Dataset Title
Radiometer Data at Snowbank Site

Dataset Author
Courtney Weeks Karkkainen
cweeks@ucar.edu
National Center for Atmospheric Research, Research Applications Laboratory
3450 Mitchell Lane, Boulder CO 80301
303.497.2824

Time of Interest
20170109-20170409 (Time reported in UTC)

Area of Interest
44.440386, -116.126184, 8327 ft MSL

Data Frequency
Roughly 1 minute

Data Spatial Type
Point measurement

General Dataset Description
The instrument used is the Radiometrics WVP-1500 profiling radiometer. It is used to produce vertical water vapor profiles from the surface to 10 km. The water vapor profiling (WVP) receives at selected frequencies between 22 and 30 GHz. Surface meteorological sensors measure air temperature, relative humidity, and barometric pressure. Microwave profiling methods make use of atmospheric radiation measurements in the 22 to 60 GHz region. Temperature profiles can be obtained by measuring the radiation intensity, or brightness temperature, at points along the side of an oxygen feature at 60 GHz. By scanning downward from line center, where the opacity is so great that all signal originates from just above the antenna, onto the wing of the line, where the radiometer “sees” deeper into the atmosphere, the instrument can obtain altitude information. Emission at any altitude is proportional to local temperature and density of oxygen; thus the temperature profile can be retrieved.

Water vapor profiles can be obtained by observing the intensity and shape of emission from pressure broadened water vapor lines. The water vapor line at 183 GHz is used for vapor profiling from satellites. The high opacity of this line hides the unknown emission emanating from the earth’s surface, eliminating this error source, but precluding profiling to low altitudes. The 183 GHz line is too opaque for observations from the ground, except in extremely arid environments. The line at 22 GHz is too transparent for effective profiling from satellites, but is suitable for ground based profiling in most areas. The emission from water vapor is in a narrow line at high altitudes and is pressure broadened at low altitudes. The intensity of emission is

proportional to vapor density and temperature. Scanning the spectral profile and mathematically inverting the observed data can therefore provide water vapor profiles.

Limited resolution cloud liquid water profiles can be obtained by measuring the contribution of cloud liquid water to atmospheric spectral features of varying opacity. Surface relative humidity, temperature, and barometric pressure are measured by the Profiling Radiometer and used in the determination of profiles. Additionally, a vertically pointed infrared thermometer (IRT) indicates the presence of cloud, and measures cloud base temperature if clouds are present. Knowing cloud base temperature yields the vapor density at cloud base (at saturation), and combined with the retrieved temperature profile, yields cloud base altitude.

Advanced specifications are as follows (note this includes some parameters for the temperature profiler, which was not used):

Function or Parameter	Specification
Calibrated Brightness Temperature Accuracy[6]	0.2 + 0.002*|TkBB-Tsky| [7]
Long Term Stability	<1.0 K / yr typical
Resolution (depends on integration time)[8]	0.1 to 1 K
Brightness Temperature Range[9]	0-400 K
Antenna System Optical Resolution and Side Lobes 22-30 GHz 51-59 GHz	 4.9 - 6.3° -24 dB 2.4 - 2.5° -27 dB
Integration Time (user selectable in 10 msec increments)	0.01 to 2.5 seconds
Frequency Agile Tuning Range Water Vapor Band Oxygen Band Minimum Frequency step size	 22-30 GHz 51-59 GHz 4.0 MHz
Standard channels used for profiles TP/WVP-3000 TP-2500 WVP-1500	 12 7 5
Spectrum Analyzer Mode [10] (brightness temperatures only)	Up to 40 channels
Pre-detection channel bandwidth (effective double-sided)	300 MHz
Surface Sensor Accuracy Temperature (-50° to +50° C) Relative Humidity (0-100%) Barometric pressure (800 to 1060 mb) IRT[11] (Note: ΔT = Tambient - Tcloud)	 0.5° C @ 25° C 2 % 0.3 mb (0.5 + .007*ΔT)°, C
Brightness Temperature algorithm for *level1* products	4 point nonlinear model
Retrieval algorithms for *level2* products	Neural Networks

Function or Parameter	Specification
Calibration Systems	
Primary standards	LN2 and TIP methods
Operational standards	Noise Diodes + ambient Black Body Target
Environmental Operating Range	
Temperature	-40° to +40° C
Relative Humidity	0-100 %
Altitude	-300 to 3000 m
Wind (operational/survival)	100 km/hr / 200 km/hr
Physical Properties	
Size (H X W X L)	50 X 28 X 76 cm (add 17 cm to height for IRT)
Mass	29 kg
Power requirements	
Radiometer (100 to 250 VAC / 50 – 60 Hz)	200 watts max
Superblower (100 to 125 VAC / 50 – 60 Hz)[12]	100 watts max
Data Interface	
Primary computer port	RS232 38.4 Kbaud
Auxiliary port	RS232 1.2 to 38.4 Kbaud
Standard cable length[13]	30 m
Data File Formats	ASCII CSV (comma separated variables)

File Names

2016-11-03_10-34-50_lv2.csv
2016-11-03_10-51-29_lv2.csv
2016-12-06_10-52-48_lv2.csv
2017-01-05_08-51-54_lv2.csv
2017-01-06_14-15-46_lv2.csv
2017-01-09_15-09-00_lv2.csv
2017-01-10_00-00-07_lv2.csv
2017-01-11_00-00-00_lv2.csv
2017-01-12_00-00-05_lv2.csv
2017-01-13_00-00-00_lv2.csv
2017-01-13_18-50-12_lv2.csv
2017-01-14_00-00-01_lv2.csv
2017-01-15_00-00-00_lv2.csv
2017-01-16_00-00-05_lv2.csv
2017-01-17_00-00-00_lv2.csv
2017-01-18_00-00-01_lv2.csv
2017-01-19_00-00-00_lv2.csv
2017-01-23_00-00-01_lv2.csv

2017-01-24_00-00-01_lv2.csv
2017-01-25_00-00-00_lv2.csv
2017-01-26_00-00-01_lv2.csv
2017-01-27_00-00-00_lv2.csv
2017-01-28_00-00-06_lv2.csv
2017-01-29_00-00-00_lv2.csv
2017-01-30_00-00-06_lv2.csv
2017-01-31_00-00-00_lv2.csv
2017-02-01_00-00-00_lv2.csv
2017-02-02_00-00-00_lv2.csv
2017-02-03_00-00-06_lv2.csv
2017-02-04_00-00-00_lv2.csv
2017-02-05_00-00-05_lv2.csv
2017-02-07_19-27-26_lv2.csv
2017-02-08_00-00-01_lv2.csv
2017-02-09_00-00-06_lv2.csv
2017-02-10_00-00-01_lv2.csv
2017-02-11_00-00-06_lv2.csv
2017-02-12_00-00-01_lv2.csv
2017-02-13_00-00-01_lv2.csv
2017-02-14_00-00-00_lv2.csv
2017-02-15_00-00-05_lv2.csv
2017-02-16_00-00-00_lv2.csv
2017-02-17_00-00-03_lv2.csv
2017-02-21_00-00-04_lv2.csv
2017-02-22_00-00-00_lv2.csv
2017-02-23_00-00-05_lv2.csv
2017-02-24_00-00-00_lv2.csv
2017-02-25_00-00-00_lv2.csv
2017-02-26_00-00-00_lv2.csv
2017-02-27_00-00-03_lv2.csv
2017-02-28_00-00-00_lv2.csv
2017-03-01_00-00-05_lv2.csv
2017-03-02_00-00-00_lv2.csv
2017-03-03_00-00-00_lv2.csv
2017-03-04_00-00-00_lv2.csv
2017-03-05_00-00-05_lv2.csv
2017-03-06_00-00-00_lv2.csv
2017-03-07_00-00-05_lv2.csv
2017-03-08_00-00-00_lv2.csv
2017-03-09_00-00-05_lv2.csv
2017-03-10_00-00-00_lv2.csv
2017-03-11_00-00-08_lv2.csv
2017-03-12_00-00-00_lv2.csv

2017-03-13_00-00-05_lv2.csv
2017-03-14_00-00-00_lv2.csv
2017-03-15_00-00-05_lv2.csv
2017-03-16_00-00-00_lv2.csv
2017-03-17_00-00-05_lv2.csv
2017-03-18_00-00-00_lv2.csv
2017-03-19_00-00-05_lv2.csv
2017-03-20_00-00-00_lv2.csv
2017-03-21_00-00-00_lv2.csv
2017-03-22_00-00-00_lv2.csv
2017-03-23_00-00-09_lv2.csv
2017-03-24_00-00-00_lv2.csv
2017-03-25_00-00-05_lv2.csv
2017-03-26_00-00-00_lv2.csv
2017-03-27_00-00-04_lv2.csv
2017-03-28_00-00-00_lv2.csv
2017-03-29_00-00-08_lv2.csv
2017-03-30_00-00-00_lv2.csv
2017-04-03_00-00-00_lv2.csv
2017-04-04_00-00-05_lv2.csv
2017-04-05_00-00-00_lv2.csv
2017-04-06_00-00-01_lv2.csv
2017-04-07_00-00-00_lv2.csv
2017-04-08_00-00-00_lv2.csv

Data Format
Comma separated values
2 Header Lines
Columns: Record, Date/Time, LineType, Tamb(K), Rh(%), Rain (logical), Vint(cm), Lqint(mm),
Remaining columns are vertical profile at height specified in header

Data Restrictions
None

GCMD Keywords
ATMOSPHERIC WATER VAPOR