PECAN FP2 Tethersonde Measurements

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1. Data Set Overview

During PECAN, the Naval Postgraduate School conducted tethersonde measurements with a 16 cubic meter aerostat during intensive observation periods that were mostly at night. The tethersonde package profiled the boundary layer several times from ground level to about 300 m above ground level. Measurements include vertical profiles of temperature, relative humidity, pressure, and wind speed/direction. These profiles were measured at FP2 in the Greensburg Business Park over an open grassy field near the NPS surface flux tower/tripod and SODAR wind profiler.

2. Instrument Description

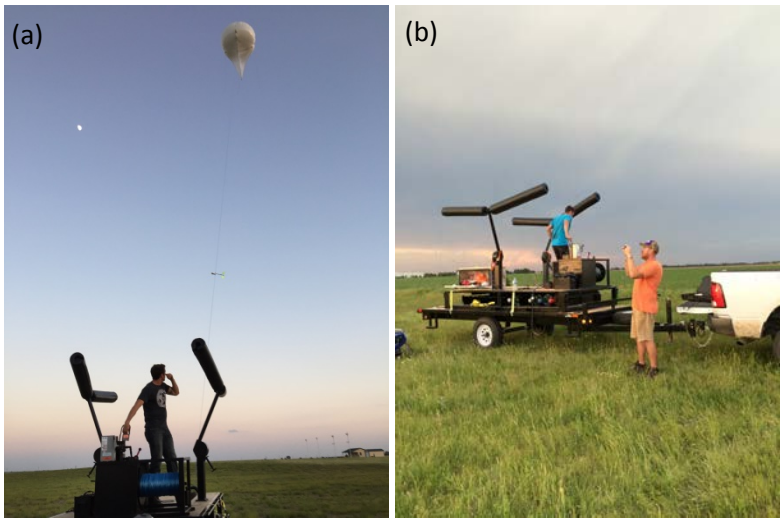

Figure 1. NPS tethered balloon system at FP2 site during PECAN. (a) Tethered balloon profiling flight; (b) the balloon mooring and winch system on a flatbed trailer.

The tethersonde sensor package included the Anasphere SmartTether Version 8 and iMET-1-AXBN rawinsonde. The Anasphere SmartTether measured temperature, relative humidity, pressure, wind speed and direction, and GPS location. The wind speeds are measured with either a pitot tube or cup and vane system. The iMET rawinsonde measured only the thermodynamic properties and GPS location. Measurements are wirelessly transmitted from the module to a receiver.

Anasphere SmartTether Version 8

Range

Pressure: 0-1110 hPa
Temperature: -55 to +125 degC
Relative Humidity: 0 – 100%
Wind Speed (pitot): 0 – 14 m/s (at sea level)

Wind Speed (cup): 0 – 59 m/s
Wind Direction: 0 – 360 degrees

Accuracy
Pressure: 0.5 hPa
Temperature: 0.5 degC
Relative Humidity: 1.7 %
Wind Speed (pitot): 0.5% of full scale
Wind Speed (cup): 1 m/s or 5%, which ever is greater
Wind Direction: 2 degrees

Resolution
Pressure: 0.1 hPa
Temperature: 0.125 degC
Relative Humidity: 0.1 %
Wind Speed (pitot): 0.1 m/s
Wind Speed (cup): 0.1 m/s
Wind Direction: 1 degree

iMET-1-AXBN Rawinsonde

Range
Pressure: 2 to 1070 hPa
Temperature: -95 to +50 degC
Relative Humidity: 0 to 100 %

Accuracy
Pressure: 0.5 hPa
Temperature: 0.2 degC
Relative Humidity: 5% RH

Resolution
Pressure: 0.01 hPa
Temperature: 0.01 degC
Relative Humidity: <0.1%

3. Data Collection and Processing

Spurious data removal

'Bad' data are replaced with 'NaN' (not-a-number). These data are identified for being out of range or having transmission issues.

Time Alignment

Data from both systems are simply aligned with their respective GPS timestamps.

4. Data Format

Data from both systems are compiled into a single netCDF file. The filenames format is given as yyyymmdd_NPSTether.nc where yyyy year, mm month, dd day. The date is representative of when the majority of the data was taken in UTC time. Each file probably has a crossover from 2359Z to 0000Z. Files having a suffix of _ASTOnly denote that it only contains Anasphere SmartTether data

and do not contain variables with suffix _imet. Data are given as 0.5 Hz point measurements. The variable names and descriptions are summarized below.

Variable	Unit	Instrument	Description
UTC_matlab_time	Day		
YEAR	YR		'Year'
MONTH	MTH		'Month'
DAY	DAY		'Day'
HOUR	HR		'Hour'
MINUTE	MIN		'Minute'
SECOND	SEC		'Second'
lat_ast8	degree	'Anasphere SmartTether v8'	'Anasphere ST8 Latitude'
lon_ast8	degree	'Anasphere SmartTether v8'	'Anasphere ST8 Longitude'
cog_ast8	degree	'Anasphere SmartTether v8'	'Anasphere ST8 Course Over Ground'
sog_ast8	meter/second	'Anasphere SmartTether v8'	'Anasphere ST8 Speed Over Ground'
alt_ast8	meter	'Anasphere SmartTether v8'	'Anasphere ST8 GPS Altitude'
Ps_ast8	hPa	'Anasphere SmartTether v8'	'Anasphere ST8 Baro Pressure'
T_ast8	degC	'Anasphere SmartTether v8'	'Anasphere ST8 Temperature'
rh_ast8	percent RH	'Anasphere SmartTether v8'	'Anasphere ST8 Relative Humidity'
wdir_ast8	degree	'Anasphere SmartTether v8'	'Anasphere ST8 Wind Direction'
wspd_ast8	meter/second	'Anasphere SmartTether v8'	'Anasphere ST8 Wind Speed'
lat_imet	degree	'iMET-1-AXBN Radiosonde'	'iMET-1 Latitude'
lon_imet	degree	'iMET-1-AXBN Radiosonde'	'iMET-1 Longitude'
alt_imet	meter	'iMET-1-AXBN Radiosonde'	'iMET-1 GPS Altitude'
Ps_imet	hPa	'iMET-1-AXBN Radiosonde'	'iMET-1 Barometric Pressure'
T_imet	degC	'iMET-1-AXBN Radiosonde'	'iMET-1 Temperature'
rh_imet	%	'iMET-1-AXBN Radiosonde'	'iMET-1 Relative Humidity'

5. Data Remarks

Dates of available data: June 2, 3, 4, 20, 26, 27, and 29 SmartTether was only sensor used.
June 30 and July 1, 2, 4, 8, 9, 10 used both SmartTether and iMET sonde
June 10 and 19 have data with the SmartTether only, however they have yet to be processed due to a different data format.

The author cautions and does not recommend the use of the Anasphere SmartTether temperature and relative humidity as the sensors have an extremely long time constant. They do not capture believable gradients in the vertical profile. However, the wind direction and speed do not exhibit these slow responses and are valid for use. The slow responding temperature and relative humidity sensor was the motivation to collocate an iMET-1-AXBN rawinsonde for its faster thermodynamic sensors.