radiometrics
Ahead of the Weather

Upper Air Thermodynamic Sounding Accuracy

Radiosondes are the gold standard for atmospheric temperature and humidity soundings. The accuracy of alternative soundings such as those provided by a microwave radiometer profiler can be formally validated by statistical comparison with radiosonde soundings. Radiosonde soundings from World Meteorological Organization (WMO) upper air stations are available online[1] one hour after launch. WMO soundings provide temperature and humidity information at the following levels:

Mandatory Levels include surface, 1000, 925, 850, 700, 500, 400, 300, 250, 200, 150, 100, 70, 50 and 10 mb. **Significant Levels** are included when there are significant, abrupt changes in the vertical temperature or dewpoint temperature profiles.

Radiometer and radiosonde soundings should be compared at the actual radiosonde launch time which typically precedes the nominal launch time by up to an hour. For example, the actual launch time highlighted in the radiosonde header shown in Figure 1 precedes the nominal launch time (first header line) by close to one hour. Near surface thermodynamics can change significantly during this time.

```
254      12      10       SEP     2015
  1   23062   72469   39.77N104.88W  1611    1101
  2     100    1760    1760     118  99999       3
  3             DNR                  99999      kt
```

Figure 1. Actual launch time (highlighted) in this example header precedes the nominal radiosonde launch time (first line) by 59 minutes.

Bias and standard deviation of radiometer and radiosonde sounding comparisons provide rigorous validation of radiometer temperature and humidity sounding accuracy. A summary of an intensive radiosonde – radiometer comparison during Factory Acceptance Testing by the Indian Air Force is summarized in Figure 2. Twenty consecutive 6-hr WMO radiosondes and a National Weather Service MP-3000A radiometer are compared. Overall statistical results are highlighted.

	October 2011											
	24		25		26		27		28		24-28	
	av	std	av	std	av	std	av	std	av	std	av	std
T (C)	1.1	0.6	0.3	0.4	1.3	0.6	2.2	0.9	0.6	0.7	1.1	0.8
V (gm-3)	-0.2	0.1	-0.2	0.1	-0.3	0.1	-0.2	0.1	-0.1	0.1	-0.2	0.1
RH (%)	-0.9	3.9	3.7	4.1	0.6	9.2	-0.7	6.8	0.0	0.2	1.3	5.0

Figure 2. Radiosonde – radiometer statistics at Denver, Colorado (20 soundings).

Radiometrics offers customer guidance for rigorous thermodynamic sounding accuracy validation via radiosonde comparison. Please contact us for further information.

Reference

WMO Guide to Meteorological Instruments and Methods of Observation, 2010.

[1] http://esrl.noaa.gov/raobs/