Status: CL31-CT12K Ceilometer Meteorological Comparison Evaluation

Presented to the

ASOS Test Review Board

NWS/OPS24

February 5, 2009

Outline

- “White Paper” summary of MCE - Action Item from CL31 OT&E TRG kick-off (11/17/08)
- Format and content of “White Paper”
- Cases analyzed at SFSC through 12/31/09
- Cases with Great differences
- Why Different?
- MCE 7 “Beta Test” Sites V2.79T
- Schedule/Future

White Paper format/content

- Introduction
- Evaluation process
- Cases Analyzed
- Results through 12/31/08 on ST0
- Conclusion
- Appendix I-III (case details sig/great diff, graphs, Cl31 versus CT12K design
- Template for TIN

ATRB Review of “White Paper”

- Sent out for review to ATRB by e-mail on January 22, 2009
- Comments were due January 30, 2009

NUMBER OF CASES 12/31/08

TABLE 5A: NUMBER OF SKY COVER CASES AS OF 12/31/2008

Layer Height Range (ft)	AFC	CLR	FEW	SCT	BKN	OVC	VV	Required Cases
CLR[1]	VFR	16/16						16
H <500	LIFR		1/5	1/5	5/15	46/15	4/10	50
500 ≤ H <1000	IFR		2/5	0/5	4/15	33/15	0/10	50
1000 ≤ H< 3000	MVFR		5/5	0/5	12/15	28/15	0/10	50
3000 ≤ H < 5000	VFR		4/4	2/4	11/10	10/10	NA	28
5000 ≤ H ≤ 12000	VFR		3/3	3/3	10/10	10/10	NA	26
Winds > 25 Knots	Any AFC is acceptable for the wind cases.							5
TOTAL (220 + 5)[2]	210 /225	16 /16	15 /22	6 /22	42 /65	127 /65	4 /30	225

1 – CLR (Clear): No clouds or obscurations are observed or detected from the point of observation.
2 – A minimum of 220 sky cover cases plus five (5) cases with sustained winds of greater than 25 knots are required.

Number of Precipitation & Wind Cases 12/31/08

TABLE 5B[1]: NUMBER OF PRECIPITATION / WIND CASES AS OF 12/31/2008

AFC (CIG[2] < 3000 FT)	Precipitation Type / Sustained Winds > 25 Knots						
	RAIN RA, +RA, FZRA	**RAIN** -RA, -FZRA	**SNOW** SN, +SN	**SNOW** -SN	**FOG, HAZE, MIST, DRIZZLE** FG, HZ, BR, DZ, FZDZ	**No Precipitation** NP	**Winds > 25kts**
LIFR	2/4	6/6	#/2	#/3	26/5	21/20	NA
IFR	#/4	11/6	#/2	#/3	9/5	17/20	NA
MVFR	2/4	5/6	#/2	#/3	#/5	33/20	NA
Total (120 +5)	4/12	22/18	#/6	#/9	35/15	71/60	#/5[4]

TABLE 6: SUMMARY OF CASES STUDIES at SFSC THROUGH 12/31/08

AFC	Cases (Total)	Comparable Cases	Some Difference	Significant Difference	Great Difference
CLR[1]	16	16 (100%)	0	0	0
LIFR	57	31 (54%)	14 (25%)	7 (12%)	5 (9%)
IFR	39	31 (79%)	7 (18%)	0	1 (3%)
MVFR	45	30 (67%)	13 (29%)	0	2 (4%)
VFR	53	47 (89%)	3 (6%)	1 (2%)	2 (4%)
Totals	210	155 (74%)	37 (18%)	8 (4%)	10 (5%)
		192 (91%)		18 (9%)	

1 – CLR is a special case of VFR events and has been listed separately.

Summary of Cases

- 91% had sky condition reports that were comparable or had some differences
- 9% had sky conditions that had significant or great differences (5% - great differences)
- Significant or great differences in LIFR with Fog/Mist and MVFR conditions with rain

Cases with Significant or Great Differences

- CL31 reports higher cloud bases in LIFR conditions with Fog/Haze
- CL31 reports higher cloud bases in MVFR conditions with rain

RMSD for heights

TABLE 7: RMSD[1] For Heights (CL31 Compared to CT12K)

Height Range (ft)	AFC	CLR[2]	FEW	SCT	BKN	OVC	VV
CLR[2]	VFR	X	X	X	X	X	X
H < 500	LIFR	X	4600[3]	300	311	197	388
500 ≤ H < 1000	IFR	X	704		63	90	
1000 ≤ H < 3000	MVFR	X	3647		102	1314	
3000 ≤ H < 5000	VFR	X	110	89	474	1041	X
5000 ≤ H ≤ 12000	VFR	X	567[4]	189	224	305	X

1 – A RMSD of zero (0) would indicate that heights from the CL31and CT12K were the same.
2 – In the CLR cases both the CL31 and CT12K both reported CLR. Therefore a RMSD could not be calculated.
3 – Only one (1) case was analyzed in this category. It was during dissipating fog; the CL12K was still reporting a low layer (FEW002 OVC050) while the CL31 was reporting just the ceiling (OVC048)
4 – Only one (1) case was comparable for both the CL31 and CT12K. The other two cases consisted of CLR reports from the CL31. In these two cases a RMSD could not be calculated.

RMSD precipitation/wind cases

TABLE 8: RMSD FOR PRECIPITATION / WIND CASES
(CL31 Compared to CT12K)

AFC **(CIG[1] < 3000 FT)**	**Precipitation Type / Sustained Winds > 25 Knots**						
	RAIN RA, +RA, FZRA	**RAIN** -RA, -FZRA	**SNOW** SN, +SN	**SNOW** -SN	**FOG, HAZE, MIST, DRIZZLE** FG, HZ, BR, DZ, FZDZ	**No Precipitation** NP	**Winds > 25k ts**
LIFR	100	80			315	98	
IFR		73			101	91	
MVFR	4902	198			200	97	
Total							

1 – CIG (ceiling) is defined as the lowest layer aloft reported as Broken (BKN) or Overcast (OVC); or the Vertical Visibility (VV) into an indefinite ceiling.

RMSD Layer Amounts

TABLE 9: RMSD For Layer Amounts
(CL31 Compared to CT12K)

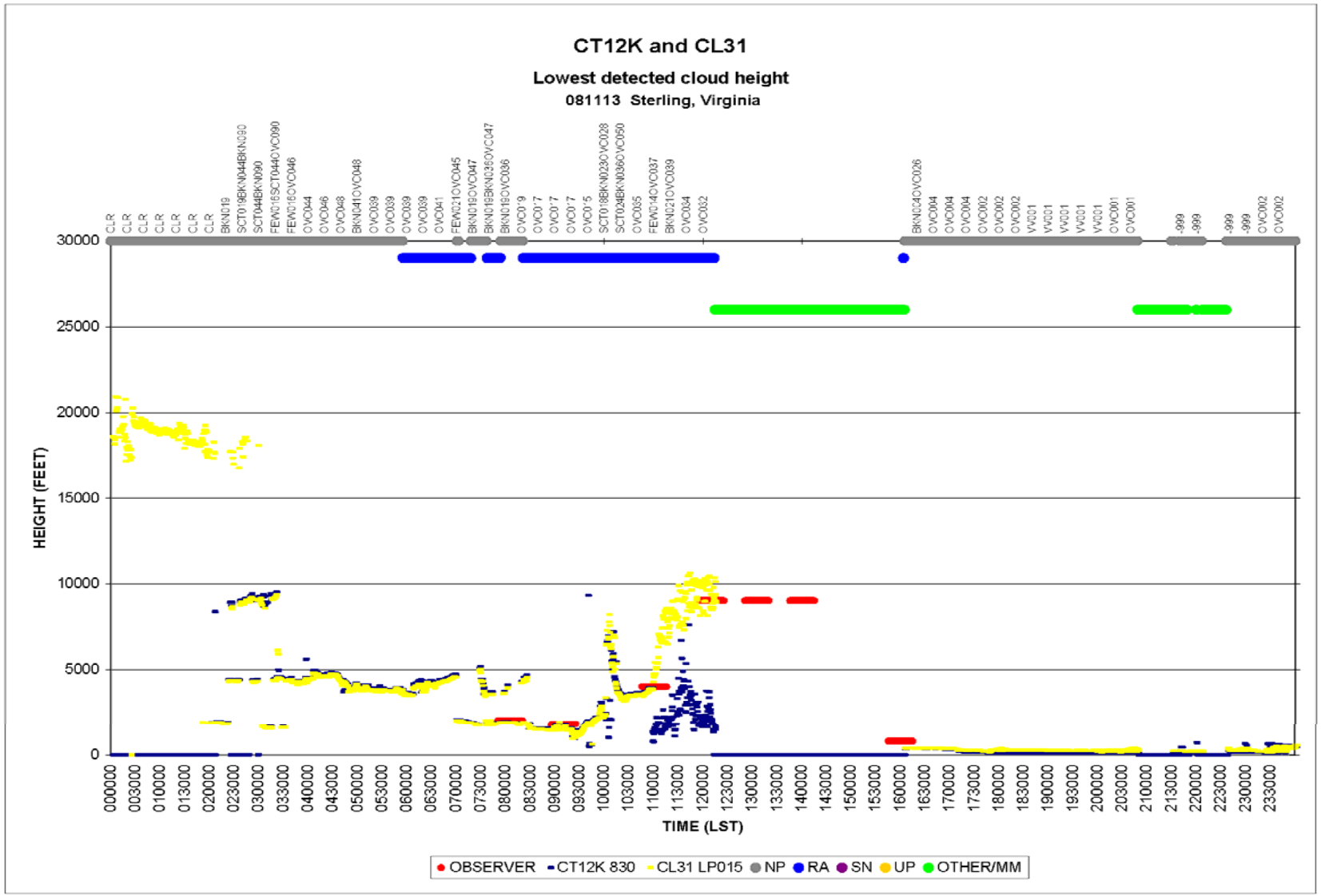
Amount	RMSD
CLR	0
FEW	1.32
SCT	0.83
BKN	0.73
OVC	0.49
VV	1.69

LIFR Case: September 3, 2008

Date/Location	4 cases on 9/30/08 at SFSC
Category	Significant Differences
Weather	MIFG, HZ, VV
CT12K	VV001, BKN 001
CL31	FEW001, VV005, VV006
CL31 – CT12K	CL31 400 – 500 FT higher
Notes	Human observer reported VV006 and VV011. Vis = .38 mi.

MVFR Case: November 13, 2008

Date/Location	1 case on 11/13/08 at SFSC
Category	Great Differences
Weather	Rain
CT12K	OVC 017 – 023
CL31	OVC090
CL31 – CT12K	CL31 6700 – 7300 ft higher
Notes	Human Observer: OVC090
See Graph of Event in Appendix II.	



Secondary X-axis has the METAR equivalent report from the CT12K

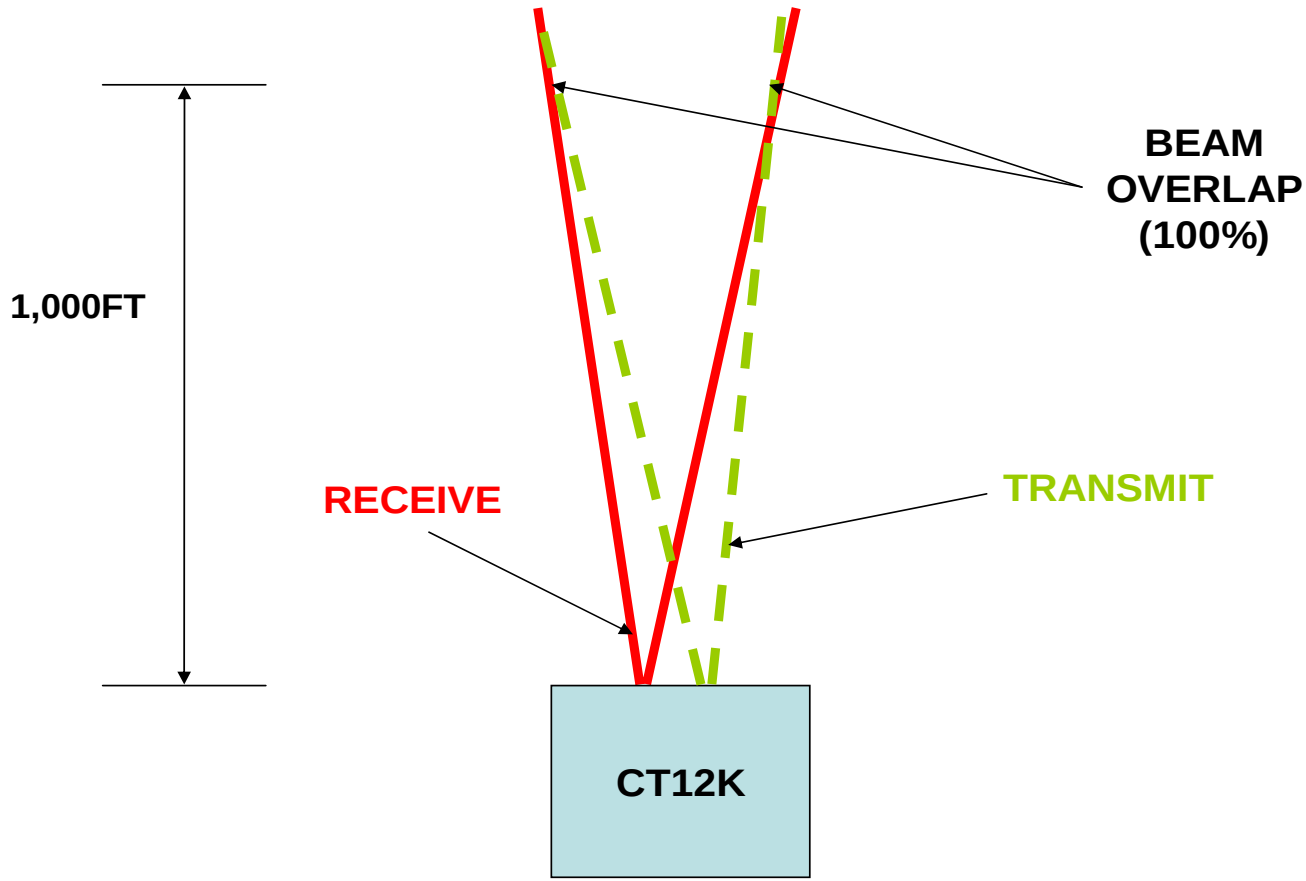
LIFR Case: December 20, 2008

Date/Location	1 case on 12/20/08 at SFSC
Category	Great Differences
Weather	Dissipating Fog
CT12K	FEW002 OVC 050
CL31	OVC048
CL31 – CT12K	CL31 4600’ higher
Notes	CL31 did not report low FEW layer in dissipating fog.

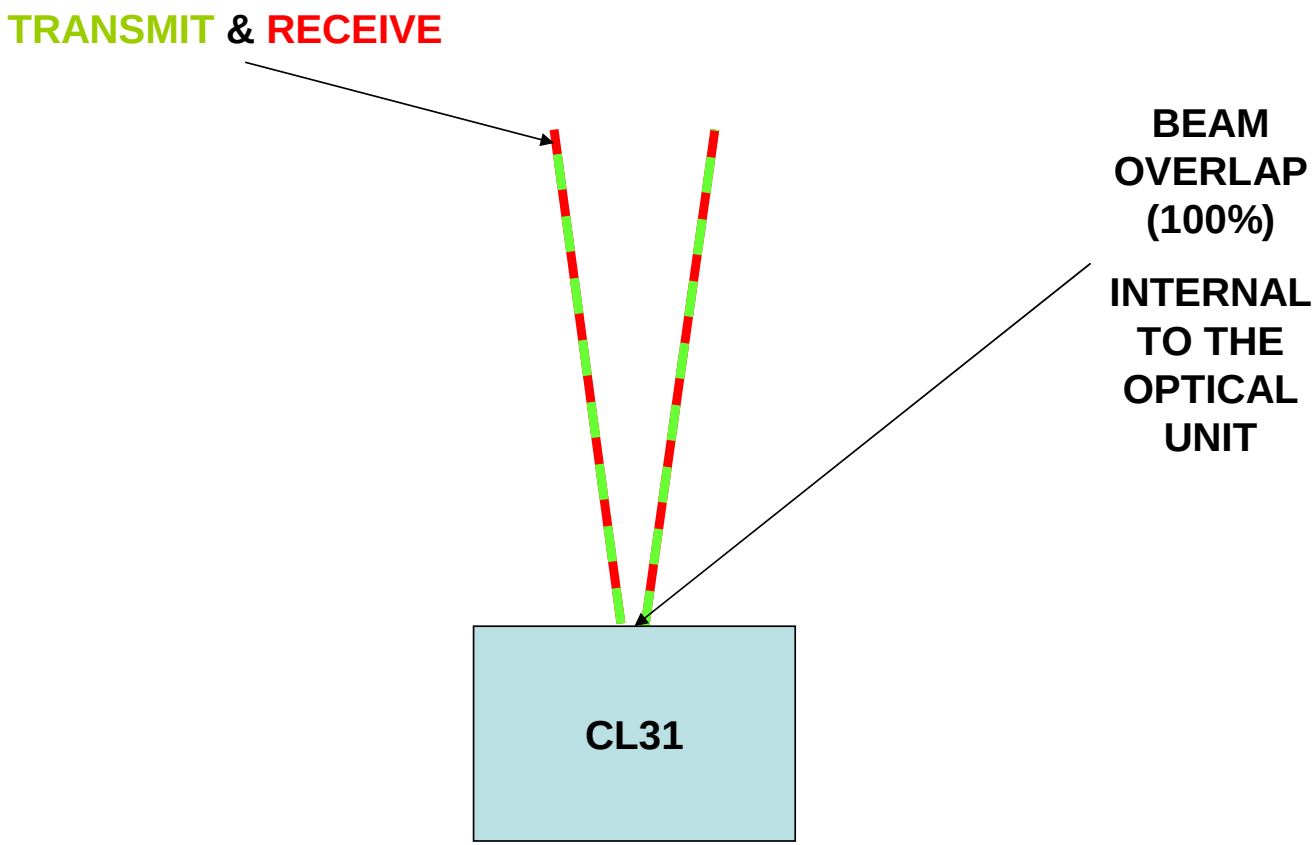
Why Does CL31 Report Higher Cloud Bases than CT12K?

- Due to coaxial lenses design of CL31 reduces noise contamination
- Smaller sky view of CL31
- Allows CL31 to penetrate precipitation and fog and detect higher cloud base

CT12K



CL31ASOS


TRANSMIT & RECEIVE
BEAM OVERLAP (100%)
INTERNAL TO THE OPTICAL UNIT
CL31

7 “BETA TEST” Sites for Expanded Evaluation V2.79T

1 CAR - Caribou, ME
2. GDP - Guadalupe Pass, TX
3. BIS - Bismarck, ND
4. JKL - Jackson, KY
5. HIO - Portland, OR
6. FAI - Fairbanks, AK
7. ITO - Hilo, HI

Schedule/Future

- Data Analysis Team will analyze snow winter precipitation cases from MCE sites
- MCE sites will run with CT12K as Operational sensor and CL31 as test sensor throughout MCE to reduce V2.79T risk until V2.79U OT&E.
- Updates every two weeks or every month
- Final report and TIN Spring/Summer 2009

RMSD height range (feet)

TABLE 4: RMSD HEIGHT RANGE (FEET) FOR CL31 COMP WITH CT12K

LAYER HEIGHT RANGE (ft)	AFC	Comparable	Some Differences	Significant Differences	Great Differences
CLR	VFR				
H < 500	LIFR	0 - 100	101 – 300	301 - 500	> 500
500 ≤ H < 1000	IFR	0 - 100	101 – 300	301 - 500	> 500
1000 ≤ H < 3000	MVFR	0 - 100	101 – 300	301 - 500	> 500
3000 ≤ H < 5000	VFR	0 - 500	501 – 1000	1001 - 1500	>1500
5000 ≤ H ≤ 12000	VFR	0 - 1000	1001 – 2000	2001 - 3000	>3000