Bunny Fence Experiment 2005 (BUFEX) Quality Controlled Radiosonde Data Set

Contents:

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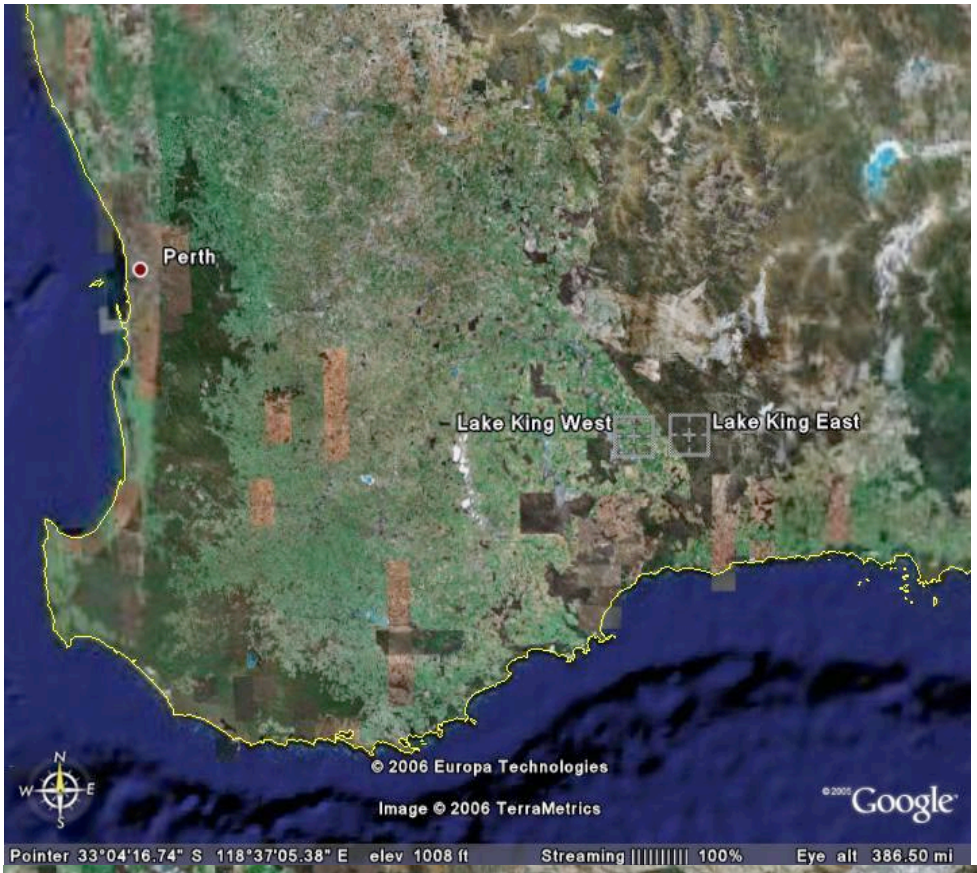
For more information on the NCAR Earth Observing Laboratory GAUS System (formally GLASS) please visit the following site:
http://www.eol.ucar.edu/facilities/gaus.html

I. GAUS Dataset Overview

The new 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.

The Bunny Fence Experiment (BUFEX) was conducted between December 3 and December 20, 2005, during which time 167 radiosondes were launched from two locations near Lake King in Southwest Australia. Eighty-one radiosondes were launched from the west site and eighty-six from the east site. The goal of BUFEX was to study how atmospheric circulation patterns and cloud formation are impacted by a contrast in landscape between extreme agricultural use and undisturbed native vegetation. This site was chosen because of the 750 km long "bunny fence", meant to keep rabbits from the crops, that clearly defines one type of land use from the other, as seen in the maps below.


Perth
Lake King West
Lake King East
© 2006 Europa Technologies
Image © 2006 TerraMetrics
Google
Pointer 33°04'16.74" S 118°37'05.38" E elev 1008 ft
Streaming 100%
Eye alt 386.50 mi

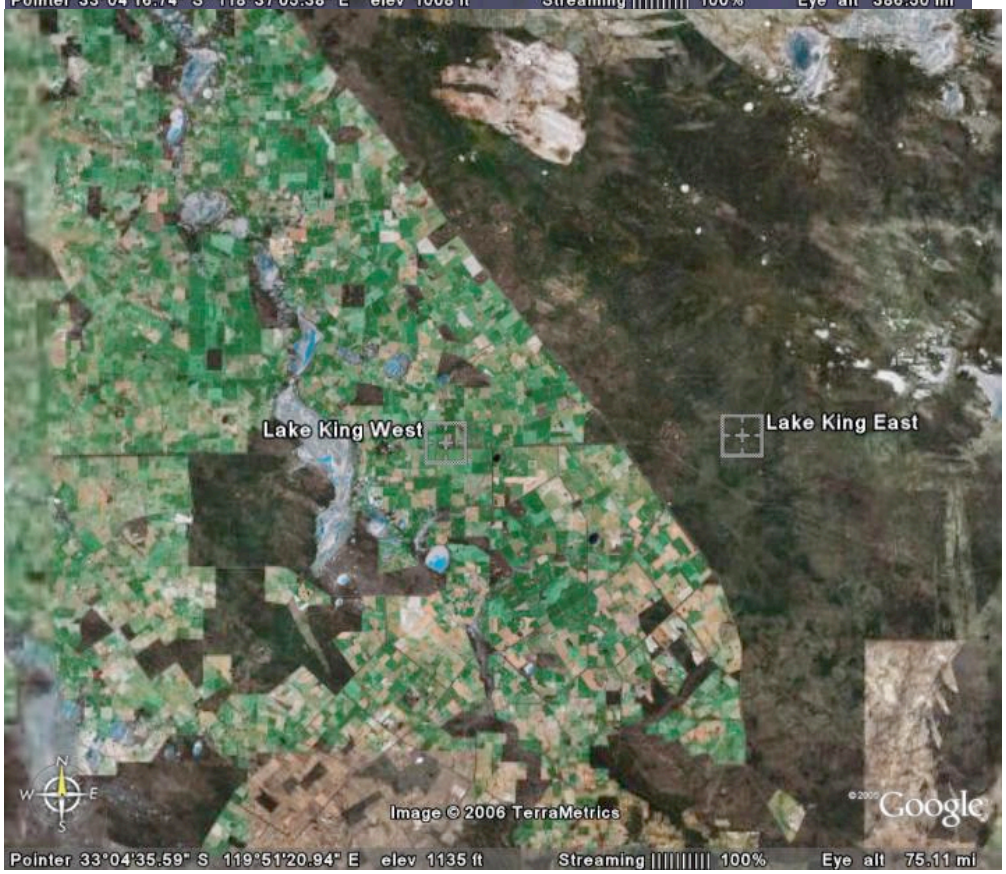

Lake King West
Lake King East
Image © 2006 TerraMetrics
Google
Pointer 33°04'35.59" S 119°51'20.94" E elev 1135 ft
Streaming 100%
Eye alt 75.11 mi

Figure 1 Maps of GAUS site locations. Map on the left is an aerial view of the southwestern tip of Australia which shows site location in proximity to Perth. Map on the right iss zoom of same area which shows more clearly the contrast on either side of the “bunny fence”.

II 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.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.

III. Header Information

The header records 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 following three header lines contain information about the surface met station used 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.

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.

IV. Data Records

Field No.	Parameter	Units	Missing Value
1	Time	Seconds	----------
2	UTC Hour	Hours	----------
3	UTC Minute	Minutes	----------
4	UTC Second	Seconds	----------
5	Pressure	Millibars	-999.00
6	Dry-bulb Temp	Degrees C	-999.00
7	Dewpoint Temp	Degrees C	-999.00
8	Relative Humidity	Percent	-999.00
9	U Wind Component	Meters/Second	-999.00

10	V Wind Component	Meters/Second	-999.00
11	Wind Speed	Meters/Second	-999.00
12	Wind Direction	Degrees	-999.00
13	Ascension Rate	Meters/Second	-999.00
14	Geopotential Altitude	Meters	-999.00
15	Longitude	Degrees	-999.00
16	Latitude	Degrees	-999.00
17	GPS Altitude	Meters	-999.00

V. 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. The geopotential altitude is calculated from the hydrostatic equation using pressure, temperature, and relative humidity. The rate of ascent calculated but the position (lat, lon, GPSAlt) come directly from the GPS sensor. All wind data are computed from GPS navigation signals received from the radiosonde. The raw wind values are calculated at a one second data rate by a commercial processing card. These raw values are subjected to a digital filter to remove low frequency oscillations due to the sonde pendulum motion beneath the balloon.

VI. Data Quality Control and Important Information for Users

The raw soundings are first run through the Atmospheric Sounding Processing ENvironment (ASPEN), which analyzes the data, performs smoothing, and removes suspect data points. Scatter plots (Figures 3 and 4) of the 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. Lastly, we create profiles of temperature, RH, wind speed and wind direction 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 BUFEX data we found that:

1. The time noted in each of the raw sounding filenames was incorrect. The time at which the surface met measurement was taken was accidentally used in the filename rather than the time of the radiosonde launch. This has been corrected in both the raw and EOL format datasets.

2. 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. It is used as a reference to determine the accuracy of the radiosondes pressure, temperature and relative humidity measurements. During the project it was discovered that some operators were inputting data from the radiosonde, while it sat on the ground prior to launch, into the sounding file as the surface observation. There is no way to

determine exactly how many soundings had incorrect surface data sources, but we believe the number to be small.

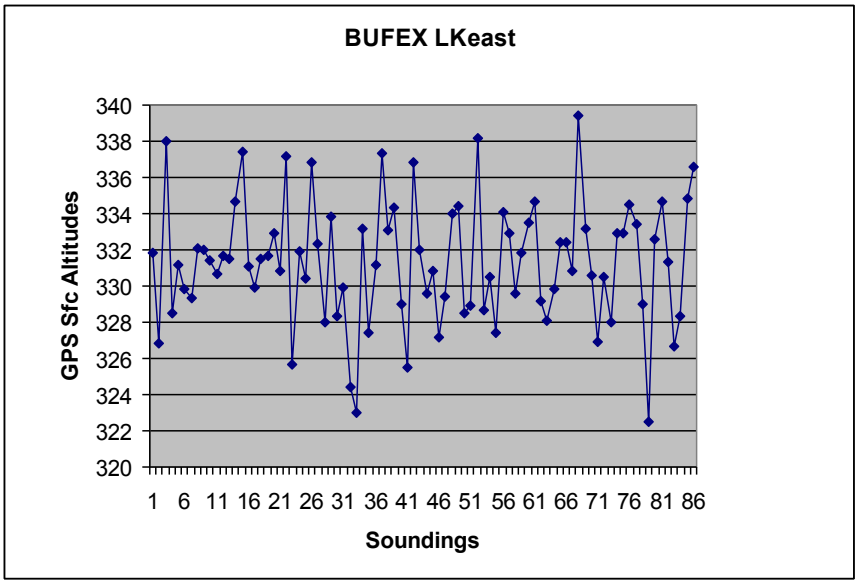
3. A number of soundings had to be corrected for errors in the launch time. These errors are caused when not enough surface pre-launch radiosonde data is collected resulting in the sounding system being unable to determine an accurate launch time.

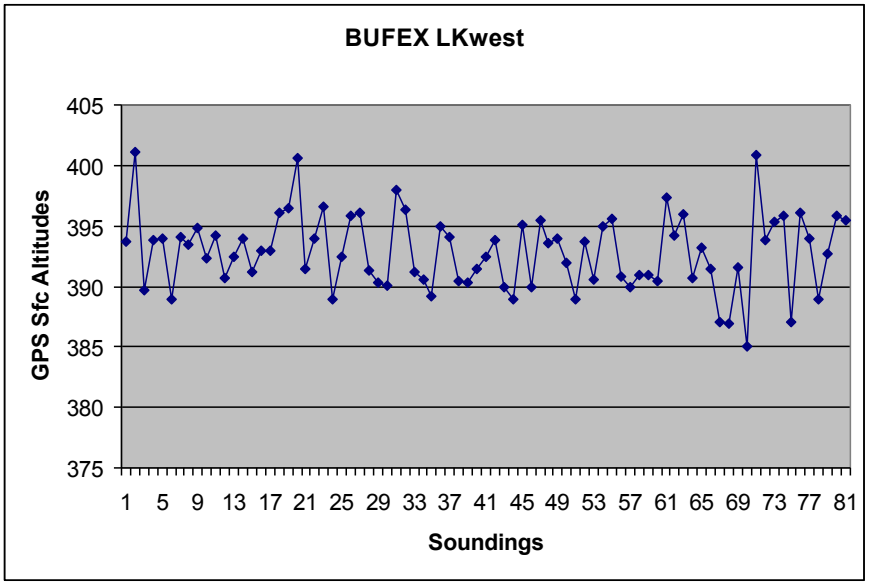
4. The RS-92 radiosondes are equipped with two hygrometers that measure alternately during the ascent of the radiosonde. These measurements are then merged into one profile. In examining the relative humidity profiles, it was determined that 6 radiosondes either had a hygrometer that failed completely or one that failed partially measuring only intermittently during the flight. These soundings are:

West Site
D20051203_092219_P.1QC.RadCor.eol
D20051219_100733_P.1QC.RadCor.eol

East Site
D20051205_004623_P.1QC.RadCor.eol
D20051208_094847_P.1QC.RadCor.eol
D20051208_215700_P.1QC.RadCor.eol
D20051210_065139_P.1QC.RadCor.eol

5 The surface location and altitude were obtained from a GPS. Both the East and West sites were fixed stations, however because of the nature of the GPS and accuracy of the sensor latitude, longitude, and altitude may vary from sounding to sounding. The uncertainty of the GPS surface altitudes is within 20 m (Fig. 2)





Figures 2 show variability of surface altitude measurements from GPS at Lake King East and Lake King West sites

6. Differences between the surface met sensor and the last radiosonde surface measurement before launch (from raw sounding files) can be seen in Figures 3 and 4 below. Red circles indicate extreme differences. While these plots are of raw sounding data, to some degree, differences do carry over to the final product. In addition, there were 6 soundings from the east site and 3 soundings from the west that were apparently rushed and contain no pre-launch surface radiosonde data. While these soundings are included in the number of soundings counted in the legend (N), they were not included in the plots.

East Site

D20051210_035249_P.1.RadCor – Has incorrect surface met RH measurement of 1.5 %.

D20051216_095340_P.1.RadCor – Cause of large RH difference undetermined.

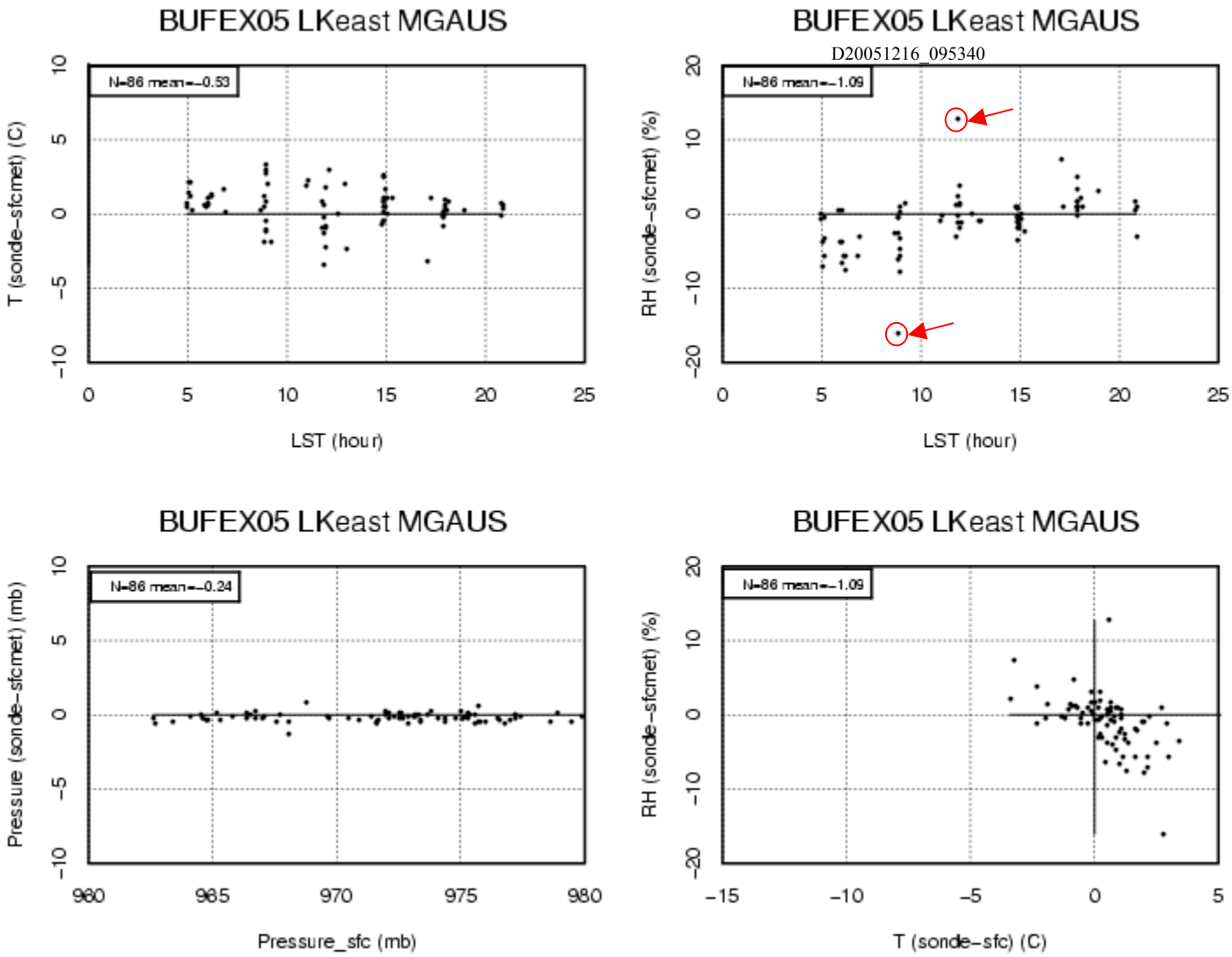


Figure 3 Difference between surface met sensor measurements and last surface radiosonde measurement before launch at East site.

West Site

D20051220_065943_P.1.RadCor – Had an incorrect surface met temperature of 3.8°, based on comparison with earlier sounding. Surface value was changed to 29.8° to more closely reflect temperature measured by the sonde.

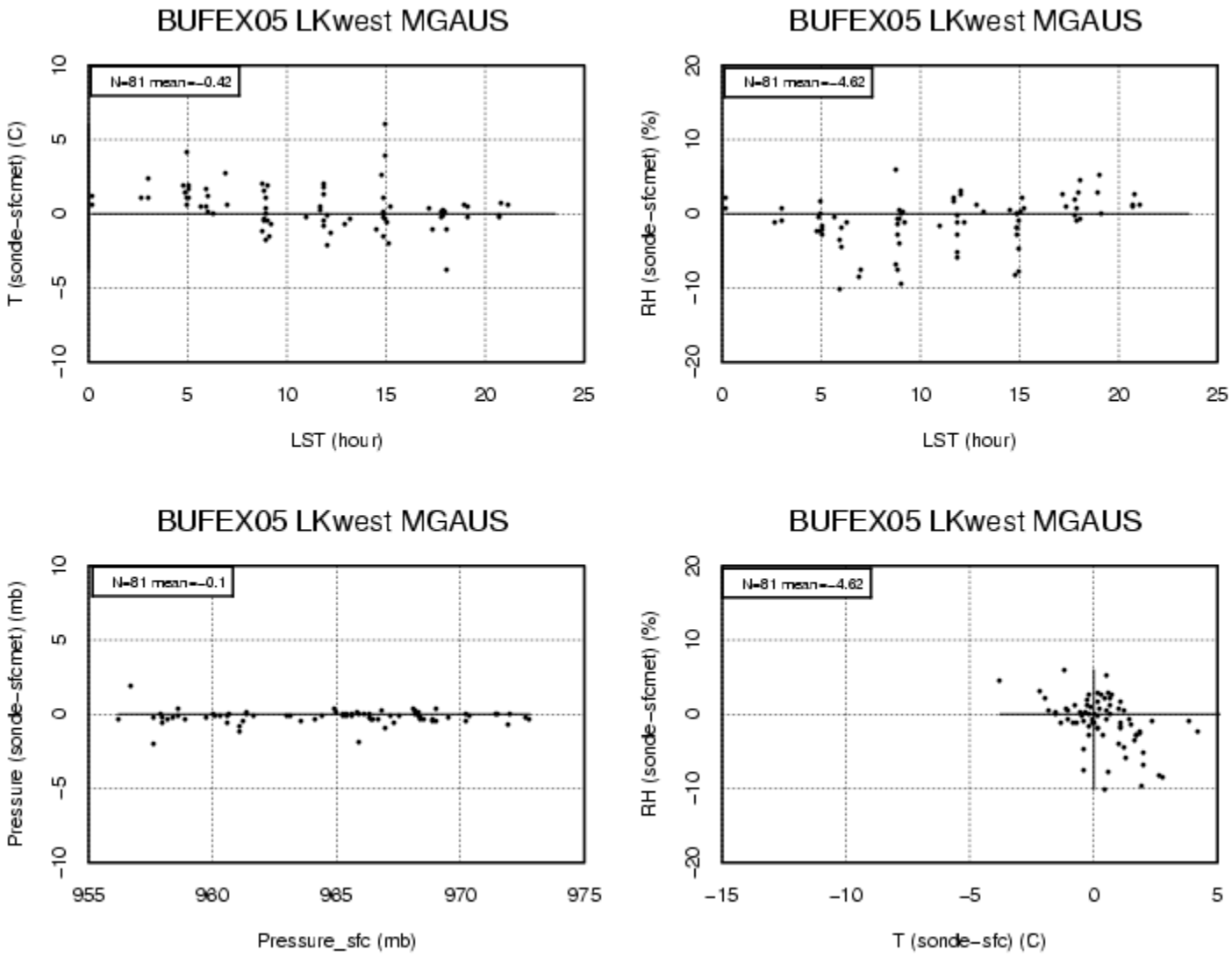


Figure 4 Difference between surface met sensor measurements and last surface radiosonde measurement before launch at West site.