METCRAX 2006 Quality Controlled Radiosonde Data Set

NEW 07/09/2009
A correction was made to the radiosonde pressure measurements to remove a .4 mb offset that was inadvertently applied when the soundings were run through ASPEN.

**05/07/2009 **
The METCRAX sounding data files were re-released on March 13, 2009. In each of the sounding files the surface met data lines were corrected to include pre-launch radiosonde temperature and relative humidity, and wind speed and direction from the surface met tower, within one minute prior to launch of the radiosondes. This was done because the original surface met measurements, in many cases, did not accurately represent conditions at the time of launch because they were collected much earlier. Also, the radiosondes and surface met were not exactly co-located, which introduced (possibly real) differences in the measurements from the two sensors.

Contents:

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For more information on the NCAR Earth Observing Laboratory GAUS System (formerly GLASS) please visit the following site:
http://www.eol.ucar.edu/facilities/gaus.html

I. GAUS Project/Dataset Overview

The Meteor Crater Experiment (METCRAX) is a 3-year meteorological research program whose purpose is to investigate the structure and evolution of temperature inversions or cold-air pools that form on a daily basis in topographic basins and valleys. For this study NCAR/EOL deployed one Integrated Sounding System (ISS) approximately 35 miles East of Flagstaff AZ and 3 miles North East of an impact crater known as Meteor Crater (Figure 1). EOL also set up four surface towers in the base of the crater. For more information on these towers please visit, http://www.eol.ucar.edu/rtf/projects/metcrax/isff/. Forty-nine radiosonde launches were performed from the ISS site between October 7 and October 31, 2006. For more information on the METCRAX project please visit: http://www.met.utah.edu/whiteman/METCRAX/

The sounding system used was the NCAR/EOL GPS Advanced Upper-air Sounding system (GAUS). It was developed to replace the 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 delivers 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.

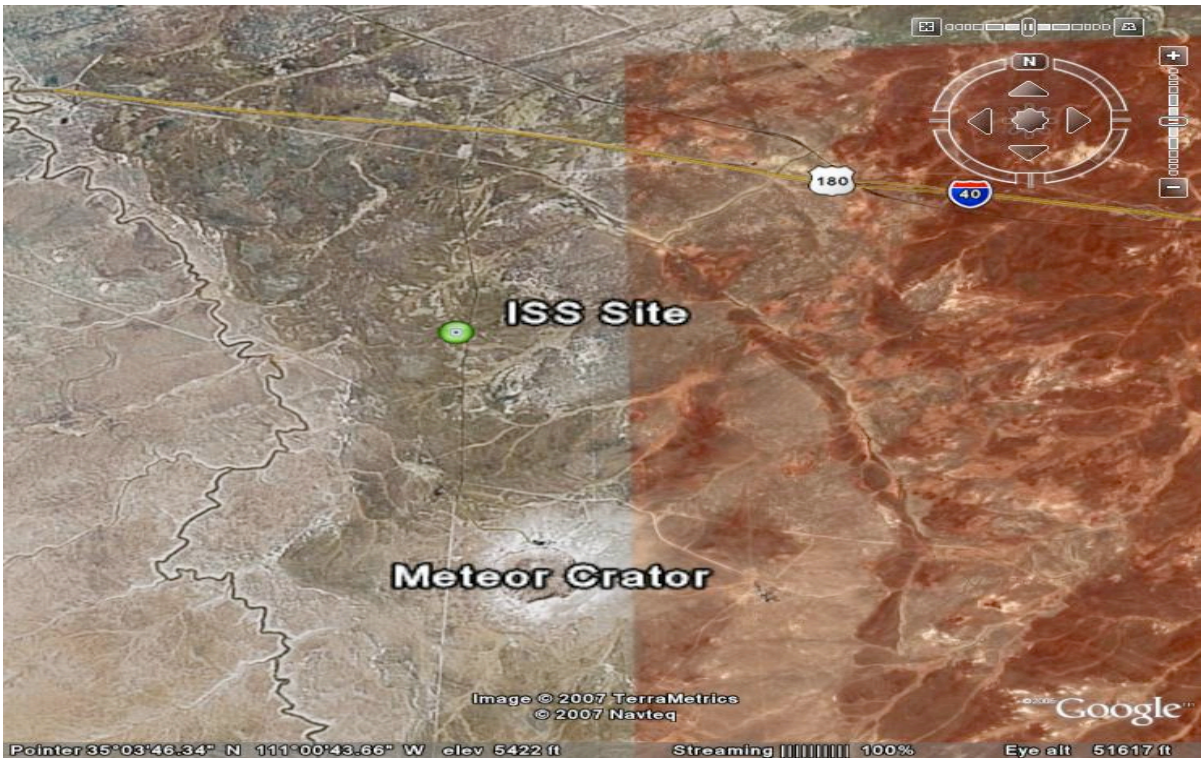

Figure 1 The ISS location during METCRAX is shown by a green dot. Figures show proximity of the ISS site to the Meteor Crater (top), and proximity of the site to Flagstaff, AZ (bottom).

II. ***New EOL File Format***

EOL has introduced a new ascii "EOL file format" for all radiosonde and dropsonde sounding files. This new file format is similar to the CLASS format, used in the past, but has been improved to include a revised header with more detailed sounding information, addition of UTC time, an increase in accuracy of the longitude and latitude to six decimal places, and GPS altitude is now also provided in addition to geopotential altitude (Table 1). Additionally, all missing values are now set to -999.

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.QC.eol" where yyyy = year, mm = month, hh = hour of the day GMT, mm = minute of the hour, ss = second of the hour and ".eol" refers to the file format type

The header records now consist of 14 lines which contain information such as data type, project name, site location, actual release time, and other specialized information. The first seven header lines contain information identifying the sounding. The release location is given as : lon (deg min), lon (dec. deg), lat (deg min), 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 following three header lines contain information about the aircraft data system and auxiliary information and comments about the sounding. The last 3 header lines contain header information for the data columns. Line 12 holds the field names, line 13 the field units, and line 14 contains dashes (--- characters) signifying the end of the header. Data fields are listed below in Table 2.

Table 1. Example of new EOL format used for both dropsonde and radiosonde sounding files

Field No.	Parameter	Units	Measured/Calculated
1	Time	Seconds	----------
2	UTC Hour	Hours	----------
3	UTC Minute	Minutes	----------
4	UTC Second	Seconds	----------
5	Pressure	Millibars	Measured
6	Dry-bulb Temp	Degrees C	Measured
7	Dewpoint Temp	Degrees C	Calculated
8	Relative Humidity	Percent	Measured
9	U Wind Component	Meters/Second	Calculated
10	V Wind Component	Meters/Second	Calculated
11	Wind Speed	Meters/Second	Measured
12	Wind Direction	Degrees	Measured
13	Ascension Rate	Meters/Second	Calculated
14	Geopotential Altitude	Meters	Calculated
15	Latitude	Degrees	Measured

Data Type/Direction: GAUS/Ascending
File Format/Version: EOL Sounding Format/1.0
Project Name/Platform: T-REX/NCAR GAUS
Launch Site: IOP01 08z
Launch Location (lon,lat,alt): 119 20.88'W -119.347997, 36 19.74'N 36.328918, 90.98
UTC Launch Time (y,m,d,h,m,s): 2006, 03, 02, 08:33:34
Sonde Id/Sonde Type: 043937408/Vaisala RS92-SGP (ccGPS)

16	Latitude	Degrees	Measured
17	GPS Altitude	Meters	Measured

Table 2. Lists all parameters provided in the sounding files, their unit of measurement, and if the values are measured or calculated.

III. 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 dew point is calculated from the relative humidity and temperature. The geopotential altitude is calculated from the hydrostatic equation using pressure, temperature, and relative humidity. The rate of ascent is calculated from pressure. The radiosonde position (lat, lon, GPSAlt) and winds are measured by use of a GPS receiver in the sonde. These raw wind values are subjected to a digital filter to remove low frequency oscillations due to the sonde pendulum motion beneath the balloon when run through ASPEN.

IV. Data Quality Control and Important Information for Users

1. Profiles of the raw soundings are first examined to determine if there are any errors with the launch detect, or if system lock-up occurred, which could result in a loss of data near the surface and an incorrect launch time.

2. All of the soundings are then subjected to a radiation correction that takes into account the solar angle at time of launch, and removes solar heating that could skew the temperature measurements.

3. Scatter plots (Figure 2) of the raw data are created to check differences in pressure, temperature and RH between the surface met data and the last available surface radiosonde measurement before launch.

4. The raw soundings are run through EOL's Atmospheric Sounding Processing ENvironment (ASPEN), which analyzes the data, performs smoothing, and removes suspect data points.

5. Lastly, we create profiles of temperature, RH, wind speed and wind direction of the quality controlled soundings which enable us to visually evaluate the soundings for outliers, or any other obvious problems.

Performing the QC steps above allows us to identify and, in some cases, correct errors that could potentially impact research performed using these data sets. During processing of the sounding data:

1. Three soundings needed repair because launch occurred before all steps of the sounding software had been completed. This caused an error in the automatic launch detect, which uses pressure change to determine time of release and requires at least one minute of surface data to accurately detect launch. Some of the data near the surface was lost. Filenames for these soundings were changed to reflect the time the first sonde data point was acquired, rather than actual launch time (since this is unknown). The sounding files are D20061008_011519, D20061008_040158 and D20061012_040127