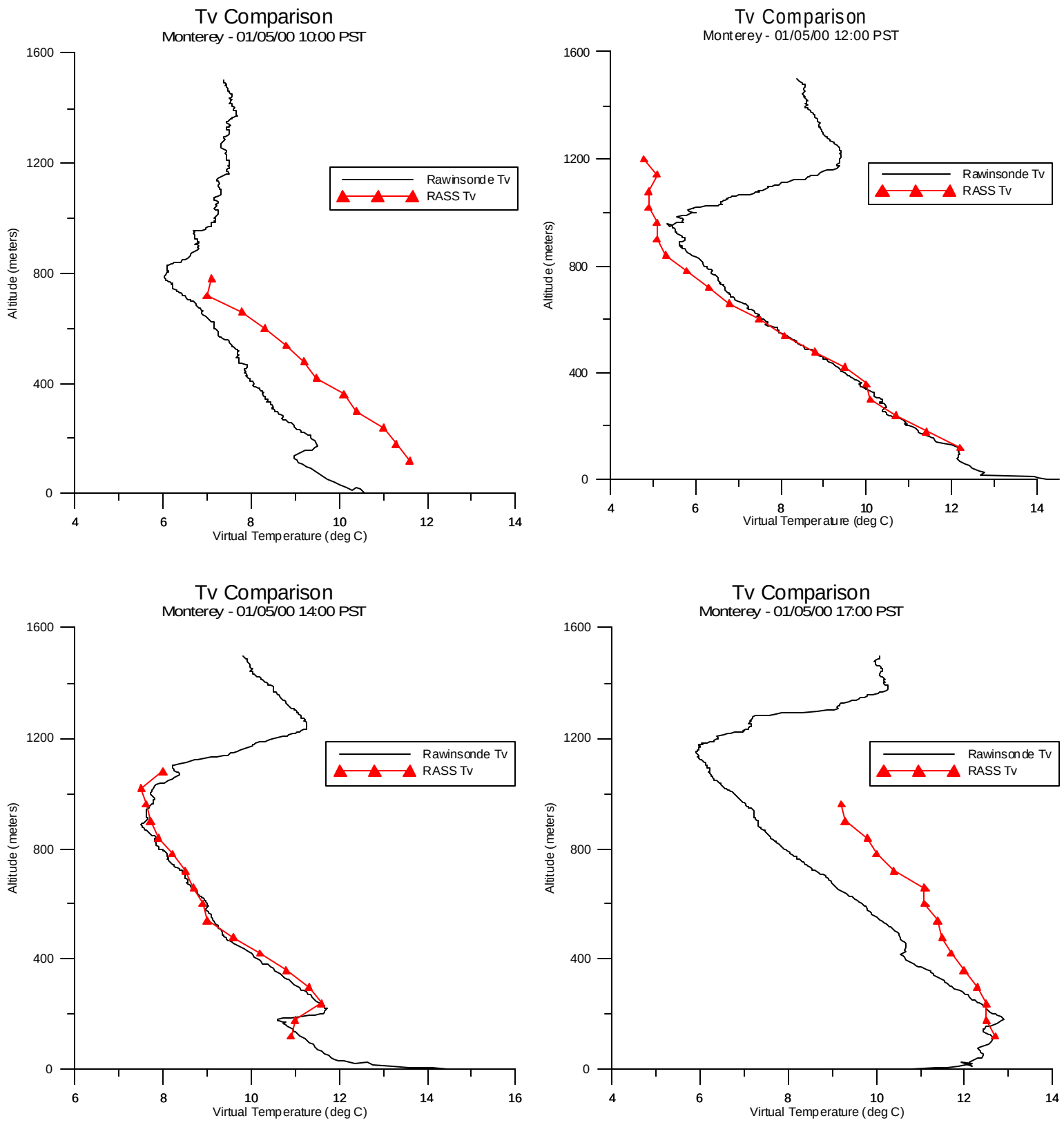

Figure 7. RASS / Rawinsonde Comparison - Monterey

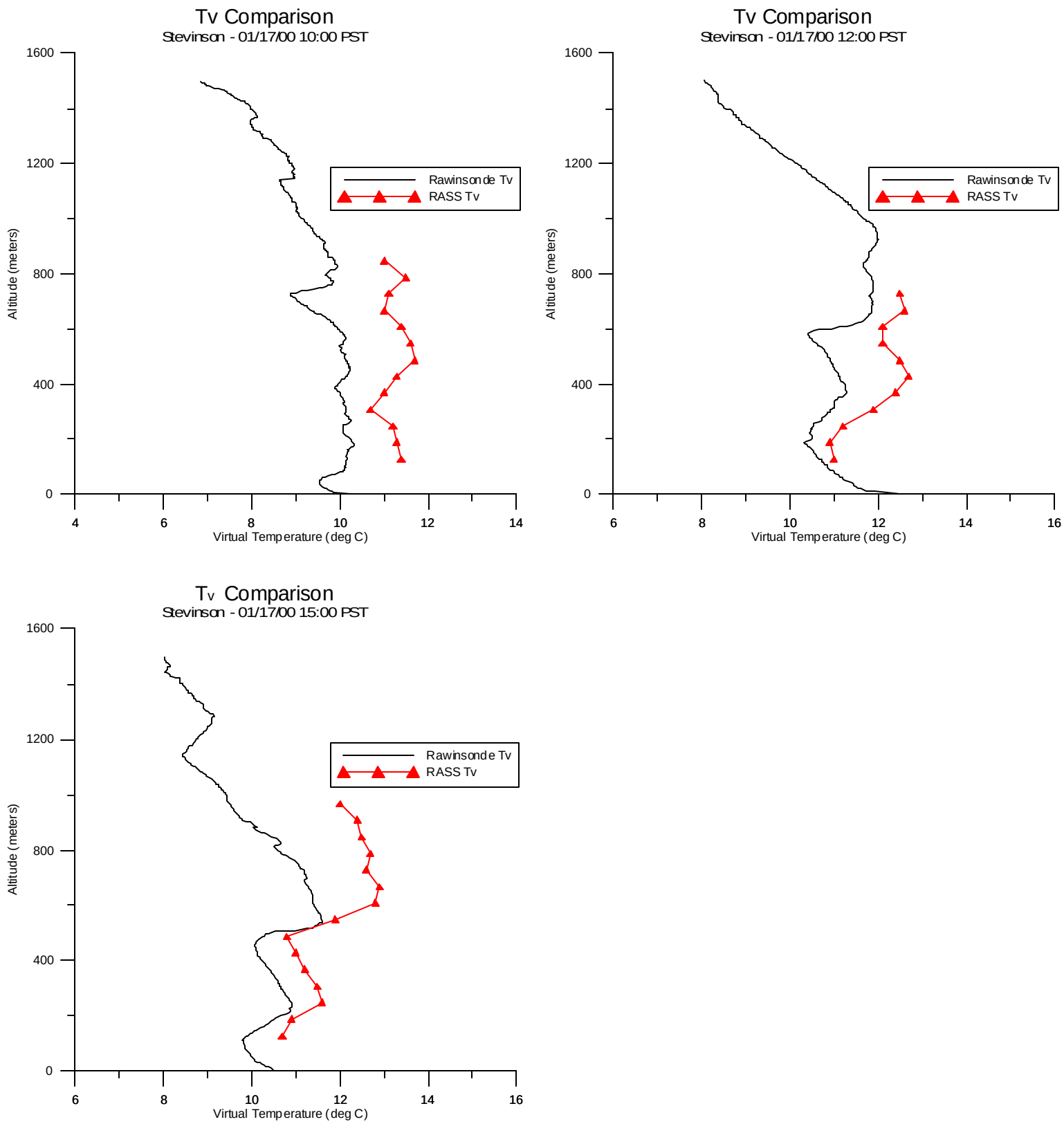

Figure 8. RASS / Rawinsonde Comparison - Stevinson

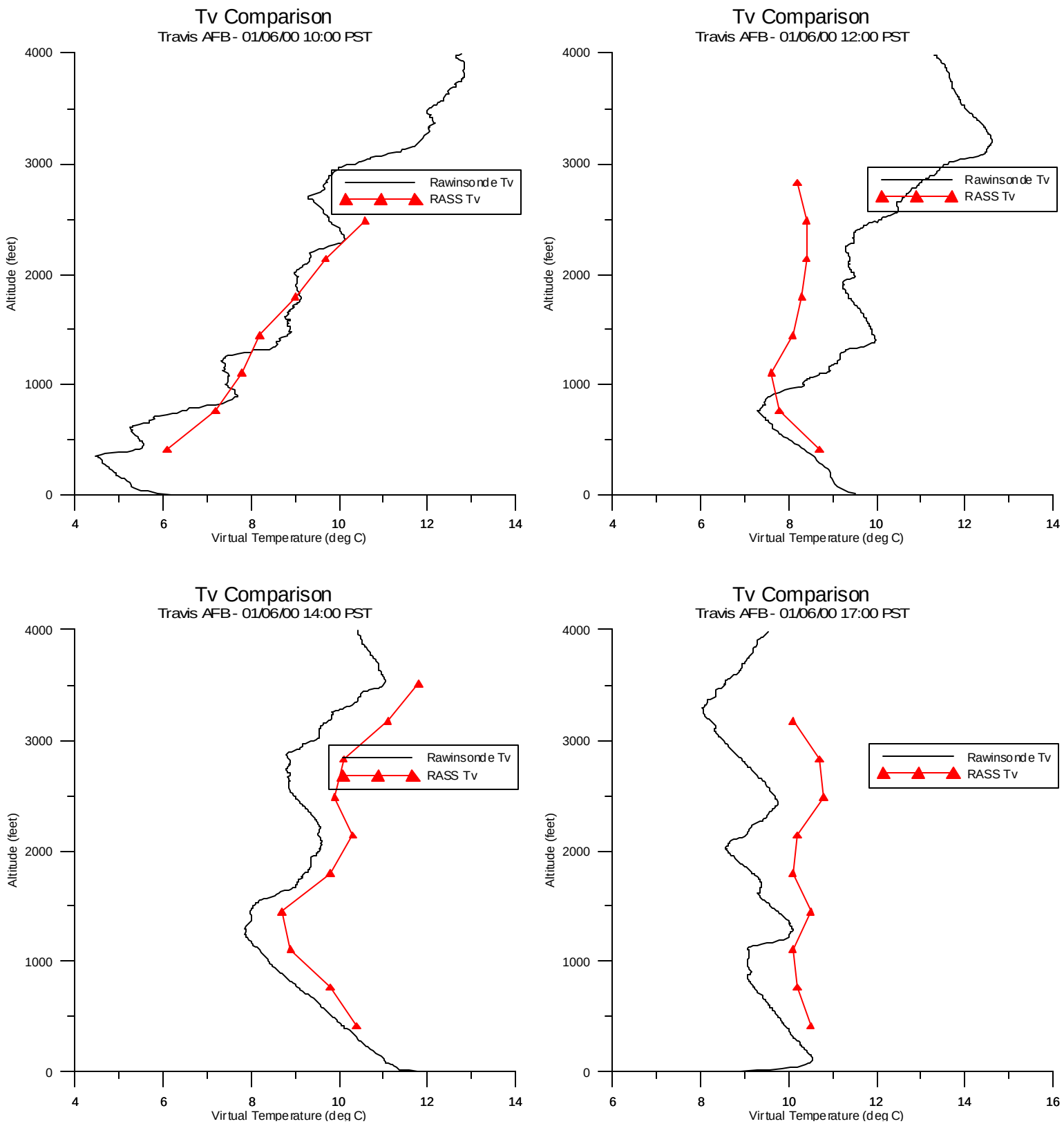

Figure 9. RASS / Rawinsonde Comparison – Travis AFB

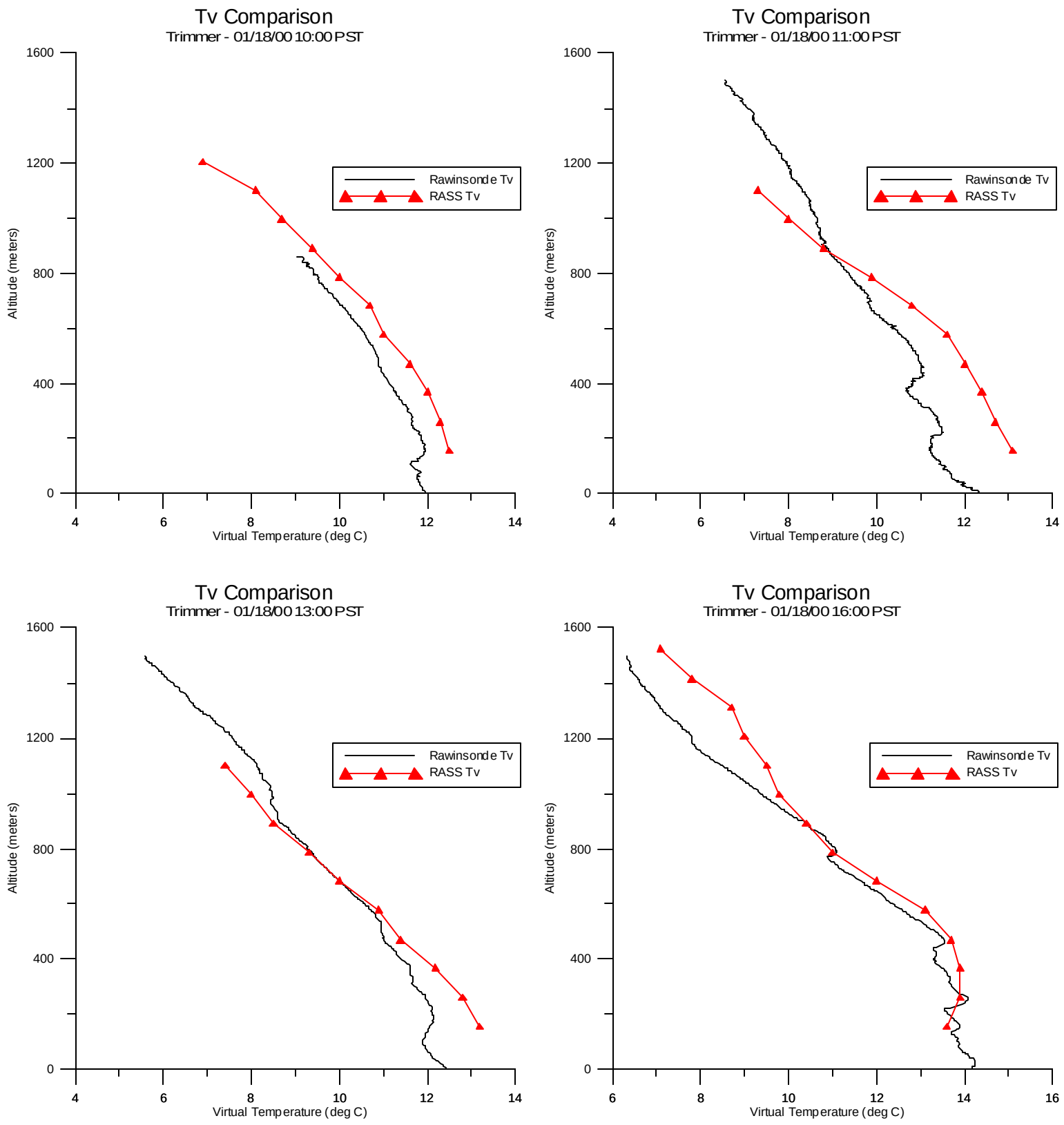

Figure 10. RASS / Rawinsonde Comparison - Trimmer

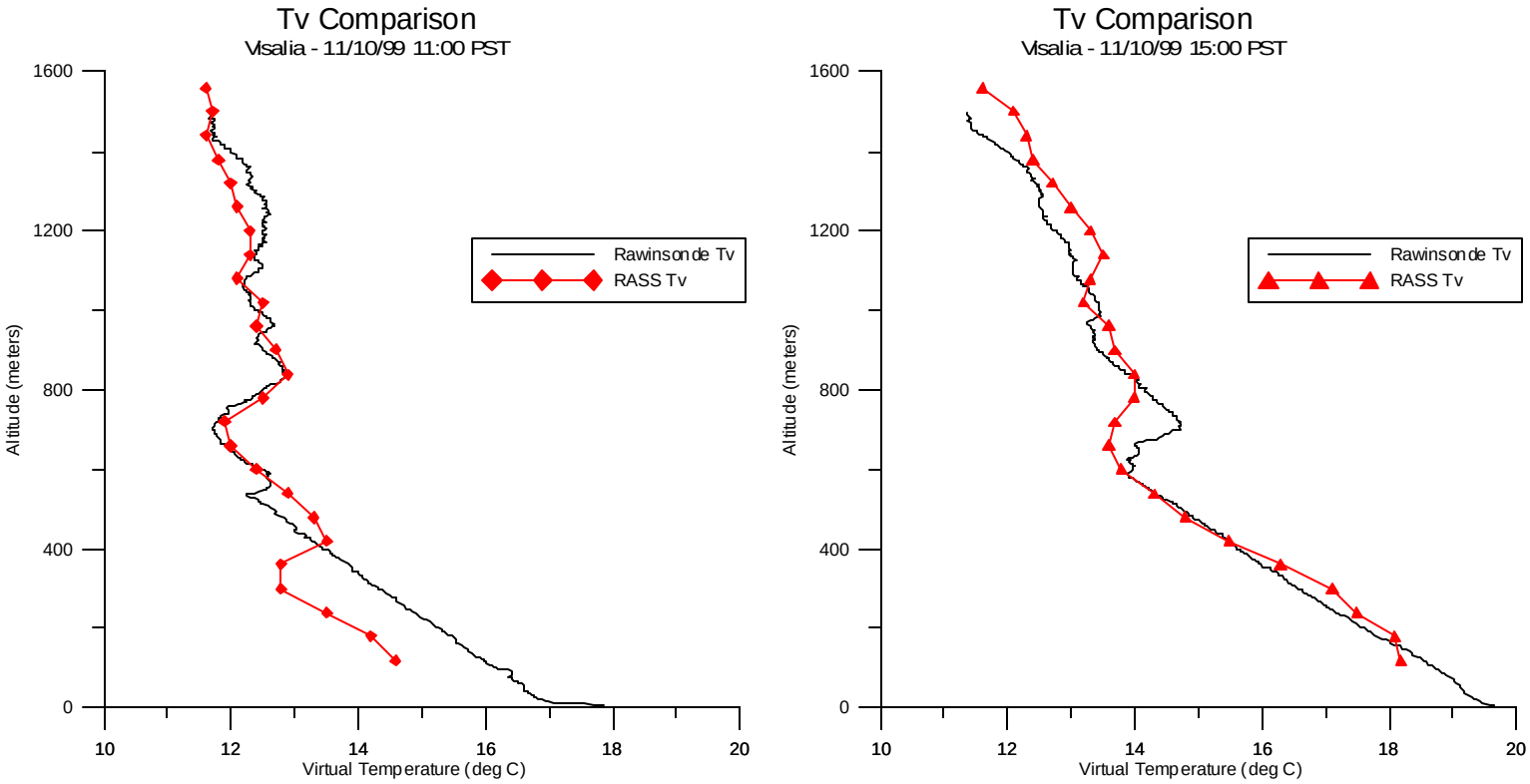

Figure 11. RASS / Rawinsonde Comparison - Visalia