Research on Convective Snows (ROCS) 2005 Quality Controlled Radiosonde Data Set

Contents:

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I. GAUS Dataset Overview

The new EOL GPS Advanced Upper-air Sounding system (GAUS) was developed to replace the venerable GPS LORAN Atmospheric Sounding System (GLASS). GAUS incorporates Vaisala RS92 next generation radiosondes, has portability, built-in test capability and flexibility for multiple channel operations, and delivers users high precision GPS measurements of radiosonde positions. The Vaisala RS92 radiosonde promises to deliver high quality wind measurements from the ground with code-correlating GPS technology, as well as pressure, temperature and humidity measurements all transmitted digitally to the receiving station. Digital technology will reduce missing data due to noise and increase overall reliability of the system. The Vaisala RS92 provides much better humidity measurements with a heated twin-sensor design and incorporates a new reconditioning procedure before launch.

The purpose of the Research on Convective Snows (ROCS) project is to determine the characteristics of clouds that produce weather events where snow is accompanied by lightening and thunder. During the project, 47 radiosondes were launched from various locations throughout the Central United States between February 8, 2005 and March 18, 2005. The final radiosonde data set consists of 44 quality controlled ascending soundings and 4 descending soundings. Three soundings were removed from the final archive because the radiosondes never left the ground. Two of the soundings experienced a loss of the radiosonde signal at some point during the flight. For each, the signal was eventually recaptured and the data were stored in new sounding files. During post-processing we identified these "extra files" and merged them with the data collected before the signal loss.

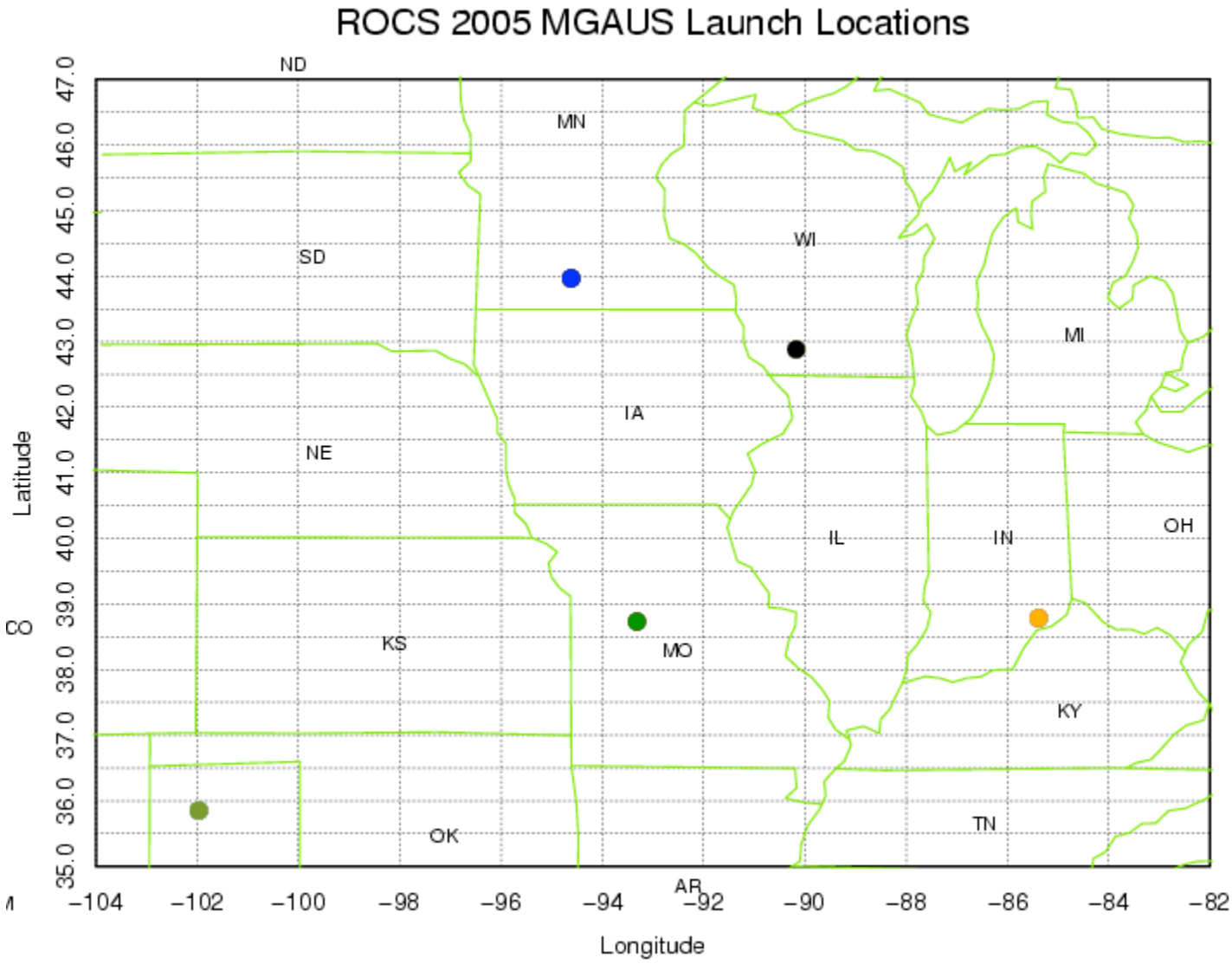
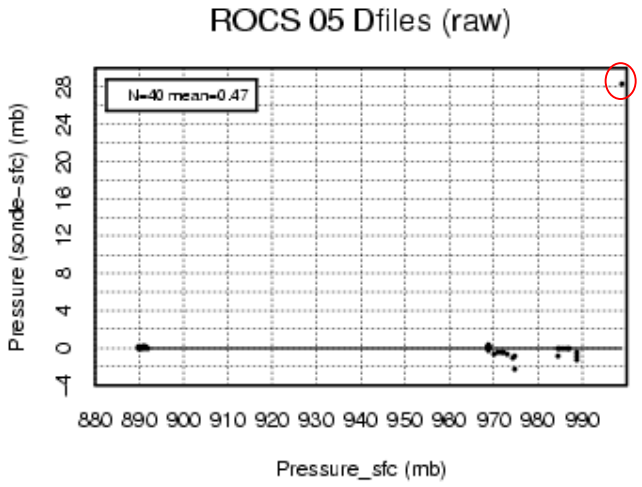
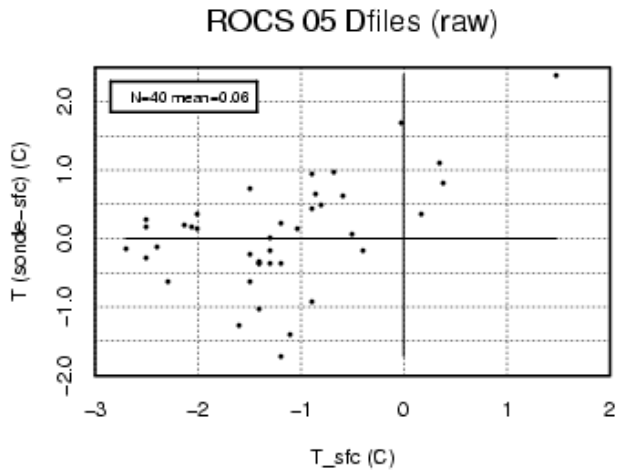


Figure 1 - Map of ROCS radiosonde launch locations.

II. Important Notes to Users

1. The first data line in each sounding, denoted by a time stamp of -1.0 second, typically represents data collected from an independent surface met station. During the quality control process this data is used as a reference to determine the accuracy of the radiosondes pressure, temperature and relative humidity measurements. **For most of the ROCS project the surface sensors failed to work properly**. When this occurred, pre-launch pressure, temperature and RH measured by the sonde and human estimated winds were entered into the first line of each sounding in place of the surface met data. The only days containing surface met data were February 20th and 24th and one sounding launched on Mar 18th at 0619 UTC. From examining scatter plots, shown in figure 2 below, there appear to be no systematic biases in sounding files containing surface met data, however there is a 28 mb difference in pressure between the surface and the first sonde point from the Mar 18th sounding that contained surface met data. This is clear evidence of the problems that were experienced with that sensor.
2. In some cases, where data collection continued after the balloon burst, there are two sounding files per sonde launched. **Only the ascending data has the temperature correction and low pass wind filter applied**.
3. **We caution users about the quality of the descending data**. The vertical resolution is low because there was no parachute attached to the sonde after the balloon burst. While the temperature sensor appears to have responded well, there is a time lag for temperature and there is a significant lag in the response of the humidity sensor.





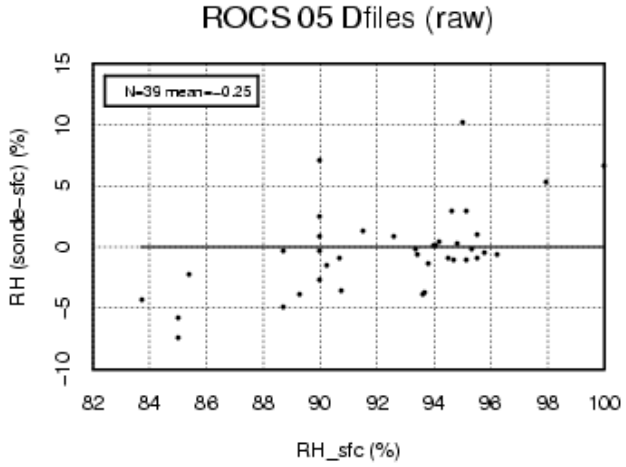


figure 2. Scatter plots showing surface pressure vs Pdiff , surface temperature vs Tdiff and surface RH vs RHdiff

**difference values should be sonde – sfcmet, however for most of ROCS soundings surface met was not working.

III File Naming Conventions

The "D" files are one second, ascii format data files with appropriate corrections and quality control measures applied. The naming convention for these files is - "D", followed by "yyyymmdd_hhmmss._P.1.wf.RadCor.cls" where yyyy = year, mm = month, hh = hour of the day GMT, mm = minute of the hour, ss = second of the hour, 1 indicates the channel used, "wf" refers to the sounding having had a low pass wind filter applied to remove radiosonde pendulum motion beneath the balloon, RadCor refers to a temperature radiation correction having been applied, and .cls refers to the NCAR CLASS format. For the descending sounding files, the names are the same except that "wf.RadCor" is replaced by "descent". Wind low-pass filtering and radiation corrections are only applied to the ascending soundings.

IV. Header/Tail Information

The header records consist of 15 lines that have a rigidly defined form. The first 8 lines contain data identifying the sounding such as data type, project ID, site type, site location, actual release time, sonde ID, frequency and operator comments. Lines 9-12 sometimes contain auxiliary information and can vary from data set to data set. The last 3 header records contain header information for the data columns. Line 13 holds the field names, line 14 the field units, and line 15 contains dashes (--- characters) signifying the end of the header.

The release location is given as : lon (deg min), lat (deg min), (lon (dec. deg), lat (dec. deg)), altitude (meters)

Longitude in deg min is in the format: ddd mm.mm'W where ddd is the number of degrees from True North (with leading zeros if necessary), mm.mm is the decimal number of minutes, and W represents W or E for west or east longitude, respectively. Latitude has the same format as longitude, except there are only two digits for degrees and N or S for north/south latitude. The decimal equivalent of longitude and latitude follow.

V. Data Records

The data records each contain time from release, pressure, temperature, dew point, relative humidity, wind speed and direction, ascent rate, balloon position data, and both geopotential and GPS altitude.

Field No.	Parameter	Units	Missing Value
1	Time	Seconds	9999.0
2	Pressure	Millibars	9999.0
3	Dry-bulb Temp	Degrees C	999.0

4	Dew Point Temp	Degrees C	999.0	
5	Relative Humidity	Percent	999.0	
6	U Wind Component	Meters/Second	999.0	
7	V Wind Component	Meters/Second	999.0	
8	Wind Speed	Meters/Second	999.0	
9	Wind Direction	Degrees	999.0	
10	Ascension Rate	Meters/Second	999.0	
11	Longitude	Degrees	999.0	
12	Latitude	Degrees	999.0	
13	Range	Kilometers	999.0	
14	Angle	Degrees	999.0	
15	Geo Altitude	Meters	99999.0	
16	wind sat		0	
17	RH1	Percent	999.0	
18	RH2	Percent	999.0	
19	snd sat		0	
20	werror	Meters/Second	99.0	
21	Altitude	Meters	999.0	

VI. Data File Specifics

The files contain data calculated at one-second intervals. The variables pressure, temperature, and relative humidity are calibrated values from measurements made by the radiosonde. The vertical velocity is a direct GPS measurement. The position (lat, lon) also come directly from the GPS. All wind data are computed from the GPS navigation signals received from the sonde. The raw wind values are calculated at a one second data rate by a commercial processing card. The wind measurements were subjected to a digital filter to remove low frequency oscillations due to payload pendulum effects.

VII. Data Quality Control

In the past typical QC of radiosonde data began with running the soundings through EOL's Atmospheric Sounding Processing Environment (ASPEN) which, among other things, smoothes the data and removes suspect data points. However, ASPEN needs to be modified before it is able to process the new GAUS data files For QC of the ascending data files, a temperature radiation correction was applied and, as mentioned above, a low pass wind filter was also applied. Profiles of both temperature and relative humidity versus pressure, and wind speed and direction versus pressure were plotted and visually evaluated for outliers and any other problems. These profiles included ascending and, when available, descending data from each flight. Lastly, histograms of PTU, and winds were created to check the percentages of available data.