GNSS Instrument System for MultiStatic and Occultation Sensing (GISMOS) 2008 Quality Controlled Dropsonde Data Set

Contents:

I. Contacts:

Data Quality
Kate Young
kbeierle@ucar.edu

Junhong (June) Wang
junhong@ucar.edu

System/Software
Dean Lauritsen
lauritsn@ucar.edu

Mailing Address: NCAR/Earth Observing Laboratory
P.O. Box 3000
1850 Table Mesa Drive
Boulder, CO 80307; USA

For more information on the NCAR GPS Dropsonde System please visit the following site:
http://www.atd.ucar.edu/rtf/facilities/dropsonde

I. Dataset Overview

GISMOS was a project conducted over the Gulf of Mexico on the G-V aircraft. The purpose of the project was to test the GNSS Instrument System for MultiStatic and Occultation Sensing, a HAIS instrument. GISMOS is part of the HEFT-08 project. HEFT-08 is one of a series of airborne projects that are conducted by the Research Aviation Facility, part of the Earth Observing Laboratory (EOL/RAF), to allow instrument developers flight time on the G-V. The goals of the HEFT projects are instrument validation, performance testing and preparation for research field deployments. During the GISMOS project 20 dropsonde soundings were collected between February 14 and February 22, 2008.

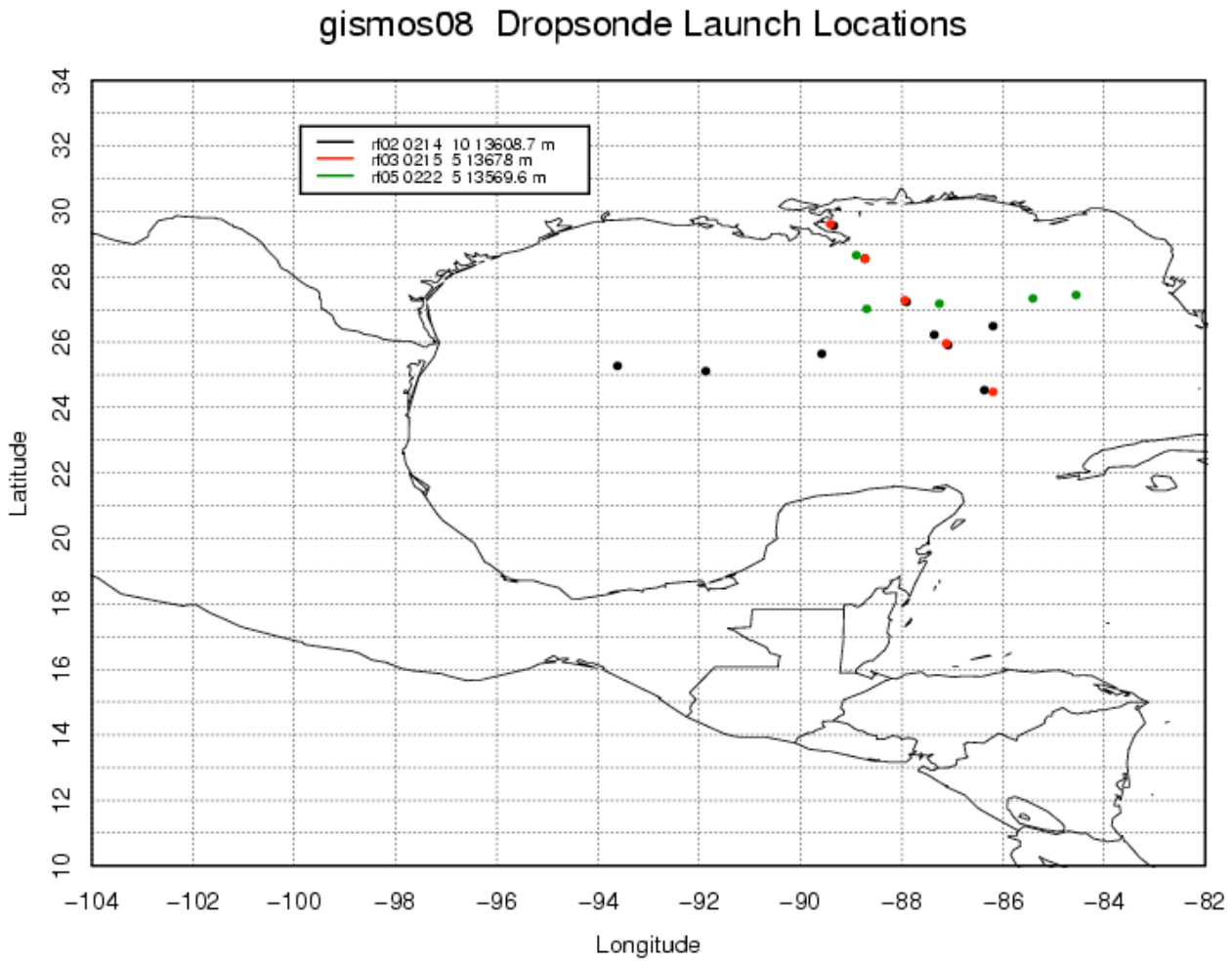

Figure 1 Map of the dropsonde launch locations. Different flights are distinguished by different colors, shown in the legend along with flight date, number of dropsondes and flight level altitude.

III. ***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 precision 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 half-second data files with appropriate corrections and quality control measures applied. The naming convention for these files is - "D", followed by "yyyymmdd_hhmmssQC.eol" where yyyy = year, mm = month, hh = hour of the day GMT, mm = minute of the hour, ss = second of the hour, QC refers to Quality Controlled, 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.

```
Data Type/Direction:                AVAPS SOUNDING DATA, Channel 4/Descending
File Format/Version:                EOL Sounding Format/1.0
Project Name/Platform:              T-REX, RF1/Gulfstream V, N677F
Launch Site:
Launch Location (lon,lat,alt):      118 14.04'W -118.234000, 36 46.04'N 36.767400, 12439.20
UTC Launch Time (y,m,d,h,m,s):      2006, 03, 02, 18:00:30
Sonde Id/Sonde Type:                053116003/Vaisala RSS903 & Ublox TIM-Lx
Reference Launch Data Source/Time:  NCAR G-V (ADS)/18:00/29
System Operator/Comments:           emk/none, Good Drop
Post Processing Comments:           Aspen Version
/
 Time  --UTC --   Press  Temp  Dewpt  RH  Uwind Vwind  Wspd  Dir   dZ  GeoPoAlt  Lon      Lat       GPSAlt
  sec  hh mm ss    mb     C     C     %    m/s   m/s    m/s   deg   m/s    m      deg      deg        m
------- -- -- -----  ------ ------ ------ ------ ------ ------ ------ ------ ------- ---------- ---------- ---------
 -1.0 18  0  29.00  178.80 -61.10 -61.10 100.00 28.44  23.18  36.69 230.81 -999.00 12439.20 -118.234000 36.767400 12446.20
  0.4 18  0  30.40 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.000000 -999.0000012416.27
  0.9 18  0  30.90 -999.00 -999.00 -999.00  0.72  -999.00 -999.00 -999.00 -999.00 -999.00 -999.00 -999.000000 -999.000000 12416.94
```

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	Calculated
12	Wind Direction	Degrees	Calculated
13	Ascension Rate	Meters/Second	Calculated
14	Geopotential Altitude	Meters	Calculated
15	Longitude	Degrees	Measured
16	Latitude	Degrees	Measured
17	GPS Altitude	Meters	Measured

Table 2 Lists data fields provided in the EOL format ascii soundings.

IV. Data File Specifics

The files contain data collected at half-second intervals. The variables pressure, temperature, and relative humidity are calibrated values from measurements made by the dropsonde. The dew point is calculated from the relative humidity. The geopotential altitude value is calculated from the hydrostatic equation using first available pressure, temperature, and relative humidity. For the dropsondes specifically, if the sonde is launched over water and transmits data to the surface, the height is calculated by integrating from the surface (sea level) upward. However, if the sonde failed to transmit data to the surface or if the dropsonde is launched over land, because of unknown surface elevations, we integrate from the flight level down. The descent rate of the dropsonde is computed using the time-differentiated hydrostatic equation. The position (lat, lon) comes directly from the GPS sensor. All wind data are computed from GPS navigation signals received from the sonde. The raw wind values are calculated at a one half second data rate by a commercial processing card.

V. Data Quality Control

1. Temperature and relative humidity profiles from the raw soundings were first examined to determine if all of the files contained data, and to ensure that nothing looked suspicious. Doing this allows us to determine if there were any errors with the automatic launch detect, or if a sounding was started up, but not launched.
2. The raw soundings were then run through the Atmospheric Sounding Processing ENvironment (ASPEN) software, which analyzes the data, performs smoothing, and removes suspect data points.
3. Time series plots of temperature (Figure 2), RH (Figure 3) and wind speed (Figure 4), with regard to altitude, were used to examine the consistency of soundings launched during each flight, and to show the variability of soundings from different missions. These plots are also used to determine if the sounding did not transmit data to the surface, or if a dropsonde was launched over land. In these cases, the soundings are re-run through ASPEN with geopotential altitude calculated from flight level downward.
4. Profiles of temperature, RH, wind speed and vertical velocity from the quality controlled soundings are visually evaluated for outliers, and are used to determine if there was a “fast fall” caused by failure of the parachute to properly deploy.
5. Histograms of pressure, temperature, relative humidity, wind speed and wind direction were then created to examine the distribution, range, and characteristics of each parameter (Figure 5).

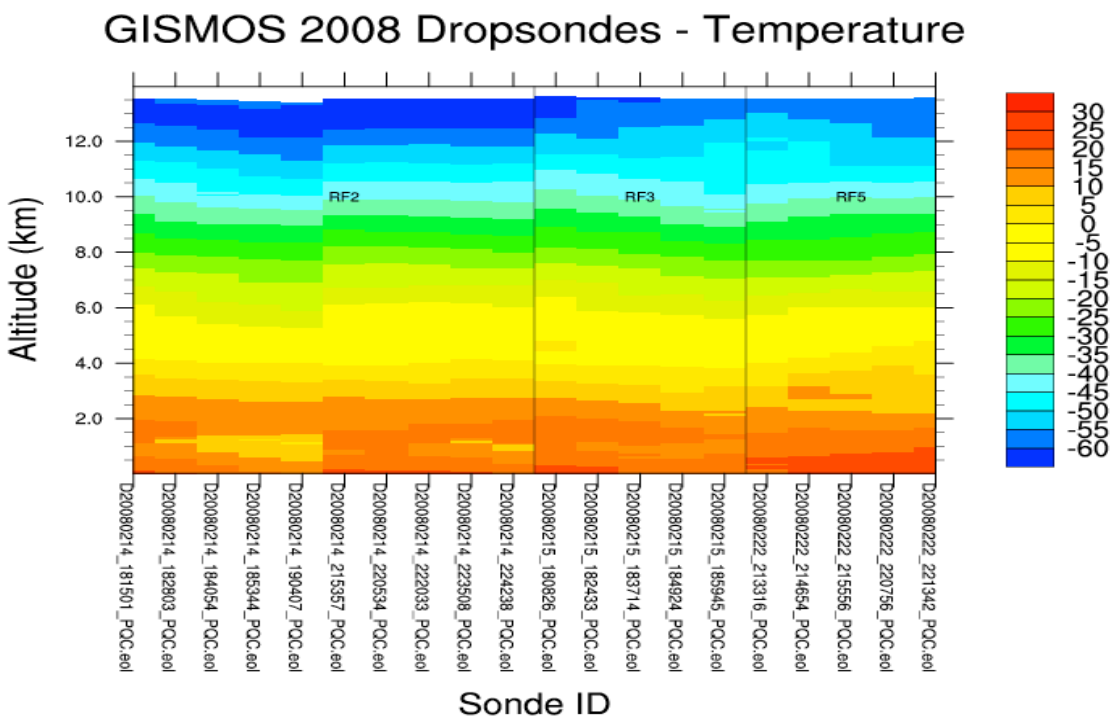

Figure 2 – Time series of dropsonde temperature (deg C) profiles. Sounding files are labeled along x-axis and RF# indicates the flight number.

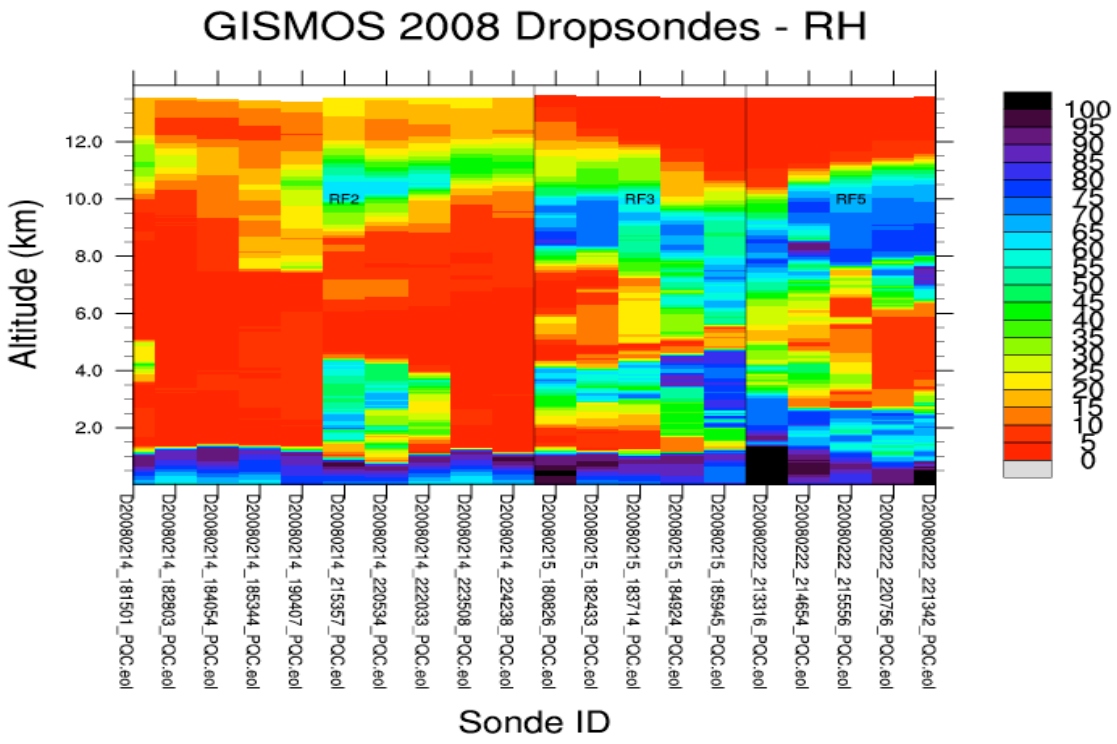

Figure 3 –Time series of dropsonde relative humidity (%) profiles. Sounding files are labeled along x-axis and RF# indicates the flight number.

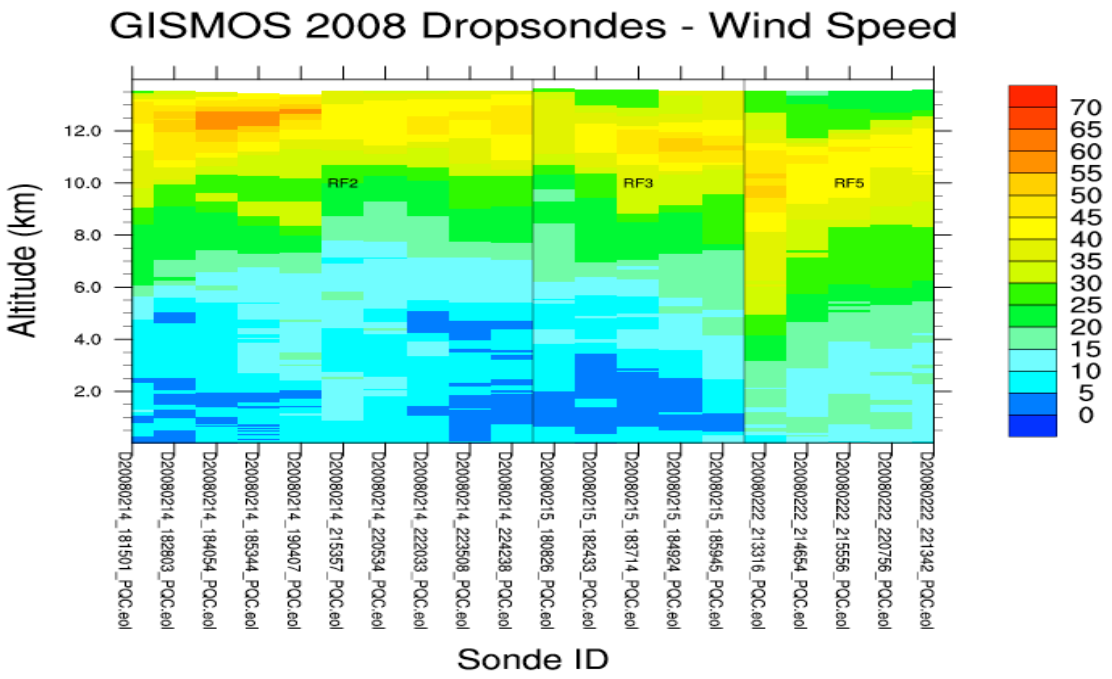

Figure 4 –Time series of dropsonde wind speed profiles (m/s). Sounding files are labeled along x-axis and RF# indicates the flight number.

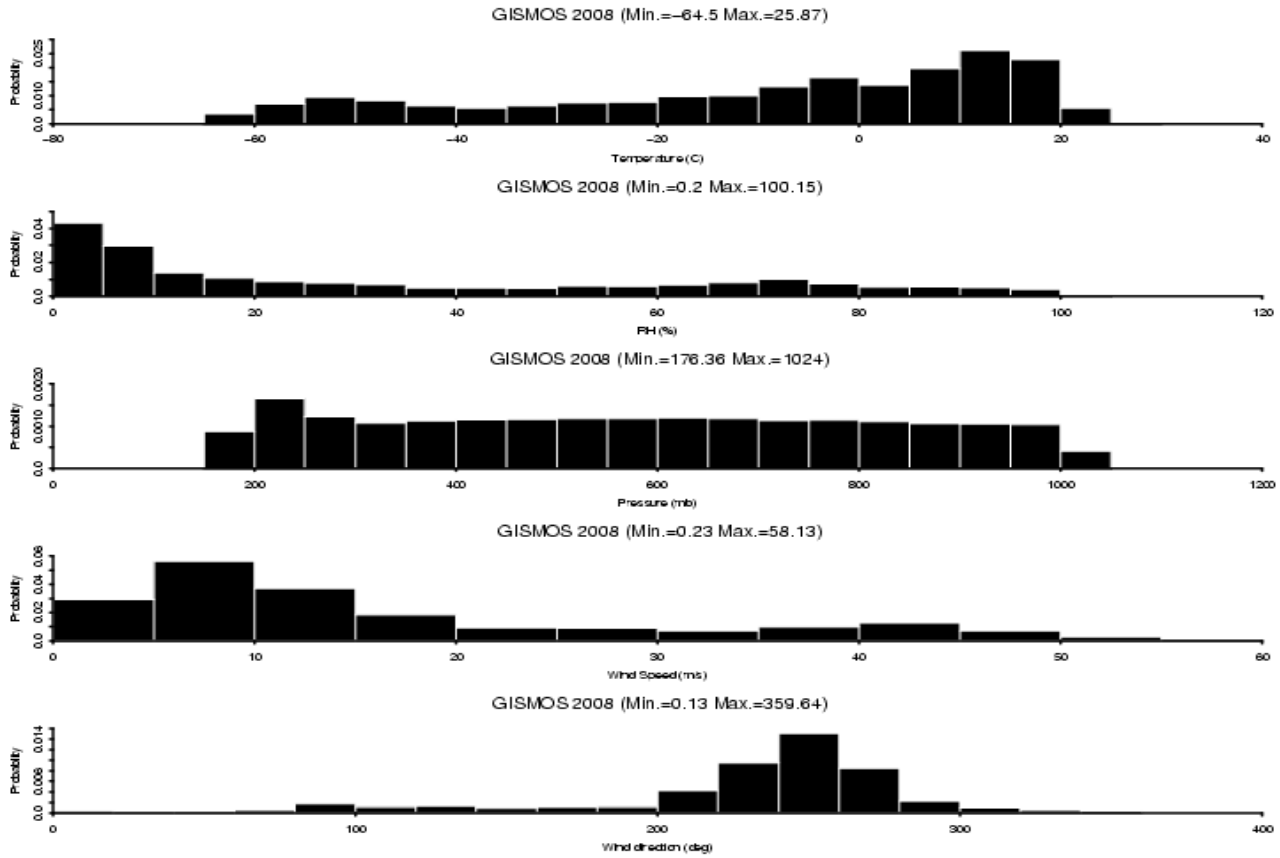

Figure 5. – Shows histograms of pressure, temperature, relative humidity and wind speed for all of the soundings.