CLIMODE 2007 Quality Controlled Radiosonde Data Set

Contents:

Contacts:

Data Quality
Kate Young
kbeierle@ucar.edu

Junhong (June) Wang
junhong@ucar.edu

System/Software
Dean Lauritsen
lauritsn@ucar.edu

Bill Brown
wbrown@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 Earth Observing Laboratory Integrated Sounding System (ISS), or on the GPS Advanced Upper-Air Sounding System (GAUS), please visit:
ISS: http://www.eol.ucar.edu/rtf/facilities/iss/
GAUS: http://www.eol.ucar.edu/facilities/gaus.html

I. ISS Project/Dataset Overview

The **CLI**var **MO**de Water **D**ynamic **E**xperiment (CLIMODE) was a project designed to study the dynamics of 'Eighteen Degree Water' (EDW); the subtropical mode water of the North Atlantic. For this study NCAR/EOL deployed one Integrated Sounding System (ISS) on board the ship R/V Knorr (Figure 1). CLIMODE was conducted in the Atlantic Ocean, off the East coast of the United States (Figure 2) during February and March, 2007. EOL deployed an Integrated Sounding System (ISS), including a UHF boundry layer wind profiler, a Radio Acoustic Sounding System (RASS) and a GPS Advanced Upper-air Sounding System (GAUS). There were a total of 150 radiosonde launches made, 148 of which are included in the final data archive. Two soundings were removed for lack of data. For more information on the CLIMODE project, please visit http://www.climode.org/

The NCAR/EOL GPS Advanced Upper-air Sounding system (GAUS) 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 Image shows research vessel the R/V Knorr. Arrows indicate location of surface meteorology sensors, wind profiler and location where radiosonde launches were performed.

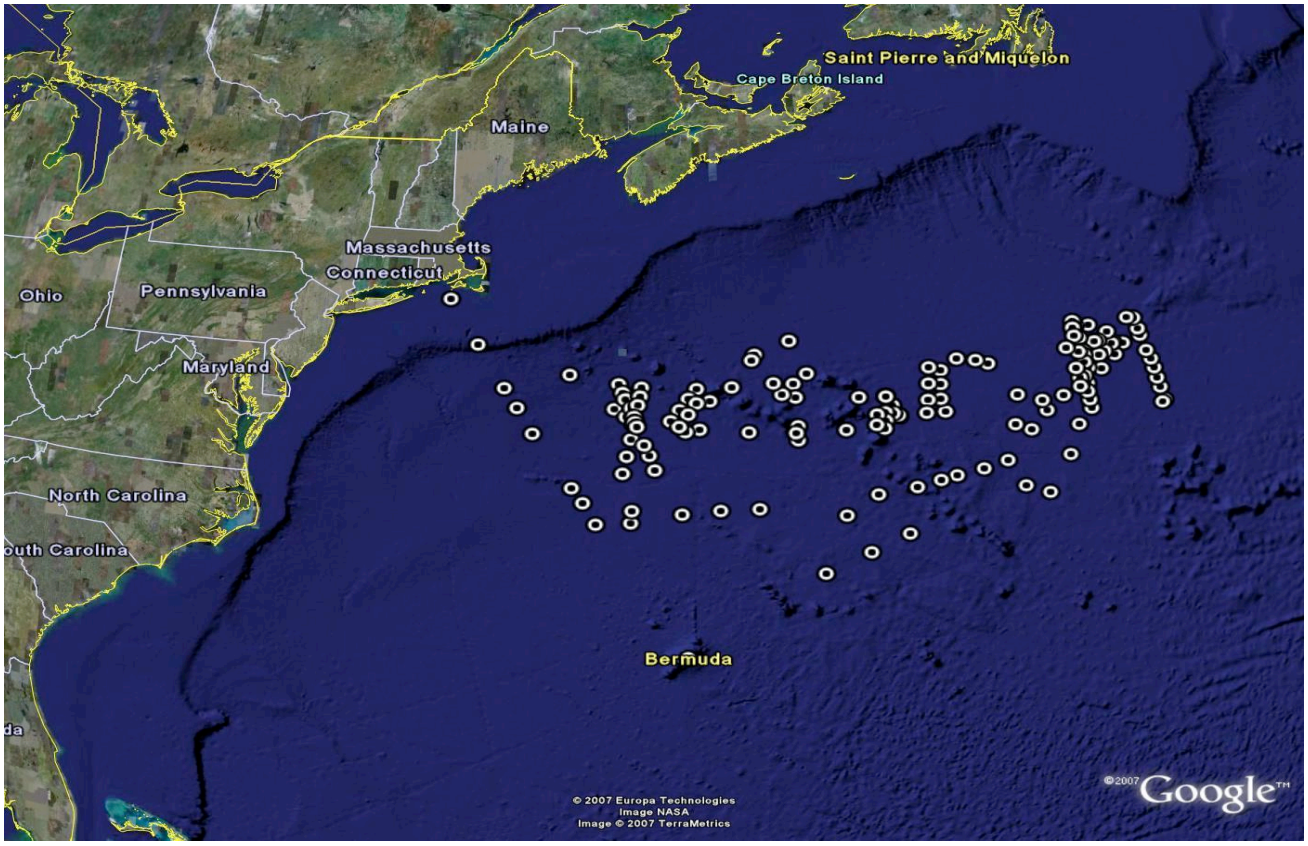

Figure 2 Radiosonde launch locations are shown by white circles. This map shows the proximity of the ships location to the East Coast of the Unites States and Bermuda.

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	Longitude	Degrees	Measured
16	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)

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 Results

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 3) 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. Two soundings experienced failure of the automatic launch detect, likely due to the radiosondes having not been able to collect enough surface data. One sounding (D20070303_003607_P.QC.eol) was removed from the final archive for lack of sufficient data. The other sounding (D20070304_150948_P.QC.eol) is included in the final archive, but only contains data between 198.34 mb and 99.76 mb.

2. One sounding (D20070310_121725_P.QC.eol) was removed from final archive because it contained no temperature data, and very little relative humidity data. This radiosonde flight was terminated early and another launch was made.

3. Five soundings did not contain GPS (latitude, longitude or altitude) data. These soundings are included in the final data archive and are list below.
   D20070215_065240_P.QC.eol
   D20070215_162808_P.QC.eol
   D20070221_143001_P.QC.eol
   D20070313_115316_P.QC.eol
   D20070321_085904_P.QC.eol

4. Differences between the last radiosonde surface measurement before launch and the surface met sensor measurement can be seen in Figure 3 below. While these plots are of raw sounding data, to some degree, differences do carry over to the final product. The green circles in the left-hand plots highlight fairly consistent differences between the radiosonde and surface met measurements. These differences can likely be attributed to a difference in location between the surface met sensors and location where the radiosondes were launched. The surface met sensors were located on a deck of the ship approximately 10-15 feet above where the launch of the radiosondes took place.

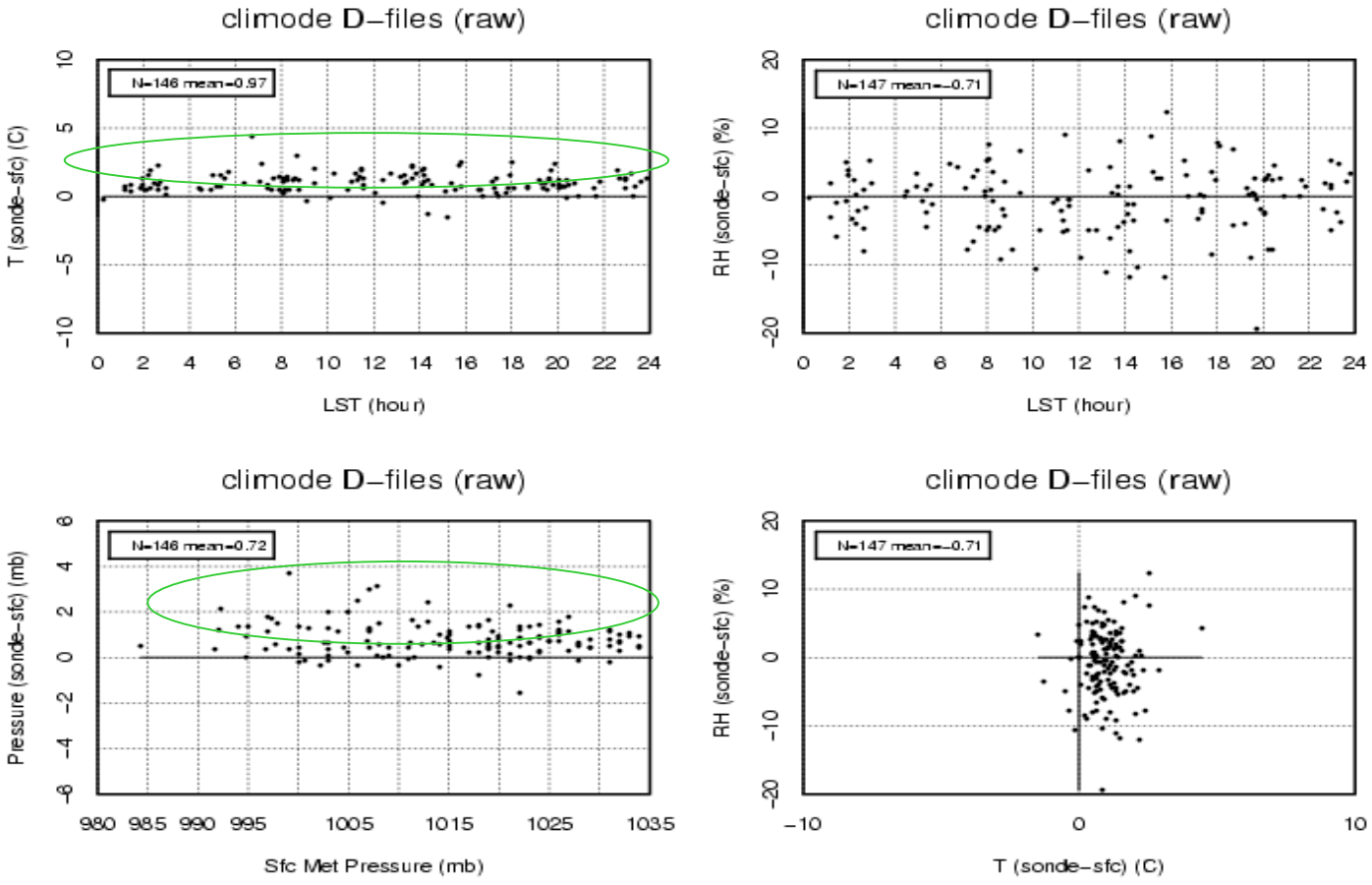

Figure 3 Scatter plots of differences calculated between the last sonde data measurement taken at the surface and the measurements taken by the surface met station. Green circles show difference between temperature and pressure measurements that may be attributed to a difference in location between the surface met sensors and where launch of the radiosondes occurred.