Mesoscale Predictability Experiment (MPEX) 2013
TAMU Mobile Radiosonde (ESC Format) Data Set

1.0   Contacts:

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2.0 Dataset Overview

Texas A&M University (TAMU) operated a mobile radiosonde system during the Mesoscale Predictability Experiment (MPEX) during the period from 21 May to 31 May 2013. Soundings were taken intermittently as determined by the weather situation, with a focus on the pre-convective and convectively disturbed environments near deep convective storms in the central United States.   This final MPEX data set includes a total of 23 quality controlled, high vertical resolution (1 second) soundings (Figure 1).
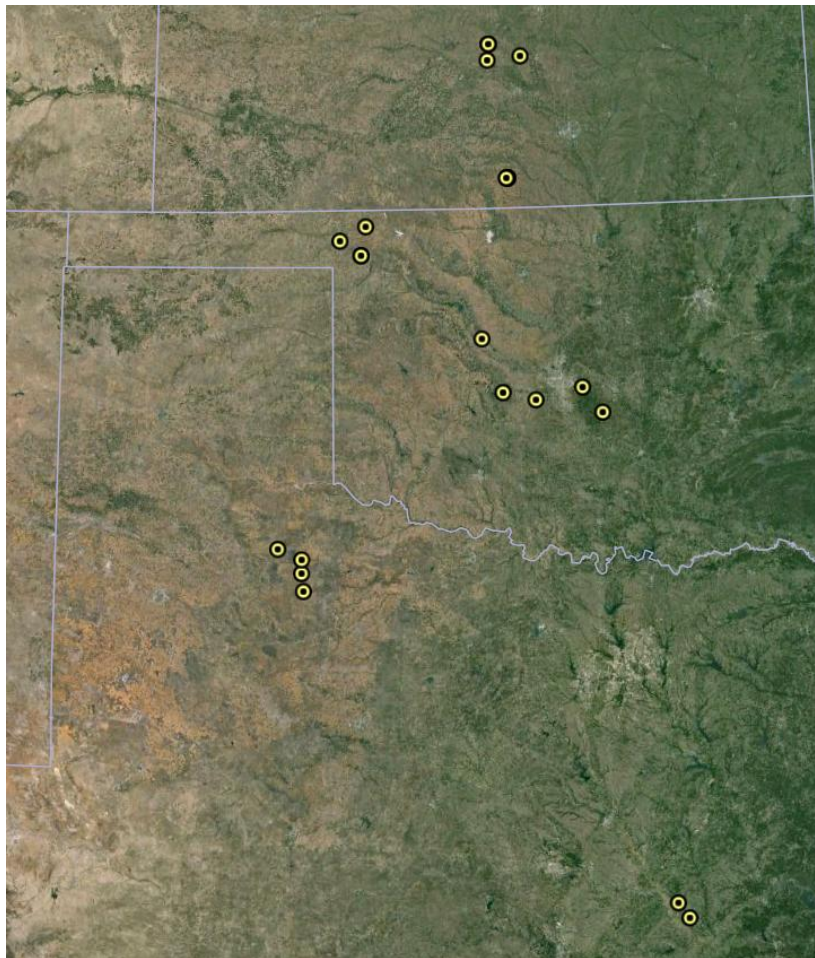

Figure 1. TAMU Mobile radiosonde release locations during MPEX.

The Mesoscale Predictability Experiment (MPEX) was a field campaign aimed at investigating if experimental sub-synoptic observations can extend convective-scale predictability and otherwise enhance sill in regional numerical weather prediction over a 6-24 hour time span. The NSF/NCAR Gulfstream-V (GV) aircraft deploying dropsondes was the primary platform used in the experiment. There were also three groups on the ground releasing radiosondes from mobile platforms. Further information on MPEX is available at the MPEX web site: https://www.eol.ucar.edu/field_projects/mpex and information on MPEX operations are available at the MPEX Field Catalog: http://catalog.eol.ucar.edu/mpex/.

3.0 EOL Sounding Composite (ESC) File Format Description

The ESC is a columnar ASCII format consisting of 15 header records for each sounding followed by the data records with associated data quality flags.

3.1 Header Records

The header records (15 total records) contain a variety of metadata about the sounding (i.e. location, time, radiosonde type, etc). The first five header lines contain information identifying the sounding, and have a rigidly defined form. The following 7 header lines are used for auxiliary information and comments about the sounding, and may vary from dataset to dataset. 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) delineating the extent of the field.

The file standard header lines are as follows:

Line	Label (padded to 35 char)	Contents
1	Data Type:	Description of the type and resolution of data
2	Project ID:	Short name for the field project
3	Release Site Type/Site ID:	Description of the release site.
4	Release Location (lon,lat,alt):	Location of the release site.
5	UTC Release Time (y,m,d,h,m,s):	Time of release.

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

Longitude in deg min is in the format: ddd mm.mm'W where ddd is the number of degrees (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 time of release is given as: yyyy, mm, dd, hh:nn:ss.
Where yyyy is the year, mm is the month, dd is the day of month, and hh:nn:ss are the UTC hour, minute, and second respectively.

The seven non-standard header lines may contain any label and contents. The labels are padded to 35 characters to match the standard header lines. Records for this data set include the following non-standard header lines:

Line	Label (padded to 35 char)	Contents
6	Sonde Type:	Radiosonde type
7	Ground Station Software:	Ground station software
8	Surface Data Source:	Source of surface observation
9		
10		
11		
12	Nominal Release Time (y,m,d,h,m,s):	Nominal release time

The nominal release time is always the same as the actual time.

3.2 Data Records

The data records each contain time from release, pressure, temperature, dew point, relative humidity, U and V wind components, wind speed and direction, ascent rate, balloon position data, altitude, and quality control flags (see the QC code description). Each data line contains 21 fields, separated by spaces, with a total width of 130 characters. The data are right-justified within the fields. All fields have one decimal place of precision, with the exception of latitude and longitude, which have three decimal places of precision. The contents and sizes of the 21 fields that appear in each data record are as follows:

Field	Width	Format	Parameter	Units	Missing Value
1	6	F6.1	Time since release	Seconds	9999.0
2	6	F6.1	Pressure	Millibars	9999.0
3	5	F5.1	Dry-bulb Temperature	Degrees C	999.0
4	5	F5.1	Dew Point Temperature	Degrees C	999.0
5	5	F5.1	Relative Humidity	Percent	999.0
6	6	F6.1	U Wind Comp	m/s	9999.0
7	6	F6.1	V Wind Comp	m/s	9999.0
8	5	F5.1	Wind speed	m/s	999.0
9	5	F5.1	Wind direction	Degrees	999.0
10	5	F5.1	Ascent Rate	m/s	999.0
11	8	F8.3	Longitude	Degrees	9999.0
12	7	F7.3	Latitude	Degrees	999.0
13	5	F5.1	Elevation Angle	Degrees	999.0
14	5	F5.1	Azimuth Angle	Degrees	999.0
15	7	F7.1	Altitude	Meters	99999.0
16	4	F4.1	QC for Pressure	Code	99.0
17	4	F4.1	QC for Temperature	Code	99.0
18	4	F4.1	QC for Humidity	Code	99.0
19	4	F4.1	QC for U Wind	Code	99.0
20	4	F4.1	QC for V Wind	Code	99.0

21	4	F4.1	QC for Ascent Rate	Code	99.0

Fields 16 through 21 contain the data quality flags from the NCAR/Earth Observing Laboratory (EOL) sounding quality control procedures. The data quality flags are defined as follows:

Code	Description
1.0	Checked, datum seems physically reasonable. ("GOOD")
2.0	Checked, datum seems questionable on a physical basis. ("MAYBE")
3.0	Checked, datum seems to be in error. ("BAD")
4.0	Checked, datum is interpolated. ("ESTIMATED")
9.0	Checked, datum is missing. ("MISSING")
99.0	Unchecked (QC information is "missing".) ("UNCHECKED")

3.3 Data Specifics

The files contain data at 1-second vertical levels

The data are in files by day, so all soundings for a particular day are concatenated into a single file ordered by time. The file naming convention is:

TAMU_Mobile_yyyymmdd.cls where yyyy is the year, mm is the month, and dd is the day of the month.

The TAMU Mobile platform utilized iMet-1 radiosondes with GPS windfinding during MPEX. The ground station software was either iMet-3050 or iMet-3150 software depending on the sounding. The one used for each sounding is noted in the Ground Station Software header record of the data files. Radiosonde serial numbers were not noted by the data source.

These data include the proprietary processing performed by the iMet software which includes corrections for standard known biases of the instrument and radiation corrections.

The surface (0 second record) data were manually entered and were measured as follows: wind speed from a handheld Kestral 4000 instrument, wind direction from a compass/streamer, P/T/RH are typically from the radiosonde but were checked against a Kestral sensor

3.4 Sample Data

The following is a sample of the MPEX TAMU Mobile high resolution radiosonde data in ESC format.

```
Data Type:                    TAMU Mobile/Ascending
Project ID:                   MPEX
Release Site Type/Site ID:    TAMU Mobile
Release Location (lon,lat,alt): 096 20.12'W, 30 37.13'N, -96.335, 30.619, 100.9
UTC Release Time (y,m,d,h,m,s): 2013, 05, 21, 12:04:00
Sonde Type:                   iMet-1 with GPS windfinding
Ground Station Software:      iMET-3050
Surface Data Source:          Temperature/Humidity/Wind speed - Kestral 4000; Wind direction - compass/streamer; Pressure -
Climatronics 092
/
/
/
Nominal Release Time (y,m,d,h,m,s):2013, 05, 21, 12:04:00
 Time  Press  Temp  Dewpt  RH    Ucmp   Vcmp  spd   dir   Wcmp    Lon    Lat   Ele   Azi   Alt    Qp   Qt   Qrh  Qu   Qv   QdZ
```

```
  sec     mb     C     C      %    m/s    m/s    m/s   deg   m/s     deg      deg   deg   deg      m    code code code code code code
------  -----  -----  -----  ----  -----  -----  -----  ----- -----  -------  ------ ----- -----  ------- ---- ---- ---- ---- ---- ----
   0.0  997.4  24.3  22.9  92.0   -1.8    3.1    3.6 150.0 999.0  -96.335  30.619 999.0 999.0   100.9 99.0 99.0 99.0 99.0 99.0  9.0
   1.0  997.1  24.1  23.9  98.9   -4.4    7.7    8.9 150.6  11.9  -96.335  30.619 999.0 999.0   112.8  3.0 99.0 99.0 99.0 99.0 99.0
   2.0  996.7  24.1  23.9  98.9   -4.5    7.7    8.9 150.0   6.0  -96.335  30.619 999.0 999.0   118.8  3.0 99.0 99.0 99.0 99.0 99.0
```

3.5 Station List

ID	Site Name	State	Longitude	Latitude	Elev (m)
N/A	TAMU Mobile	Mobile	Mobile	Mobile	Mobile

4.0 Data Quality Control Procedures

1. Each sounding was converted from its original format (columnar ASCII) into the ESC format described above.

2. Each sounding was passed through a set of automated data quality checks which included basic gross limit checks as well as rate of change checks. This is further described in Section 4.1.

3. Each sounding was visually examined utilizing the NCAR/EOL XQC sounding quality control software. This is further described in Section 4.2.

4.1 Automated Data Quality Checks

This data set was passed through a set of automated data quality checks. This procedure includes both gross limit checks on all parameters as well as rate-of-change checks on temperature, pressure, and ascent rate. A version of these checks is described in Loehrer et al. (1996) and Loehrer et al. (1998).

4.1.1 Gross Limit Checks

These checks were conducted on each sounding and the data quality flags in the ESC files were adjusted as appropriate. Only the data point under examination was flagged. All checks also produced warning messages that specified the location of the problem and the severity of the issue. These warning messages where then summarized statistically and examined to determine any consistent issues.

For this data set NCAR/EOL conducted the following gross limit checks. In the table P = pressure, T = temperature, RH = relative humidity, U = U wind component, V = V wind component, B= bad, and Q = questionable.

Parameter	Check	Parameter(s) Flagged	Flag Applied
Pressure	<0 or > 1050	P	B
Altitude	< 0 or >40000	P, T, RH	Q
Temperature	< -90 or > 45	T	B
Dew Point	< -99.9 or > 33	RH	Q
	> T	T, RH	Q
Wind Speed	< 0 or > 100	U, V	Q
	> 150	U, V	B
U Wind	< 0 or > 100	U	Q
	> 150	U	B

V Wind	< 0 or > 100	V	Q
	> 150	V	B
Wind Direction	< 0 or > 360	U, V	B
Ascent Rate	< -10 or > 10	P, T, RH	Q

4.1.2 Vertical Consistency Checks

These checks were conducted on each sounding and the data quality flags in the ESC files were adjusted as appropriate. These checks were started at the surface and compared each neighboring data record. In the case of checks that ensured that the values increased/decreased as expected, only the data point under examination was flagged. However, for the other checks, all of the data points used in the examination were flagged. All items within the table are as previously defined. All checks also produced warning messages that specified the location of the problem and the severity of the issue. These warning messages where then summarized statistically and examined to determine any consistent issues.

Parameter	Check	Parameter(s) Flagged	Flag Applied
Time	Decreasing/equal	None	None.
Altitude	Decreasing/equal	P, T, RH	Q
Pressure	Increasing/equal	P, T, TH	Q
	> 1mb/s or < -1mb/s	P, T, TH	Q
	> 2mb/s or < -2mb/s	P, T, TH	B
Temperature	< -15°C/km	P, T, RH	Q
	< -30°C/km	P, T, RH	B
	> 50°C/km	P, T, RH	Q
	> 100°C/km	P, T, RH	B
Ascent Rate	> 3m/s or < -3m/s	P	Q
	> 5m/s or < -5m/s	P	B

4.2 Visual Data Quality Checks

Each sounding was visually examined using the NCAR/EOL XQC sounding data quality control software. This software allows the user to view a skew-t/log-p diagram of each sounding and apply data quality flags as appropriate. The user can zoom in on sections of soundings for detailed examination and can adjust the data quality flags for an individual point, sections of soundings, or entire soundings for each parameter individually. The software also allows the user to override the quality flags applied by the automated procedure.

4.3 Data Quality Issues of Note

201305232124 – PTH bad above 448mb. The surface lat/lon in the provided raw data file was incorrect. Changed the surface value to match the radiosonde lat/lon and elevation data.
201305240105 – PTH bad above 409mb.
201305272357 – PTH after 3079 seconds are questionable.
201305280106 – PTH bad from 324-200mb. TH questionable 422-325mb.
201305282000 – Wetbulbing ~776mb.
201305282101 – Winds bad 339-322mb.
201305292239 – Temperature data questionable 649-281mb.

5.0 References

Loehrer, S. M., T. A. Edmands, and J. A. Moore, 1996: TOGA COARE upper-air sounding data archive: development and quality control procedures. Bull. Amer. Meteor. Soc., 77, 2651-2671.

Loehrer, S. M., S. F. Williams, and J. A. Moore, 1998: Results from UCAR/JOSS quality control of atmospheric soundings from field projects. Preprints, Tenth Symposium on Meteorological Observations and Instrumentation, Phoenix, AZ, Amer. Meteor. Soc., 1-6.