

VORTEX-SE Sounding Cleanup

Mission summaries

- http://catalog.eol.ucar.edu/vortex-se_2017/tools/missions (http://catalog.eol.ucar.edu/vortex-se_2017/tools/missions)

Information about map: EDT

Map name (internal) : EDT000 Sounding set (internal) : 0 RS-Number : J1843008 Data record length : 40 bytes Number of data records : 789
 Max filemap size : 789 bytes Data header size : 12504 bytes Free space in map : -43275 bytes (107373100 records) Status flag (not used) : 1

Record name: Unit: Data type: Divisor: Offset:

time	sec	float (4)	1	0
Psc1	ln	short (2)	1	0
T	K	short (2)	10	0
RH	%	short (2)	1	0
v	m/s	short (2)	-100	0
u	m/s	short (2)	-100	0
Height	m	short (2)	1	30000
P	hPa	short (2)	10	0
TD	K	short (2)	10	0
MR	g/kg	short (2)	100	0
DD	dgr	short (2)	1	0
FF	m/s	short (2)	10	0
AZ	dgr	short (2)	1	0
Range	m	short (2)	0.01	0
Lon	dgr	short (2)	100	0
Lat	dgr	short (2)	100	0
SpuKey	bitfield	unsigned short (2)	1	0
UsrKey	bitfield	unsigned short (2)	1	0
RadarH	m	short (2)	1	30000

```

In [1]: import os
import glob
import numpy as np
import pandas
from collections import defaultdict

In [2]: %matplotlib inline
import matplotlib.pyplot as plt

In [3]: from metpy.units import units
from metpy.calc import dewpoint_rh, get_wind_components, get_wind_dir, get_wind_speed, mixing_ratio, saturation_vapor_pressure
# from scipy.constants import K2C
from metpy.plots import SkewT, Hodograph

In [4]: tsv_dtype = [('time', 'f4'), ('Psc1', 'f4'),
                    ('T', 'f4'), ('RH', 'f4'),
                    ('v', 'f4'), ('u', 'f4'),
                    ('Height', 'f4'), ('P', 'f4'),
                    ('TD', 'f4'), ('MR', 'f4'),
                    ('wdir', 'f4'), ('wspd', 'f4'),
                    ('AZ', 'f4'), ('Range', 'f4'),
                    ('Lon', 'f4'), ('Lat', 'f4'),
                    ('SpuKey', 'f4'), ('UsrKey', 'f4'),
                    ('RadarH', 'f4'),
                    ]

def read_tsv(filename, skip=0):
    data = np.loadtxt(filename, dtype=tsv_dtype, skiprows=skip)
    return data

In [5]: header_template = """# VORTEX-SE TTU Radiosonde Data
# %Y-%m-%d, %H%M UTC, {0}
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb),
temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
"""

from datetime import datetime, timedelta
import os
class SoundingPostProcessor(object):
    def __init__(self, filename, dateparser='TTUBOLT_%y%m%d_%H%M%S.sounding.tsv',
                 start_latlon=None, location='Unknown Location'):
        """ Sounding post-processing helper class.

        Arguments:
        *filename* path to a Vaisala RS-92 .tsv file on disk
        *dateparser* used by strp

        Filtered data are available from
        self.T, self.p, self.RH, self.Td, self.uv

        To filter data, set a key in self.filters that matches one of
        the filtered data attributes listed above. Matching values will be set to
        NaN when retrieved through the filtered data attributes.

        Helper functions for visualizing data:
        -----
        plot_hodo: plots hodograph; returns figure instance
        plot_skewt: plots Skew-T; returns figure instance
        print_raw_data: returns a pandas dataframe. Can be sliced by passing start, stop, step.

        """
        #import appropriate .tsv for plotting, downloaded directly from sounding laptop
        self.launch = datetime.strptime(os.path.split(filename)[-1], dateparser)
        self.location = location
        print self._file_header()
        # print("Launch at {0}".format(self.launch))
        self.filename = filename
        self.data=read_tsv(filename, skip=40)
        self.filters = defaultdict(lambda:np.zeros(self.data.shape, dtype=bool))
        self.start_latlon = start_latlon
        # pathparts = os.path.split(filename)

```

```

def _file_header(self):
    header_withlocation = header_template.format(self.location)
    header = self.launch.strftime(header_withlocation)
    return header

@property
def utctime(self):
    """UTC time to the nearest second"""
    tsec = self.data['time']
    tutc = [self.launch + timedelta(0,int(tseci)) for tseci in tsec]
    tutcout = pandas.DataFrame(pandas.to_datetime(tutc), columns=('time',))
    tutcout.set_index({'time'},inplace=True)
    return tutcout

@property
def height(self):
    "height in meters"
    filt = self.filters['height']
    z = self.data['Height'] * units.meter
    filt |= ((z < 0*units.meter) | (z > 30*units.kilometer))
    z[filt] = np.nan
    return z

@property
def p(self):
    " pressure in millibars "
    filt = self.filters['p']
    Pmb = self.data['P']*units.millibar
    Pmb[filt] = np.nan
    return Pmb

@property
def T(self):
    "temperature in deg C"
    filt = self.filters['T']
    TC = (self.data['T']*units.kelvin).to(units.celsius)
    TC = K2C(self.data['T'])

    TC[filt] = np.nan
    return TC

@property
def RH(self):
    filt = self.filters['RH']
    RHpct = self.data['RH']*units.percent #/100.0
    RHpct[filt] = np.nan
    return RHpct

@property
def Td(self):
    "dewpoint temperature in deg c"
    filt = self.filters['Td']
    TdC = (self.data['TD']*units.kelvin).to(units.celsius)
    TdC = K2C(self.data['TD']) #dewpoint_rh(T,RH)
    TdC[filt] = np.nan
    return TdC

@property
def mixing_ratio(self):
    return mixing_ratio(saturation_vapor_pressure(self.Td), self.p)

@property
def uv(self):
    "wind speed and direction in knots"
    filt = self.filters['uv']
    u, v = get_wind_components(self.data['wspd'], self.data['wdir']*units.deg)
    u, v = (u*units('m/s')).to(units.knot), (v*units('m/s')).to(units.knot)

    spd = np.sqrt(u*u+v*v)
    wind_mask = spd > 200*units.knot
    filt |= wind_mask

    u[filt] = np.nan
    v[filt] = np.nan
    return (u,v)

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@property
def azran(self):
    filt = self.filters['azran']
    az, ran = self.data['AZ']*units.degree, self.data['Range']*units.degree
    filt |= (az < 0.0) | (az > 360.0)
    filt |= (ran.astype(int) == -32768)

    az[filt] = np.nan
    ran[filt] = np.nan
    return (az,ran)

@property
def latlon(self):
    filt = self.filters['latlon']
    lat, lon = self.data['Lat']*units.degree, self.data['Lon']*units.degree

    if self.start_latlon is not None:
        start_lat, start_lon = self.start_latlon
        if ((np.abs(np.median(lat[0:10]) - start_lat) > 0.01) |
            (np.abs(np.median(lon[0:10]) - start_lon) > 0.01)):
            #
            print("Recalculating lat, lon data from az, range data because starting location
differs substantially from initial location in data file.")
            lat, lon = self.recalculate_latlon()

    filt |= (np.abs(lat) > 90.0) | (np.abs(lon) > 180.0)
    lat[filt] = np.nan
    lon[filt] = np.nan

    return (lat, lon)

def recalculate_latlon(self):
    """ Using the starting location specified in self.start_latlon, use azimuth and range
to calculate a new track.
    """

    ctr_lat, ctr_lon = self.start_latlon
    from lmatools.coordinateSystems import MapProjection, GeographicSystem
    mapSys = MapProjection(projection='aeqd', ctrLat=ctr_lat, ctrLon=ctr_lon, lat_ts=ctr_lat,
lon_0=ctr_lon, lat_0=ctr_lat, lat_1=ctr_lat, ellipse='WGS84', dat
um='WGS84')
    geoSys = GeographicSystem()

    az, ran = self.azran #np.radians(self.data['AZ']), self.data['Range']
    az = np.radians(az)
    lon, lat, alt = geoSys.fromECEF(*mapSys.toECEF(ran*np.sin(az), ran*np.cos(az), np.zeros_1
ike(az)))
    return lat, lon

def plot_track(self):
    traj = plt.figure(figsize=(12,6))
    ax = traj.add_subplot(121)
    lat,lon = self.latlon
    ax.plot(lon, lat)
    ax.plot(self.start_latlon[1], self.start_latlon[0], 'ro')
    ax.set_title(self.filename)
    ax.set_xlabel('Longitude (deg)')
    ax.set_ylabel('Latitude (deg)')

    axz = traj.add_subplot(122)
    axz.plot_date(self.utctime.index, self.height.to('kilometer'), '-')
    axz.set_title(self.filename)
    axz.set_xlabel('Time (UTC)')
    axz.set_ylabel('Altitude (km)')
    return traj

def plot_hodo(self):
    """plot the hodograph"""
    hodo = plt.figure(figsize=(8,8))
    hodo_ax = hodo.add_subplot(111)
    h = Hodograph(hodo_ax, component_range=100.)
    h.add_grid(increment=20)

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#         hodo_mask = (self.p > 200*units.millibar) &(self.p<891.0002441*units.millibar)
u, v = self.uv
h.plot(u,v)
#         h.plot(u[hodo_mask],v[hodo_mask])

hodo_ax.axis((-40,100, -40,100))
hodo_ax.set_xlabel('u wind (kt)')
hodo_ax.set_ylabel('v wind (kt)')
#change title depending on location and time of launch
title = self.filename
hodo_ax.set_title(title)
return hodo

def plot_skewt(self, barbs_every=50):
    """plot the skew-t"""
    skewt = SkewT(plt.figure(figsize=(12,12)))
    skewt.plot(self.p, self.T, 'b')
    skewt.plot(self.p, self.Td, 'g')
    barb_mask = slice(None,None,barbs_every)
    u, v = self.uv
    skewt.plot_barbs(self.p[barb_mask],u[barb_mask],v[barb_mask])
    skewt.plot_dry_adiabats()
    skewt.plot_moist_adiabats()
    skewt.plot_mixing_lines()
    #change title depending on location and time of launch
    title = self.filename #'10 July 2015, 2300 UTC - 3 W Shallowater'
    skewt.ax.set_title(title)
    skewt.ax.axis((-40, 40, 1000, 100))
    skewt.ax.set_xlabel(u'Temperature (°C)')
    skewt.ax.set_ylabel(u'Pressure (mb)')
    return skewt

def print_raw_data(self, start=None, end=None, step=1):
    sl = slice(start, end, step)
    d = self.data
    return pandas.DataFrame(d[sl])

def print_filtered_data(self, start=None, end=None, step=1):
    sl = slice(start, end, step)
    d = self.assemble_filtered_data()
    return d[sl]

def assemble_filtered_data(self):
    """ Assemble filtered data into a pandas DataFrame """
    #latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure
    (mb), temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

    lat, lon = self.latlon
    tutc = self.utctime
    z = self.height.to('meters')
    z -= np.nanmin(z)*units.meters
    p = self.p.to('millibars')
    T = self.T.to('celsius')
    mixr = self.mixing_ratio.to('g/kg')
    u, v = self.uv
    wdir, wspd= get_wind_dir(u, v).to(units.degree), get_wind_speed(u, v).to('m/s')

    dataout = pandas.DataFrame({
        'lat':lat, 'lon':lon, 'time':tutc.index,
        'height':z, 'p':p, 'T':T, 'mixr':mixr, 'wspd':wspd, 'wdir':wdir
    })
    return dataout

def save_filtered(self, filename):
    """ Apply filters and save a new CSV-formatted data file to filename"""
    dataout = self.assemble_filtered_data()
    header_data = self._file_header()
    outfile = open(filename, 'w')
    outfile.write(header_data)
    dataout.to_csv(outfile, date_format='%H%M%S',
        columns=('lat', 'lon', 'time',
            'height', 'p', 'T', 'mixr', 'wspd', 'wdir'),
        header=False, #self._file_header(),

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        index=False,
        float_format=' %10.6f')
outfile.close()

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In [6]: orig_paths = glob.glob('../TTUBOLT_17*.tsv')
for pth in orig_paths: print(" "+pth+"")

'../TTUBOLT_170217_202610.sounding.tsv'
'../TTUBOLT_170301_192724.sounding.tsv'
'../TTUBOLT_170301_192724_fixsfc.sounding.tsv'
'../TTUBOLT_170301_192724_test.sounding.tsv'
'../TTUBOLT_17030_214804.sounding.tsv'
'../TTUBOLT_17031_000203.sounding.tsv'
'../TTUBOLT_170325_160533.sounding.tsv'
'../TTUBOLT_170325_180010.sounding.tsv'
'../TTUBOLT_170326_195145.sounding.tsv'
'../TTUBOLT_170327_150136.sounding.tsv'
'../TTUBOLT_170327_205855.sounding.tsv'
'../TTUBOLT_170328_012422.sounding.tsv'
'../TTUBOLT_170330_160556.sounding.tsv'
'../TTUBOLT_170330_160556.sounding_wrong_fmt.tsv'
'../TTUBOLT_170330_181325.sounding.tsv'
'../TTUBOLT_170330_214804.sounding.tsv'
'../TTUBOLT_170331_000203.sounding.tsv'
'../TTUBOLT_170403_200116.sounding.tsv'
'../TTUBOLT_170405_112420.sounding.tsv'
'../TTUBOLT_170405_172306.sounding.tsv'
'../TTUBOLT_170405_195620.sounding.tsv'
'../TTUBOLT_170405_231923.sounding.tsv'
'../TTUBOLT_170428_180212.sounding.tsv'
'../TTUBOLT_170430_150020.sounding.tsv'
'../TTUBOLT_170430_162941.sounding.tsv'
'../TTUBOLT_170430_181742.sounding.tsv'
'../TTUBOLT_170501_000117.sounding.tsv'
'../TTUBOLT_170501_030240.sounding.tsv'

```

```

In [7]: febl7_20 = '../TTUBOLT_170217_202610.sounding.tsv' # at TTU
mar01_19 = '../TTUBOLT_170301_192724.sounding.tsv' # 0B
# '../TTUBOLT_170301_192724_fixsfc.sounding.tsv'
# '../TTUBOLT_170301_192724_test.sounding.tsv'
# '../TTUBOLT_17030_214804.sounding.tsv' # 0330 below
# '../TTUBOLT_17031_000203.sounding.tsv' # 0331 below
mar25_16 = '../TTUBOLT_170325_160533.sounding.tsv' # 1A
mar25_18 = '../TTUBOLT_170325_180010.sounding.tsv' # 1A
mar26_20 = '../TTUBOLT_170326_195145.sounding.tsv' # intercomparison
mar27_15 = '../TTUBOLT_170327_150136.sounding.tsv' # 1B
mar27_21 = '../TTUBOLT_170327_205855.sounding.tsv' # 1B
mar28_01 = '../TTUBOLT_170328_012422.sounding.tsv' # 1B
mar30_16 = '../TTUBOLT_170330_160556.sounding.tsv' # 2
mar30_18 = '../TTUBOLT_170330_181325.sounding.tsv' # 2
mar30_22 = '../TTUBOLT_170330_214804.sounding.tsv' # 2
mar31_00 = '../TTUBOLT_170331_000203.sounding.tsv' # 2
apr03_20 = '../TTUBOLT_170403_200116.sounding.tsv' # 3a Lunch-n-launch
apr05_11 = '../TTUBOLT_170405_112420.sounding.tsv' # 3b
apr05_17 = '../TTUBOLT_170405_172306.sounding.tsv' # 3b
apr05_20 = '../TTUBOLT_170405_195620.sounding.tsv' # 3b
apr05_23 = '../TTUBOLT_170405_231923.sounding.tsv' # 3b
# no soundings for 4a.
apr28_18 = '../TTUBOLT_170428_180212.sounding.tsv' # 4b
apr30_15 = '../TTUBOLT_170430_150020.sounding.tsv' # 5
apr30_16 = '../TTUBOLT_170430_162941.sounding.tsv' # 5
apr30_18 = '../TTUBOLT_170430_181742.sounding.tsv' # 5
may01_00 = '../TTUBOLT_170501_000117.sounding.tsv' # 5
may01_03 = '../TTUBOLT_170501_030240.sounding.tsv' # 5

```

March 1, 2017

Sounding at Cullman, AL Exit 130, a bit NE

- -34.2147, -86.8780, 1012 feet elevation
- Launch at 0127 CST, 1927 UTC

```
In [8]: snd = SoundingPostProcessor(mar01_19, start_latlon=(34.2147, -86.8780), location="Cullman, AL")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

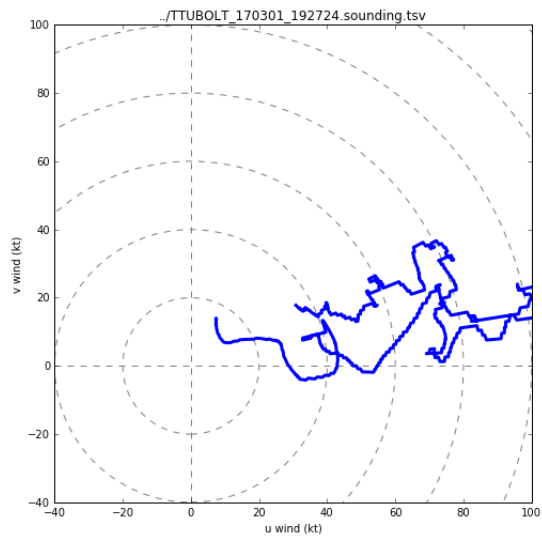
T_filt = snd.filters['T']
T_filt[range(0,64)] = True
snd.filters['T'] = T_filt
snd.filters['Td'] = T_filt
snd.filters['p'] = T_filt
snd.filters['uv'] = T_filt
snd.filters['height'] = T_filt

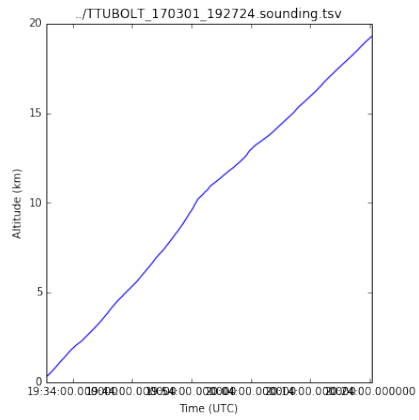
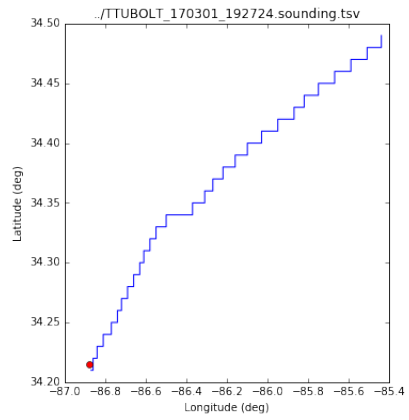
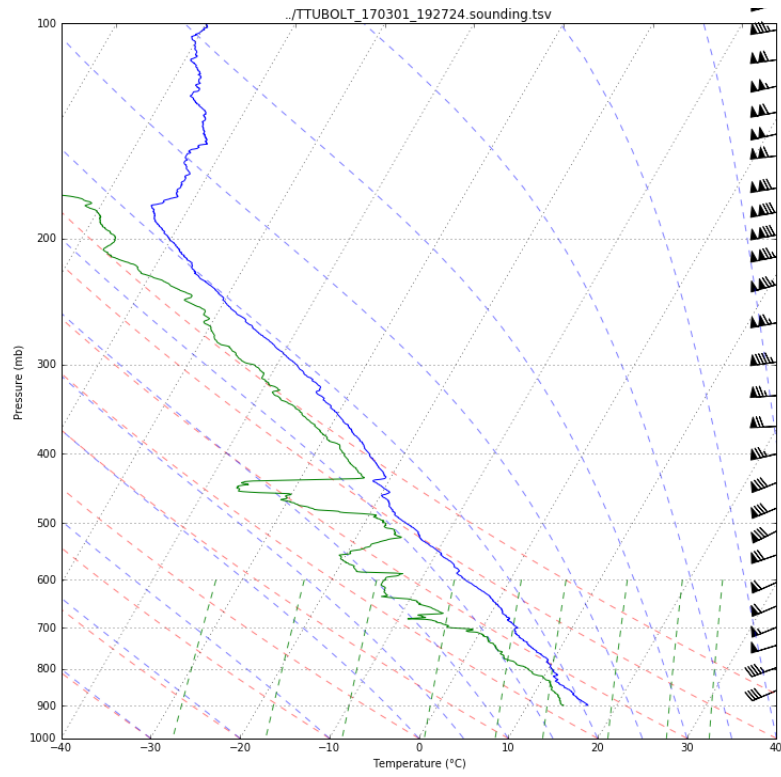
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

data = snd.print_filtered_data(50, 75)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2017-03-01, 1927 UTC, Cullman, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
, temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
```





March 25, 2017 - IOP1A

DARTS at Moulton, AL Rec Center Pick up 1927 UTC, solar panel and batteries blown off.

Sounding at Moulton Rec Center

- 34.481077, -87.305841, elevation
- Launch at 1605 UTC

Sounding S of Moulton AL on AL 157

- 34.464425, -87.256560, 746 feet elevation
- Launch at 1800 UTC

```
In [9]: snd = SoundingPostProcessor(mar25_16, start_latlon=(34.481, -86.306), location="Moulton, AL")

T_filt = snd.filters['T']
T_filt[0,1] = True
snd.filters['T'] = T_filt
snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

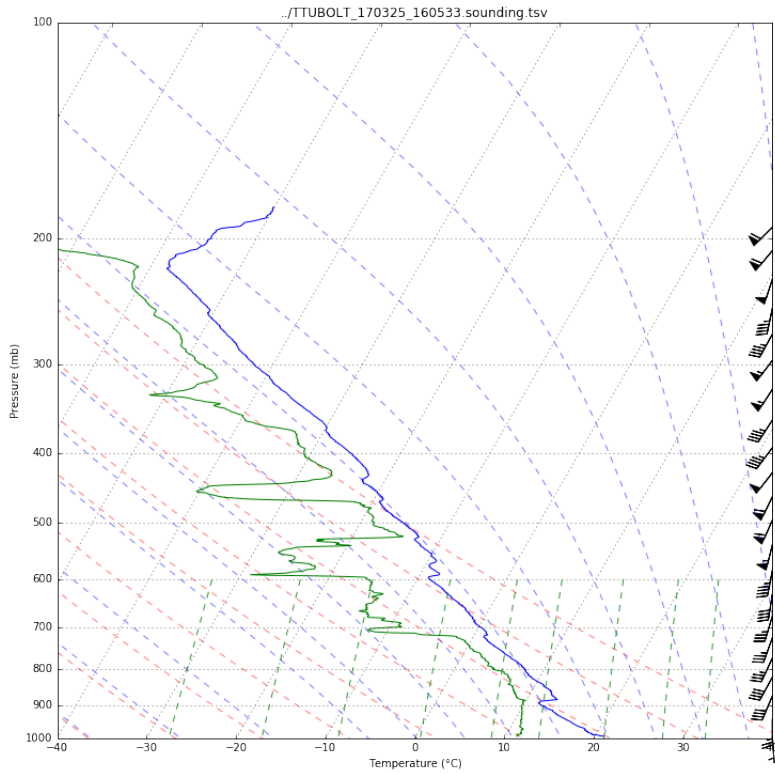
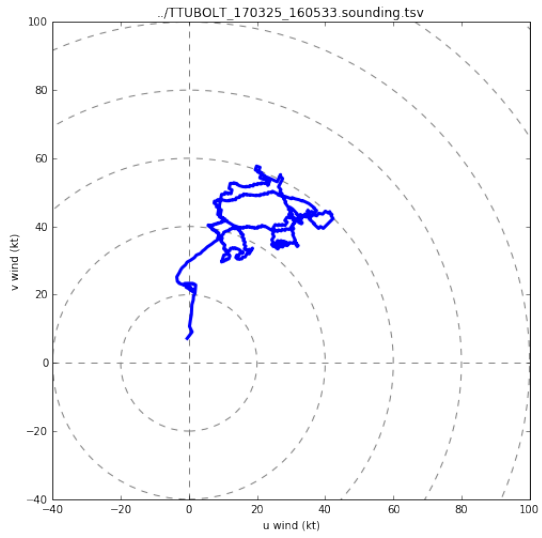
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

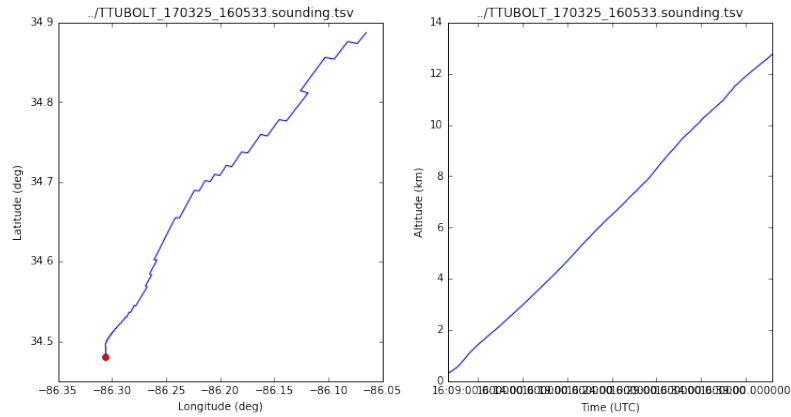
# data = snd.print_filtered_data(50, 75)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2017-03-25, 1605 UTC, Moulton, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# , temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





```
In [10]: snd = SoundingPostProcessor(mar25_18, start_latlon=(34.464425, -87.256560), location="SE of Moulton, AL")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

T_filt = snd.filters['T']
# T_filt[2:] = True
snd.filters['T'] = T_filt
snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

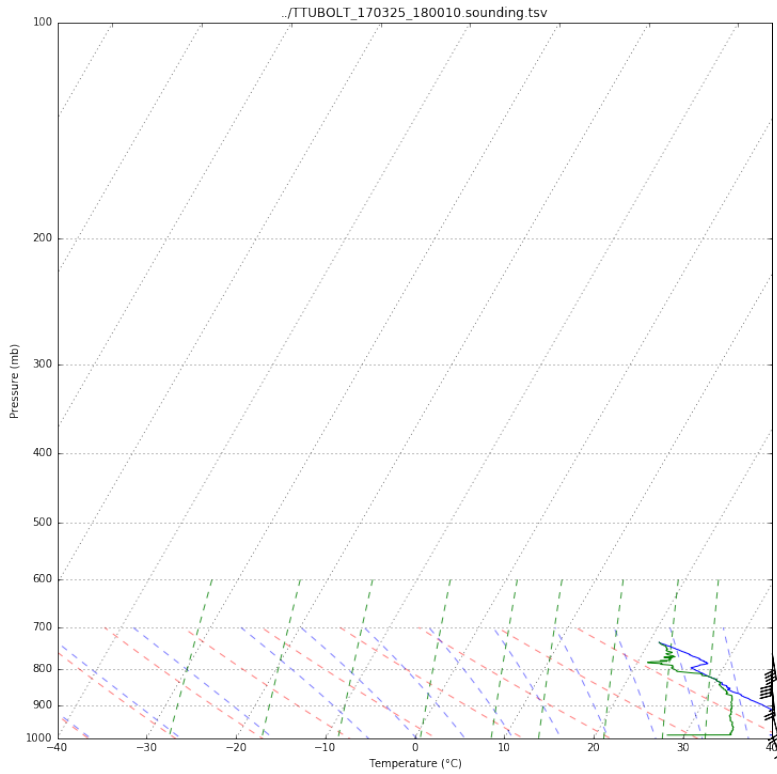
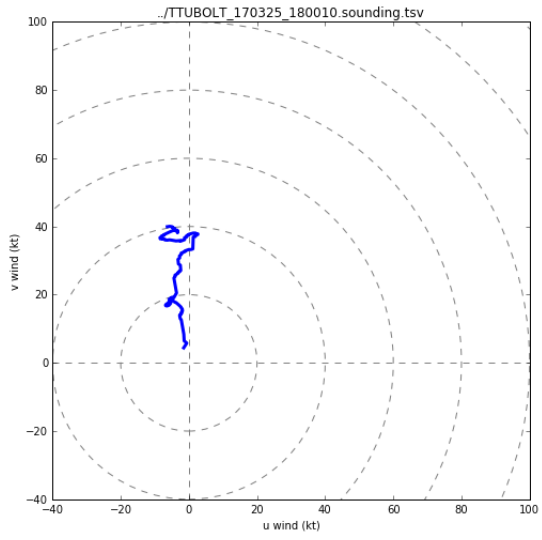
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

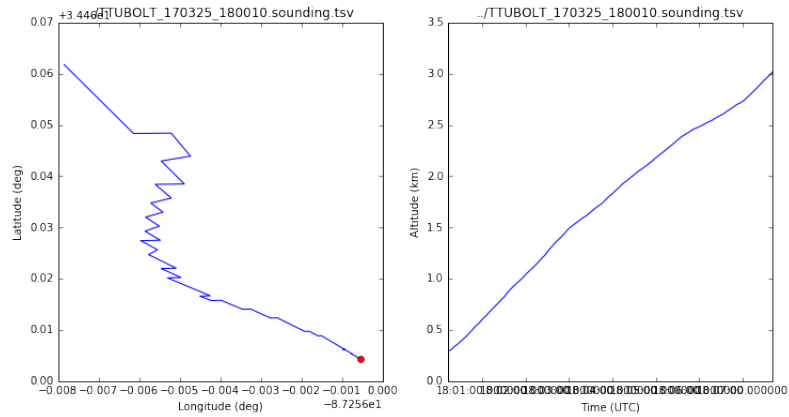
# data = snd.print_filtered_data(0, 10)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%M2_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2017-03-25, 1800 UTC, SE of Moulton, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# , temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





March 26, 2017 - intercomparison test flight

Launch with multiple radiosondes from different manufacturers on a single balloon.

Sounding at UAH SWIRLL

- 34.724636, -86.646355

```
In [11]: snd = SoundingPostProcessor(mar26_20, start_latlon=(34.724636, -86.646355), location="UAH SWIRLL,
Huntsville, AL")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

# T_filt = snd.filters['T']
# T_filt(range(0,64)) = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

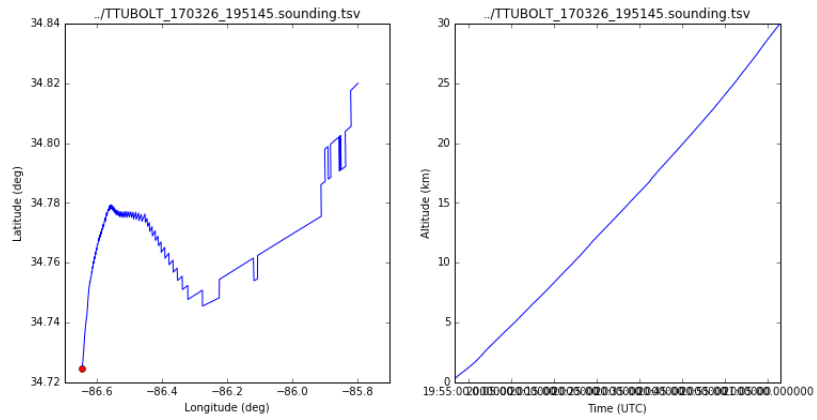
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

data = snd.print_filtered_data(50, 75)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").repl
ace(",","")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2017-03-26, 1951 UTC, UAH SWIRLL, Huntsville, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# , temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```

March 27-28, 2017 - IOP 1B

LMA at Muscle Shoals Airport

- 34.7403, -87.6119, 550 feet elevation
- Deployed at 1550 UTC

Sounding at Courtland Airport

- 34.6619, -87.3378
- Launch at 1501 UTC

Sounding at Moulton

- 34.4961 -87.2807
- Launch at 2058 UTC

Sounding at Killen

- 34.8554, -87.5422
- Launch at 0124 UTC

```
In [12]: snd = SoundingPostProcessor(mar27_15, start_latlon=(34.6619, -87.3378), location="Courtland, AL A
airport")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

# T_filt = snd.filters['T']
# T_filt[range(0,64)] = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

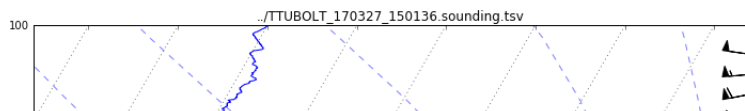
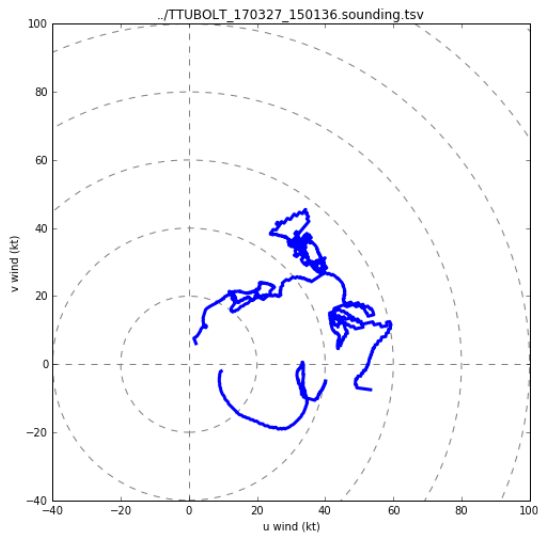
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

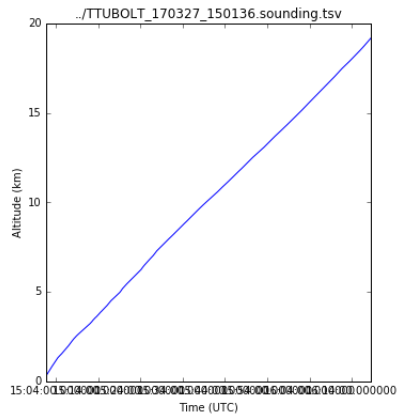
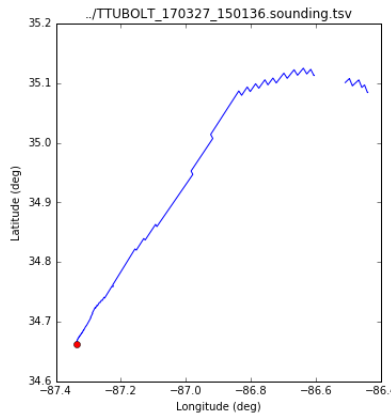
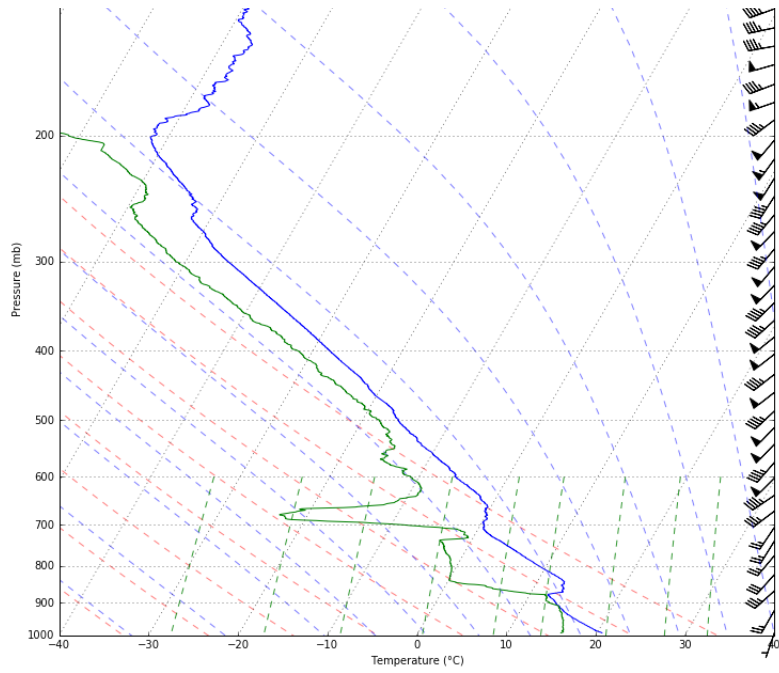
data = snd.print_filtered_data(50, 75)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").rep
lace(", ", "")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2017-03-27, 1501 UTC, Courtland, AL Airport
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
, temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
```

```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





```
In [13]: snd = SoundingPostProcessor(mar27_21, start_latlon=(34.4961, -87.2807), location="Moulton, AL")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

# T_filt = snd.filters['T']
# T_filt(range(0,64)) = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

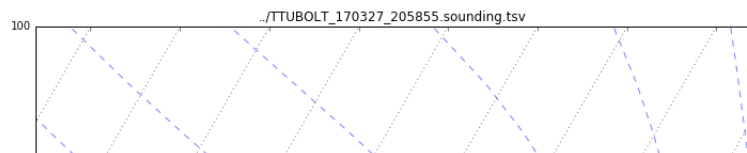
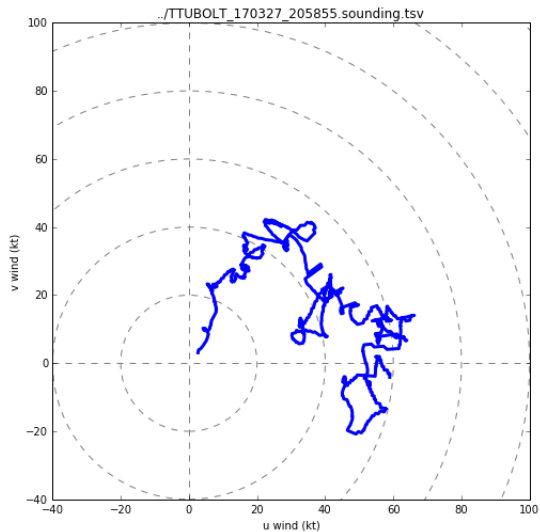
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

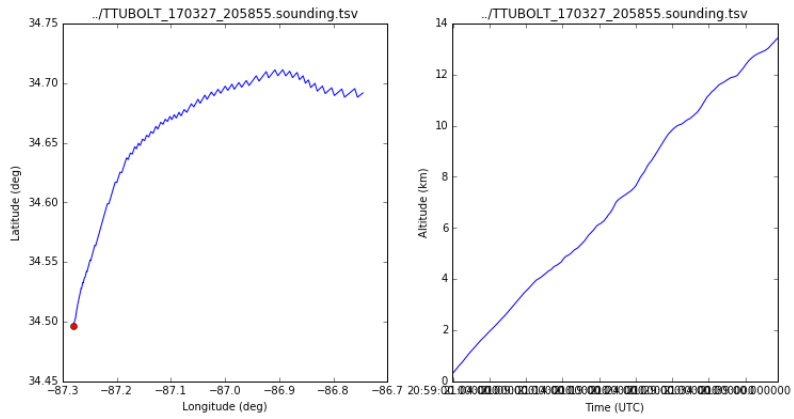
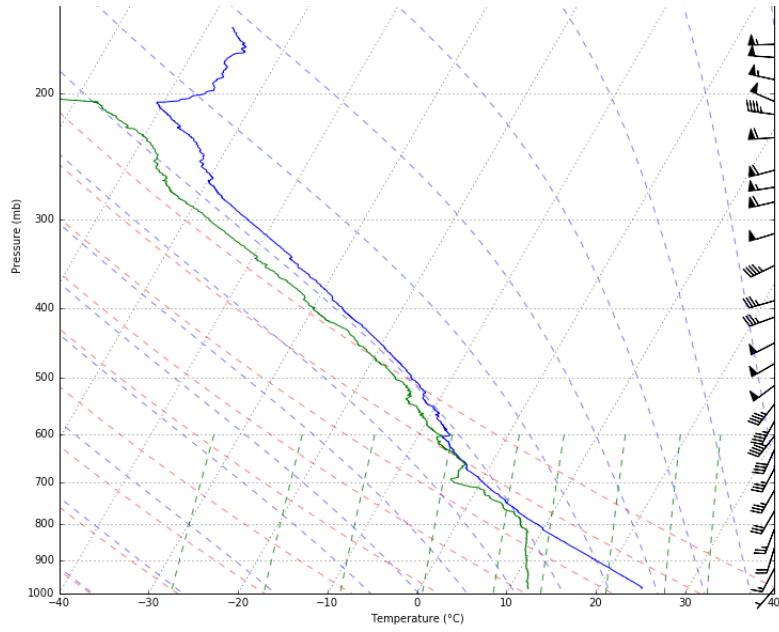
data = snd.print_filtered_data(50, 75)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2017-03-27, 2058 UTC, Moulton, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
```

```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





```
In [14]: snd = SoundingPostProcessor(mar28_01, start_latlon=(34.8554, -87.5422), location="Killen, AL")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

# T_filt = snd.filters['T']
# T_filt(range(0,64)) = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

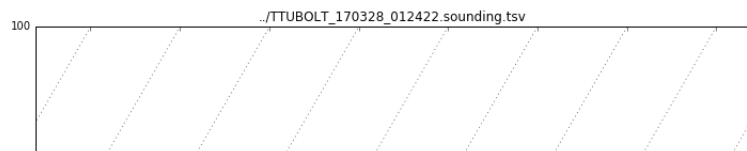
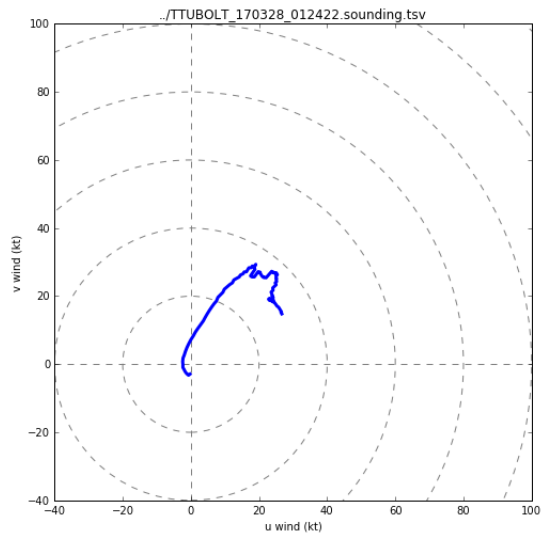
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

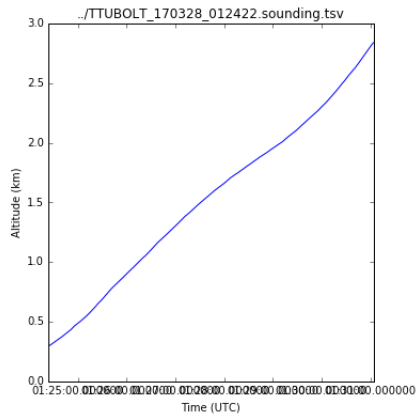
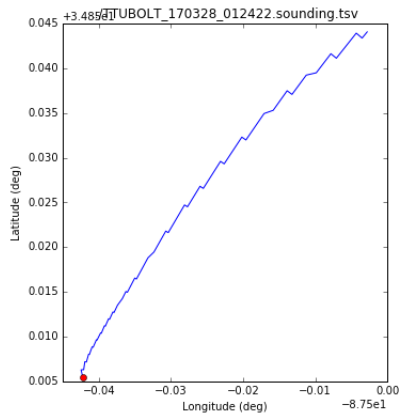
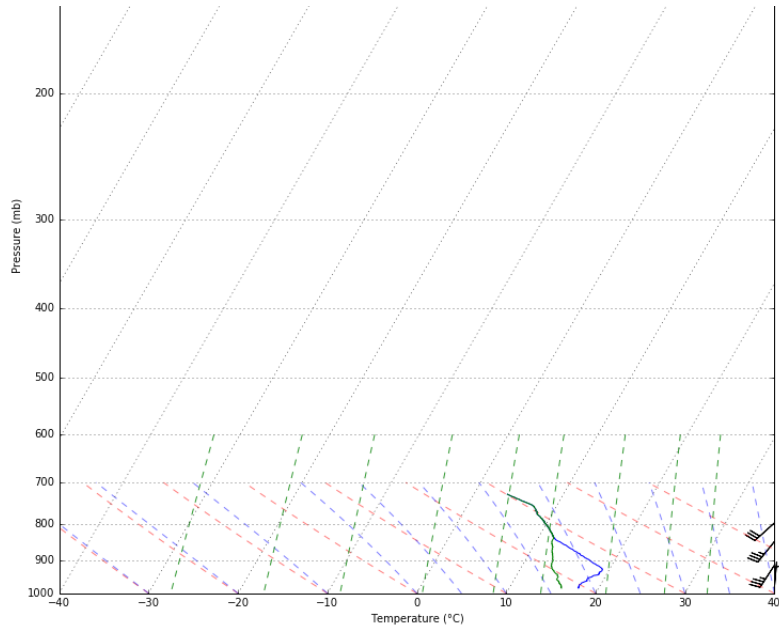
data = snd.print_filtered_data(50, 75)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2017-03-28, 0124 UTC, Killen, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
```

```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





In []:

March 30-31, 2017 - IOP 2

Sounding at UAH SWIRLL

- 34.724636, -86.646355
- Launch at
 - 1606 UTC
 - 1812 UTC
 - 2147 UTC
 - 0001 UTC

```
In [15]: snd = SoundingPostProcessor(mar30_16, start_latlon=(34.724636, -86.646355), location="UAH SWIRLL,
Huntsville, AL")
uv_filt = snd.filters['uv']
uv_filt[[0,1,2,3,4,5,6]] = True
snd.filters['uv'] = uv_filt

# T_filt = snd.filters['T']
# T_filt(range(0,64)) = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

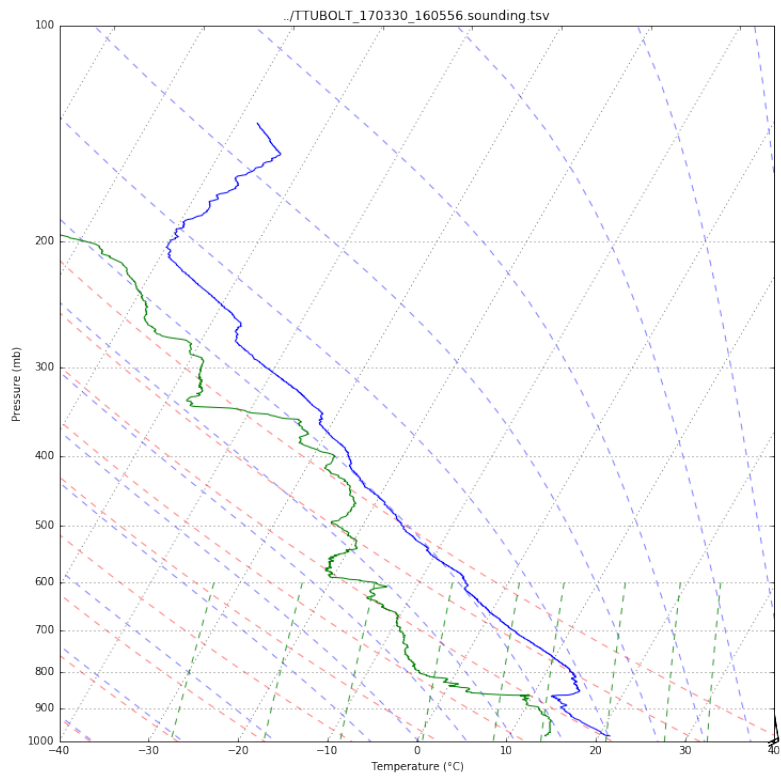
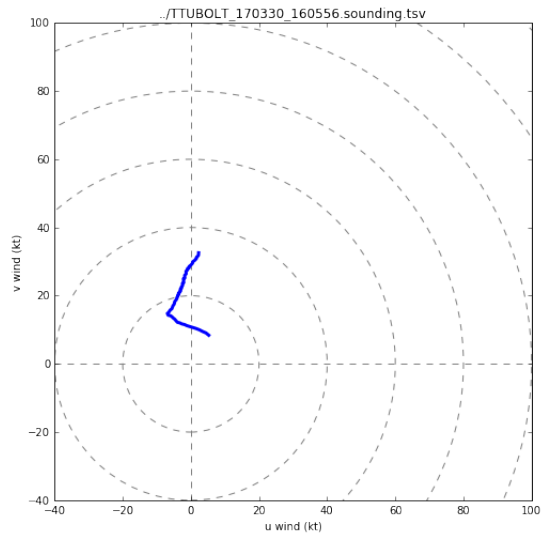
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

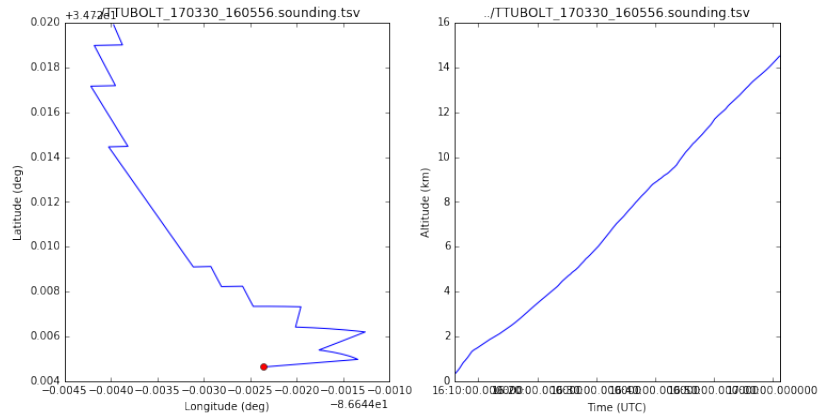
data = snd.print_filtered_data(0, 75)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").repl
lace(", ", "")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2017-03-30, 1605 UTC, UAH SWIRLL, Huntsville, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# , temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





```
In [16]: snd = SoundingPostProcessor(mar30_18, start_latlon=(34.724636, -86.646355), location="UAH SWIRLL,
Huntsville, AL")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

T_filt = snd.filters['T']
T_filt[[0,]] = True
snd.filters['T'] = T_filt
snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

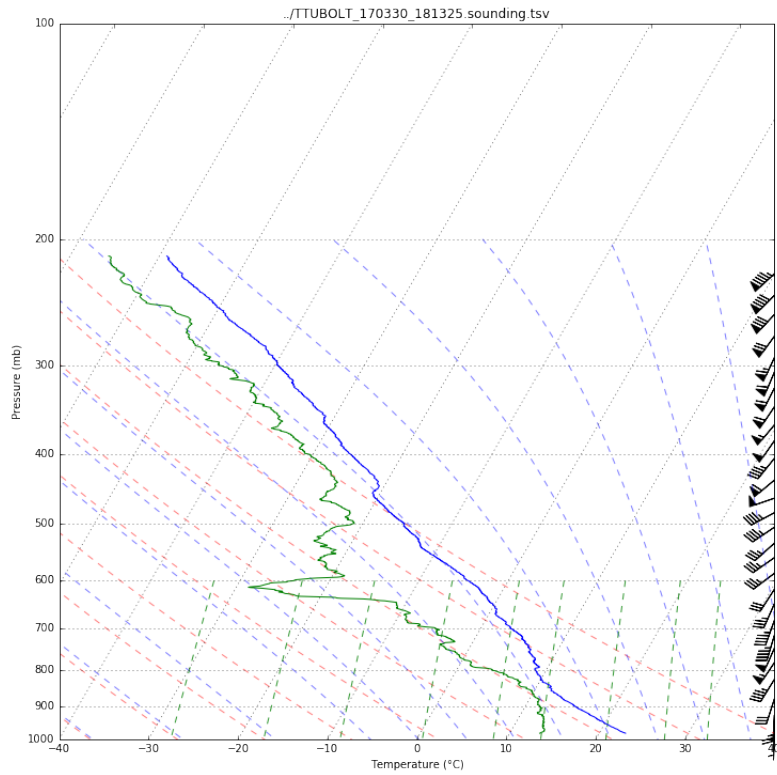
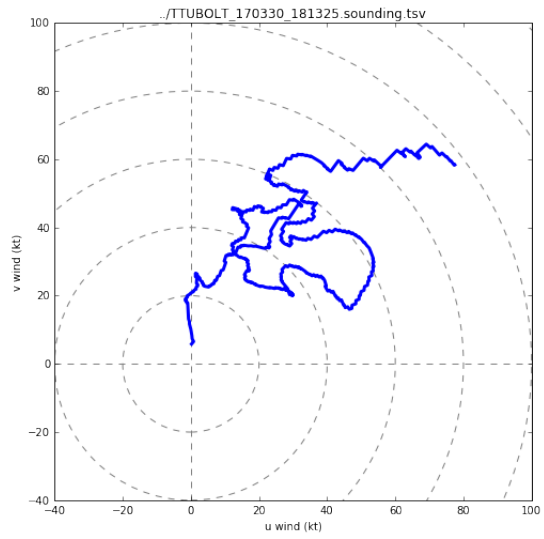
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

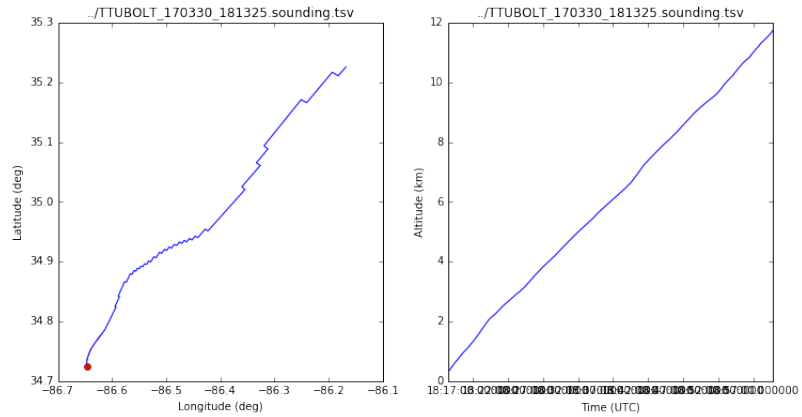
data = snd.print_filtered_data(50, 75)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").repl
ace(", ", "")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2017-03-30, 1813 UTC, UAH SWIRLL, Huntsville, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# , temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```



```
In [17]: snd = SoundingPostProcessor(mar30_22, start_latlon=(34.724636, -86.646355), location="UAH SWIRLL,
Huntsville, AL")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

# T_filt = snd.filters['T']
# T_filt(range(0,64)) = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

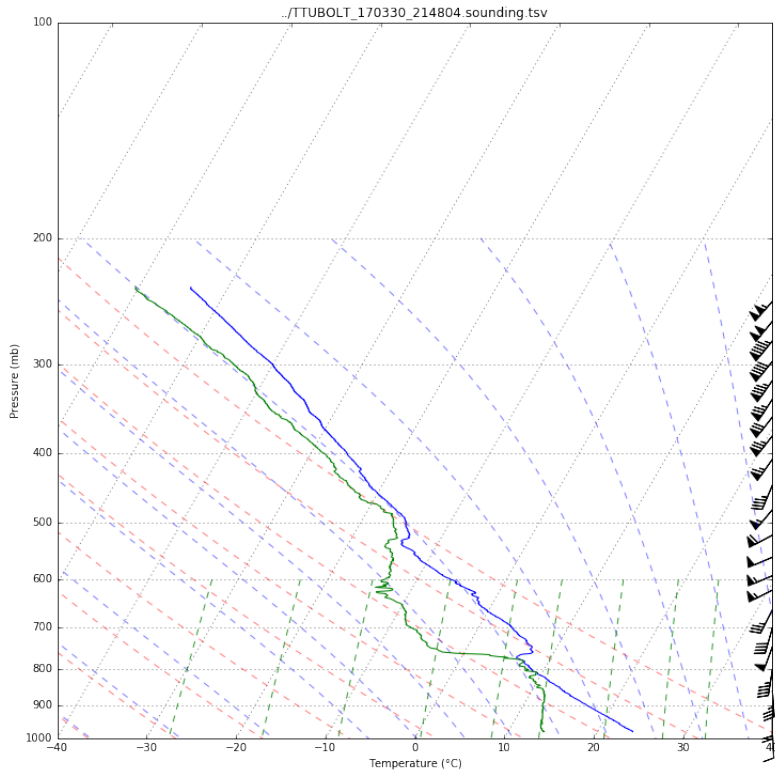
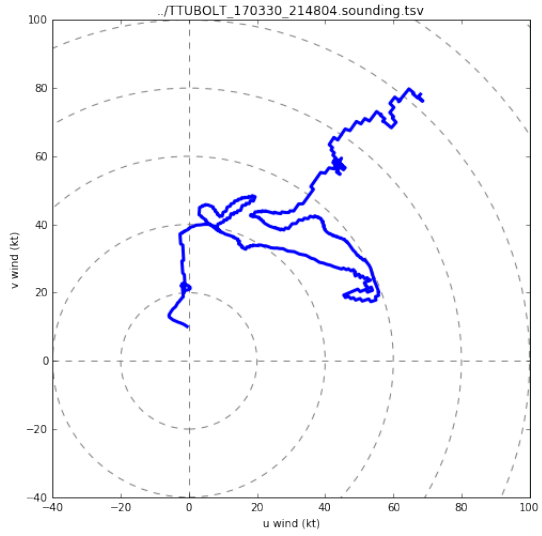
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

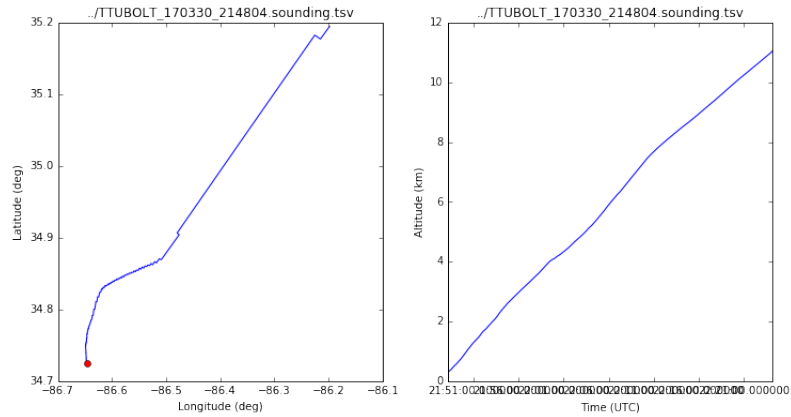
data = snd.print_filtered_data(50, 75)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%M2_TTU_{0}.txt".format(snd.location.replace(" ", "").repl
ace(",","")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2017-03-30, 2148 UTC, UAH SWIRLL, Huntsville, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
, temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





```
In [18]: snd = SoundingPostProcessor(mar31_00, start_latlon=(34.724636, -86.646355), location="UAH SWIRLL,
Huntsville, AL")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

# T_filt = snd.filters['T']
# T_filt(range(0,64)) = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

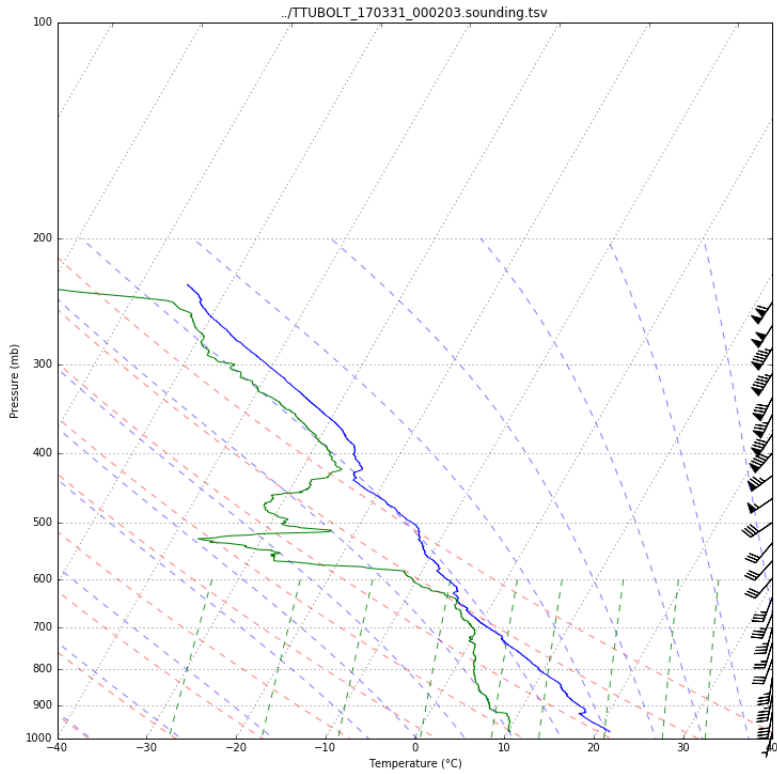
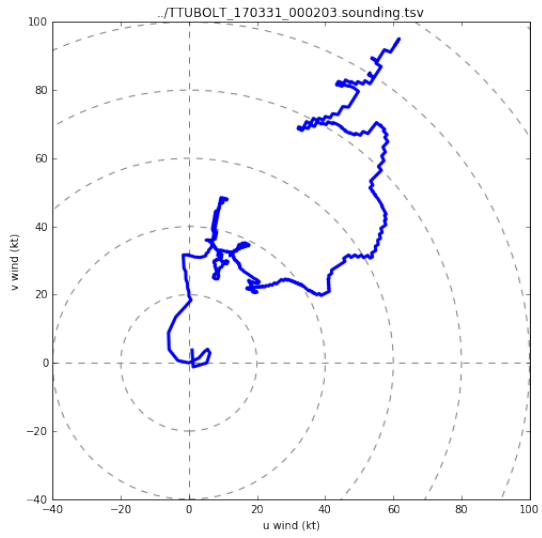
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

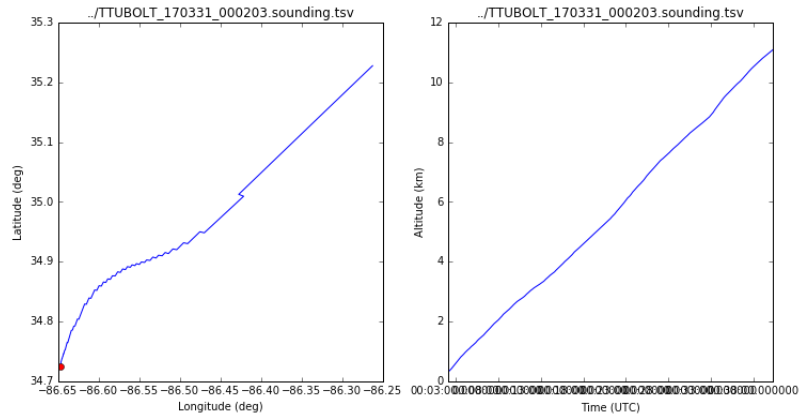
data = snd.print_filtered_data(50, 75)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").repl
ace(",","")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2017-03-31, 0002 UTC, UAH SWIRLL, Huntsville, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# , temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





In []:

April 3, 2017 - IOP 3a - Lunch 'n' Launch

Sounding at 2001 UTC

- 34.6924, -86.7835
- Launch at 1010 UTC
- Lost at 500 mb.

```
In [19]: snd = SoundingPostProcessor(apr03_20, start_latlon=(34.6924, -86.7835), location="Madison, AL")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

T_filt = snd.filters['Td']
T_filt[[0,]] = True
# snd.filters['T'] = T_filt
snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

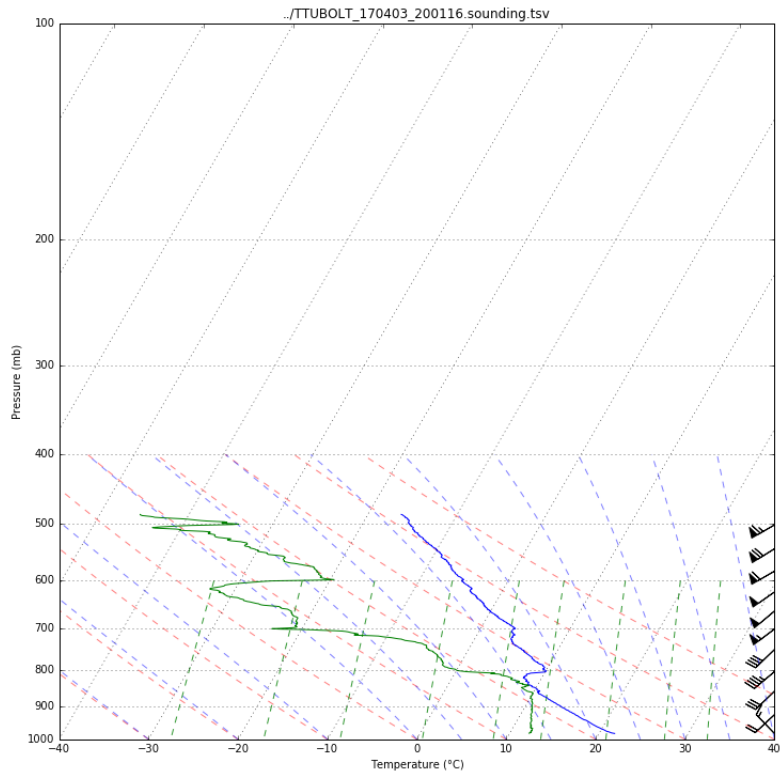
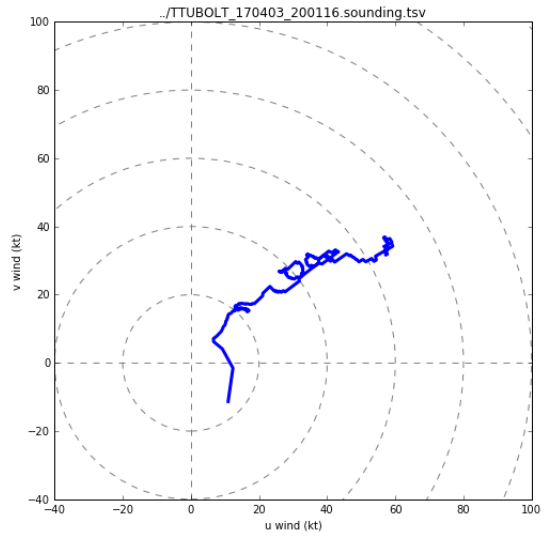
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

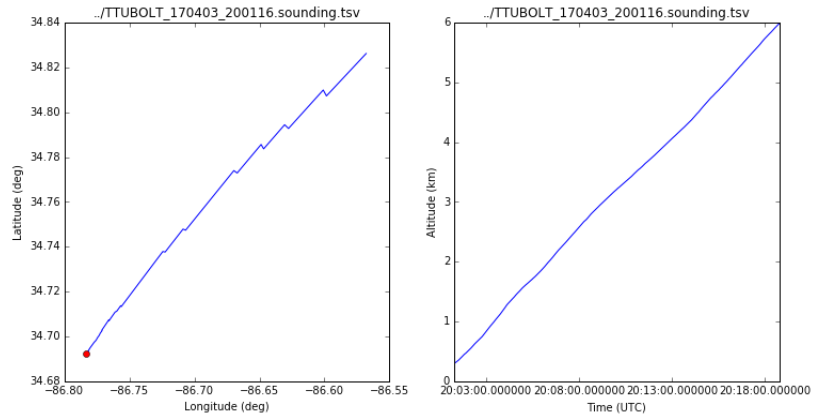
# data = snd.print_filtered_data(50, 75)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2017-04-03, 2001 UTC, Madison, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# , temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





April 5, 2017 - IOP 3b

DARTS at Rainsville, AL

- 34.511112, -85.8424 Deployed 1207 UTC

Sounding 1

- 34.4391, -85.7602
- Launch at 1124 UTC

Sounding 2

- 34.4864, -85.841
- Launch at 1722 UTC

Sounding 3

- 34.4864, -85.841
- Launch at 1956 UTC

Sounding 4

- 34.6908, -85.6657
- Launch at 2319 UTC


```
In [20]: snd = SoundingPostProcessor(apr05_11, start_latlon=(34.4391, -85.7602), location="Fort Payne, AL"
)
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

# Seems to have a very shallow cool surface layer.
# T_filt = snd.filters['T']
# T_filt[[0,1,2]] = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

data = snd.print_filtered_data(0, 10)
print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%M2_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2017-04-05, 1124 UTC, Fort Payne, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
, temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
```

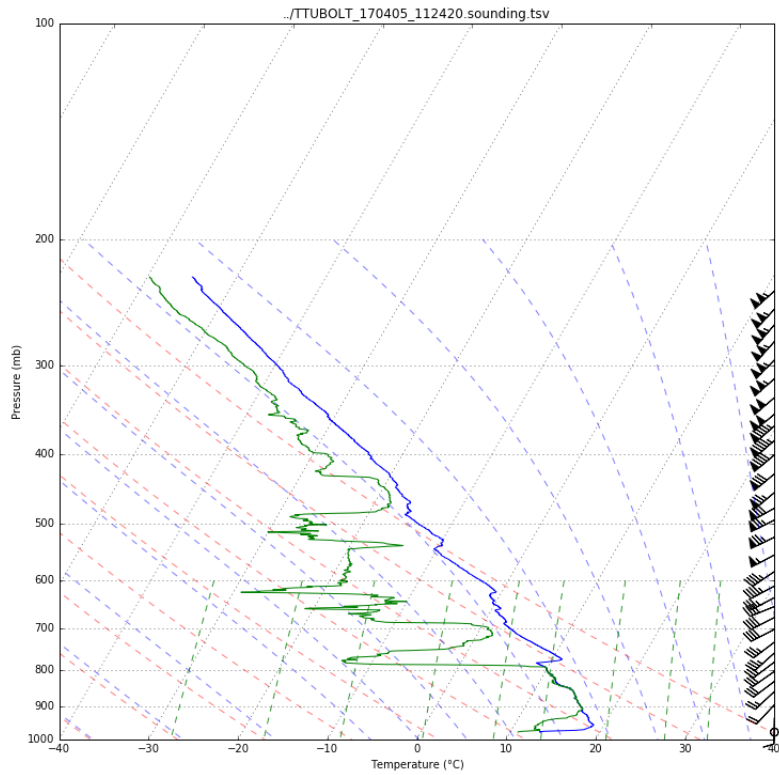
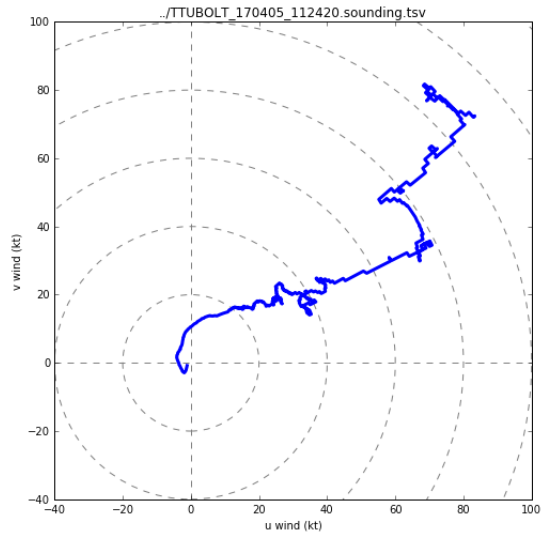
```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```

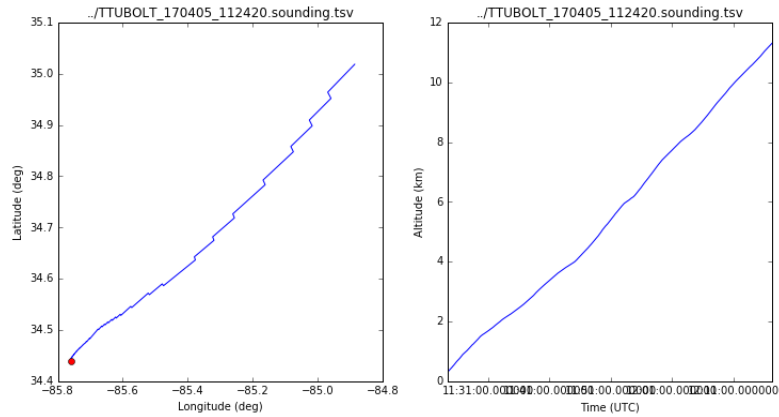
```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```

	T	height	lat	lon	mixr	p \
0	13.450012	0.0	34.4391	-85.7602	8.378037	977.200012
1	13.250000	7.0	34.4391	-85.7602	8.385865	976.299988
2	13.450012	16.0	34.4391	-85.7602	8.507556	975.400024
3	13.750000	24.0	34.4391	-85.7602	8.689039	974.500000
4	14.750000	32.0	34.4391	-85.7602	9.115829	973.500000
5	16.050018	40.0	34.4391	-85.7602	9.624240	972.599976
6	17.050018	49.0	34.4391	-85.7602	9.828192	971.599976
7	17.550018	57.0	34.4391	-85.7602	9.773404	970.599976
8	17.950012	65.0	34.4391	-85.7602	9.847754	969.700012
9	18.149994	73.0	34.4391	-85.7602	9.726000	968.900024

	time	wdir	wspd
0	2017-04-05 11:24:22	54.000000	0.7
1	2017-04-05 11:24:24	48.000000	0.8
2	2017-04-05 11:24:26	40.999996	1.0
3	2017-04-05 11:24:28	36.999996	1.1
4	2017-04-05 11:24:30	33.999996	1.3
5	2017-04-05 11:24:32	33.000000	1.4
6	2017-04-05 11:24:34	32.999996	1.6
7	2017-04-05 11:24:36	32.999996	1.7
8	2017-04-05 11:24:38	34.000000	1.8
9	2017-04-05 11:24:40	35.999996	1.8

```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





```
In [21]: snd = SoundingPostProcessor(apr05_17, start_latlon=(34.4864, -85.841), location="Rainsville, AL")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

# T_filt = snd.filters['T']
# T_filt[[0,]] = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

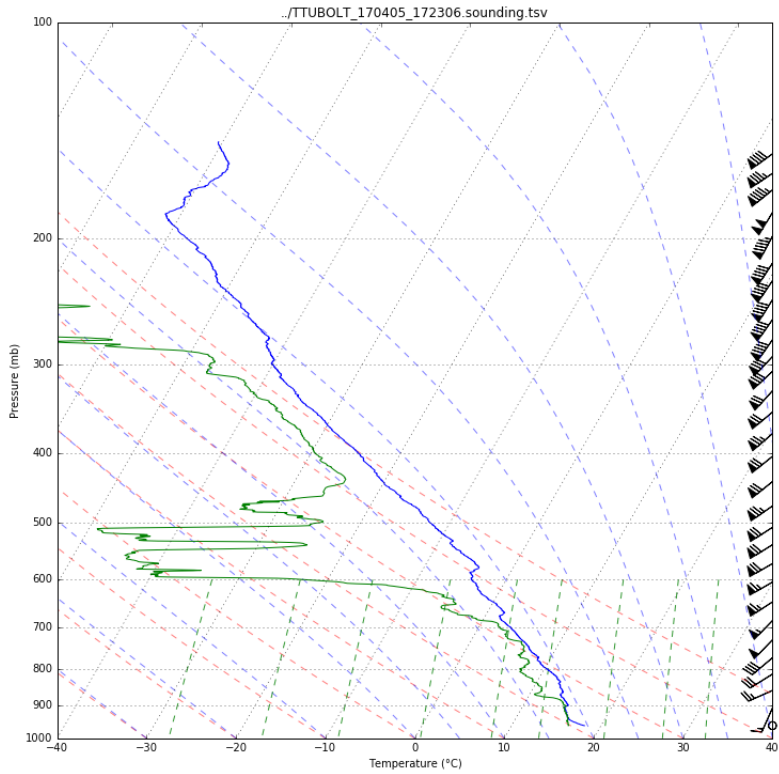
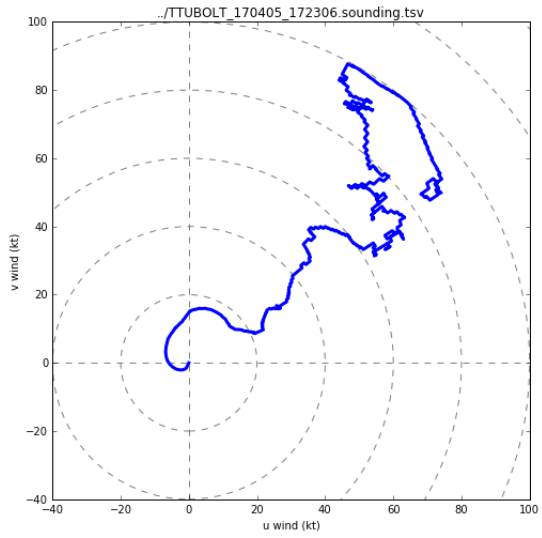
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

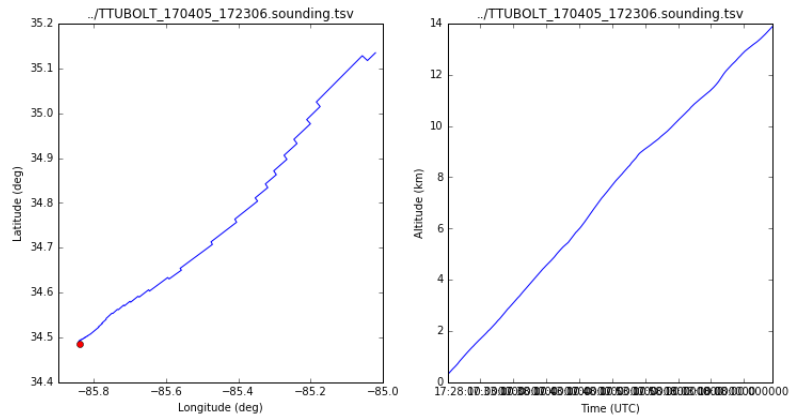
data = snd.print_filtered_data(0, 50)
# print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2017-04-05, 1723 UTC, Rainsville, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# , temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





```
In [22]: snd = SoundingPostProcessor(apr05_20, start_latlon=(34.4864, -85.841), location="Rainsville, AL")
uv_filt = snd.filters['uv']
uv_filt[[0,1,2]] = True
snd.filters['uv'] = uv_filt

# T_filt = snd.filters['Td']
# T_filt[[0,]] = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

data = snd.print_filtered_data(0, 10)
print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)
```

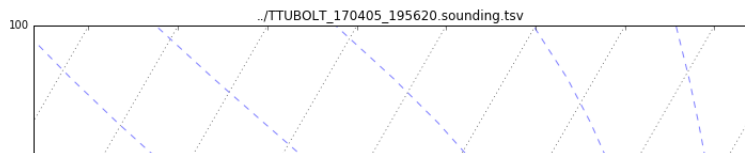
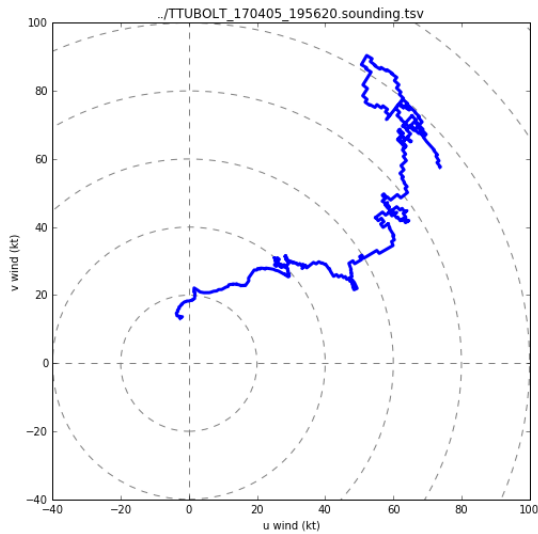
```

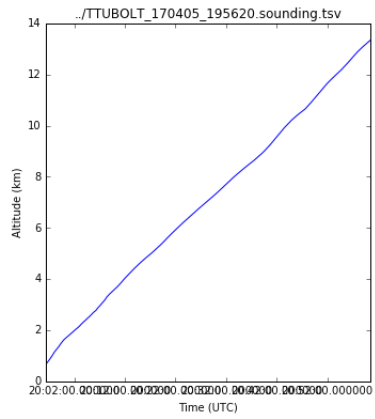
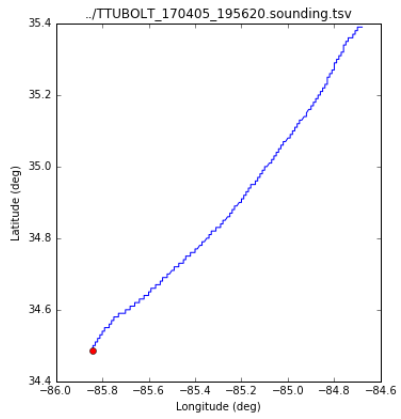
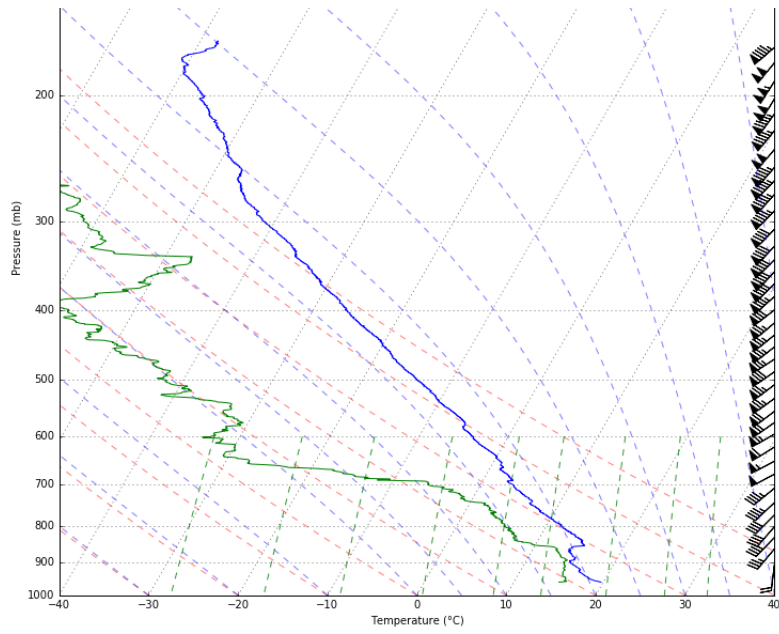
# VORTEX-SE TTU Radiosonde Data
# 2017-04-05, 1956 UTC, Rainsville, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
, temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

```

	T	height	lat	lon	mixr	p	\
0	19.750000	0.0	34.490002	-85.839996	11.293661	958.599976	
1	19.550018	9.0	34.490002	-85.839996	11.605548	957.599976	
2	19.450012	18.0	34.490002	-85.839996	11.847737	956.599976	
3	19.350006	25.0	34.490002	-85.839996	11.935433	955.799988	
4	19.050018	35.0	34.490002	-85.839996	11.794538	954.700012	
5	18.850006	46.0	34.490002	-85.839996	11.734066	953.400024	
6	18.750000	58.0	34.490002	-85.839996	11.827359	952.099976	
7	18.550018	71.0	34.490002	-85.839996	11.843838	950.799988	
8	18.350006	81.0	34.490002	-85.839996	11.781911	949.599976	
9	18.250000	89.0	34.490002	-85.839996	11.793301	948.700012	

	time	wdir	wspd
0	2017-04-05 19:56:22	NaN	NaN
1	2017-04-05 19:56:24	NaN	NaN
2	2017-04-05 19:56:26	NaN	NaN
3	2017-04-05 19:56:28	169.0	6.900001
4	2017-04-05 19:56:30	172.0	7.100000
5	2017-04-05 19:56:32	170.0	7.100000
6	2017-04-05 19:56:34	169.0	7.200000
7	2017-04-05 19:56:36	168.0	7.300000
8	2017-04-05 19:56:38	167.0	7.300000
9	2017-04-05 19:56:40	166.0	7.400000





```

In [23]: snd = SoundingPostProcessor(apr05_23, start_latlon=(34.6908, -85.6657), location="Ider, AL")
# uv_filt = snd.filters['uv']
# uv_filt[[0,1,2,3,4]] = True
# snd.filters['uv'] = uv_filt

# T_filt = snd.filters['Td']
# T_filt[[0,]] = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

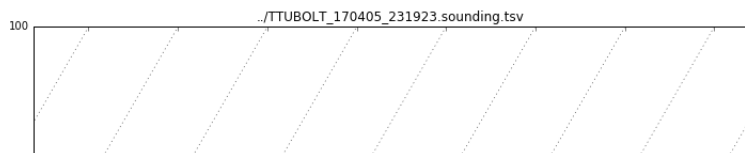
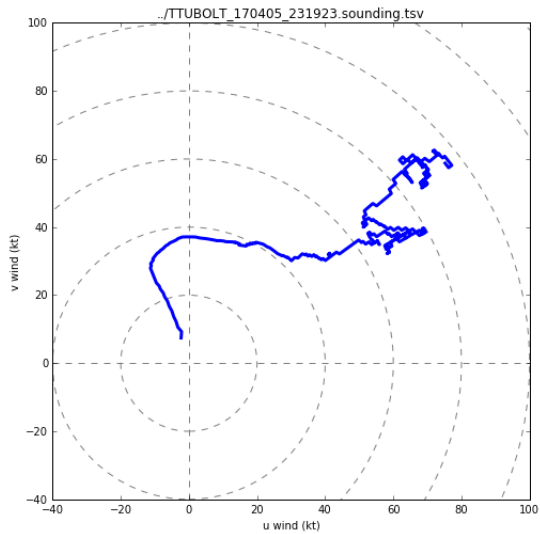
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

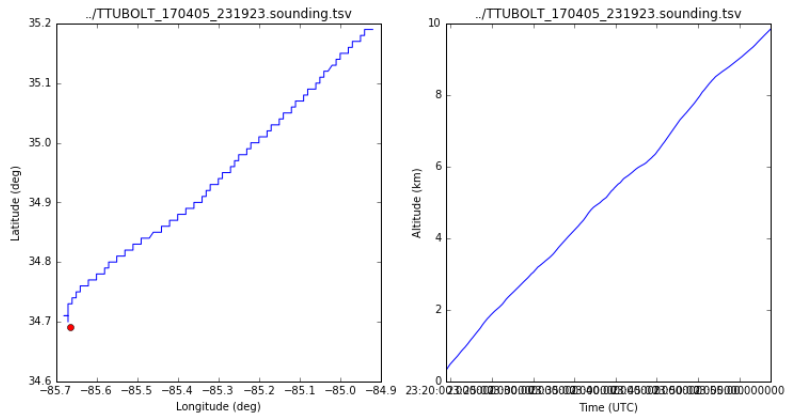
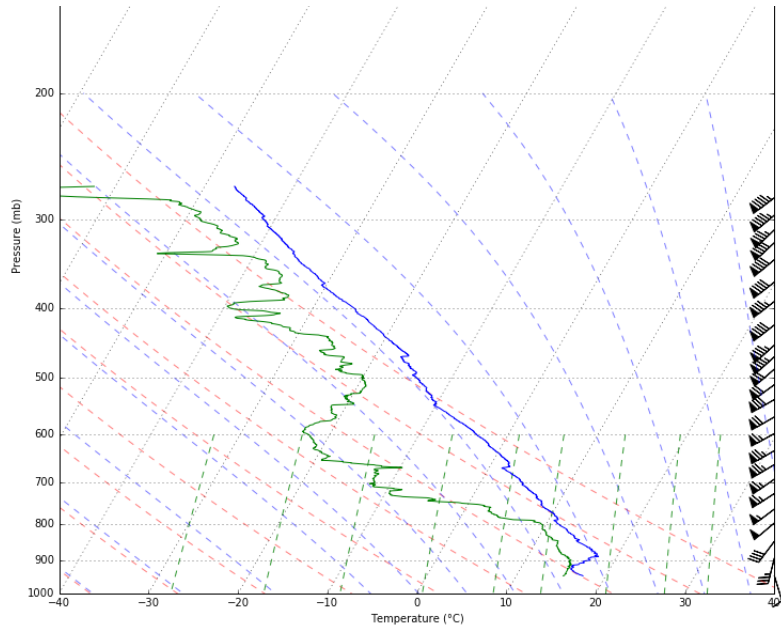
# data = snd.print_filtered_data(50, 75)
# print(data)

outfile = snd.launch.strftime("%Ym%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2017-04-05, 2319 UTC, Ider, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)

```





TTU performed no soundings for IOP 4a

April 28, 2017 - IOP 4b

Sounding

- 34.4794, -87.3067
- Launch at 1801 UTC

```
In [24]: snd = SoundingPostProcessor(apr28_18, start_latlon=(34.4794, -87.3067), location="Moulton, AL")
uv_filt = snd.filters['uv']
uv_filt[[0,1,2,3,4]] = True
snd.filters['uv'] = uv_filt

# T_filt = snd.filters['Td']
# T_filt[[0,]] = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

data = snd.print_filtered_data(0, 10)
print(data)

outfile = snd.launch.strftime("%Ym%d %H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(", ", "")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2017-04-28, 1802 UTC, Moulton, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
```

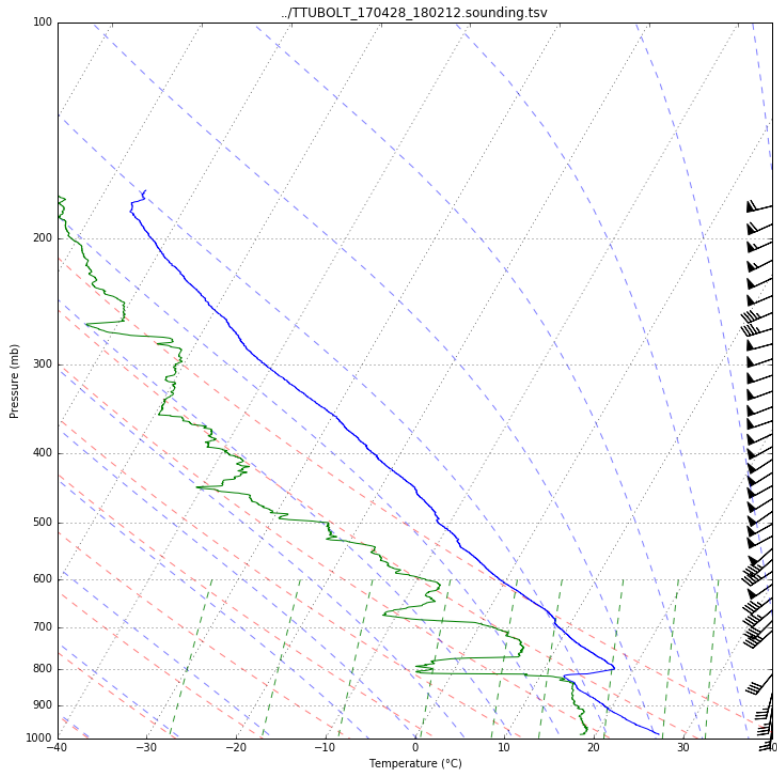
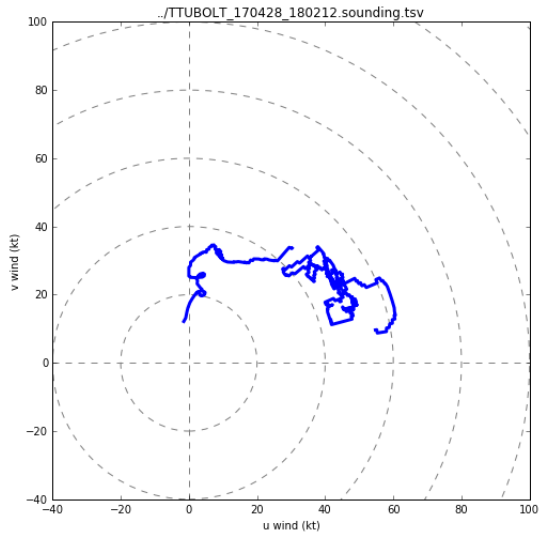
```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```

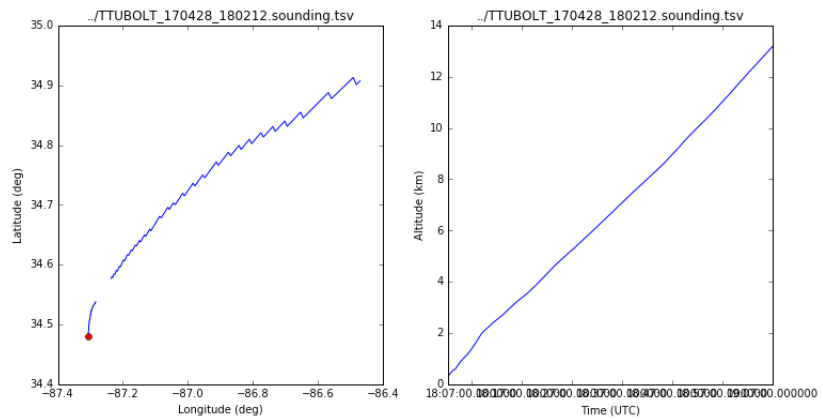
```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```

	T	height	lat	lon	mixr	p \
0	27.050018	0.0	34.479400	-87.306700	13.481710	987.599976
1	27.050018	6.0	34.479400	-87.306700	13.752036	987.000000
2	26.950012	17.0	34.479400	-87.306700	13.946517	985.799988
3	26.750000	29.0	34.479400	-87.306700	13.787730	984.500000
4	26.550018	39.0	34.479400	-87.306700	13.804932	983.299988
5	26.550018	48.0	34.479400	-87.306700	13.906590	982.400024
6	26.450012	54.0	34.479400	-87.306700	13.916729	981.700012
7	26.350006	60.0	34.480203	-87.307194	13.926882	981.000000
8	26.350006	67.0	34.480236	-87.307108	13.938502	980.200012
9	26.250000	75.0	34.480252	-87.307054	14.041175	979.299988

	time	wdir	wspd
0	2017-04-28 18:02:14	NaN	NaN
1	2017-04-28 18:02:16	NaN	NaN
2	2017-04-28 18:02:18	NaN	NaN
3	2017-04-28 18:02:20	NaN	NaN
4	2017-04-28 18:02:22	NaN	NaN
5	2017-04-28 18:02:24	173.0	6.300001
6	2017-04-28 18:02:26	176.0	6.800000
7	2017-04-28 18:02:28	177.0	7.300000
8	2017-04-28 18:02:30	178.0	7.800000
9	2017-04-28 18:02:32	179.0	8.300000

```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





April 30 - May 1, 2017 - IOP 4c (aka IOP 5 on sounding log from Google Drive)

Sounding 1

- 34.4806, -87.3109
- Launch at 1500 UTC

Sounding 2

- 34.6971, -87.6374
- Launch at 1629 UTC
- Lost at 600 mb

Soundings 3, 4, 5

- 34.4803, -87.3059
- Launch at 1815, 0000, 0301 UTC

```
In [25]: snd = SoundingPostProcessor(apr30_15, start_latlon=(34.4806, -87.3109), location="Moulton, AL")
uv_filt = snd.filters['uv']
uv_filt[[0,1]] = True
snd.filters['uv'] = uv_filt

Td_filt = snd.filters['Td']
# T_filt[[0,]] = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

bad_ob = (snd.Td < -20*units.celsius) & (snd.p > 450*units.millibar)
Td_filt[bad_ob] = True

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

data = snd.print_filtered_data(0, 10)
print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2017-04-30, 1500 UTC, Moulton, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
```

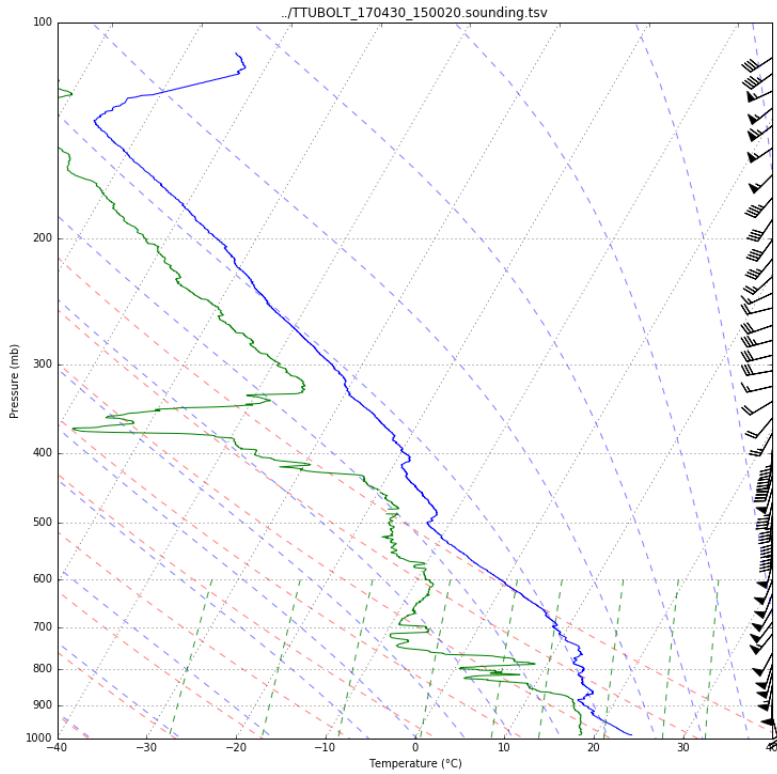
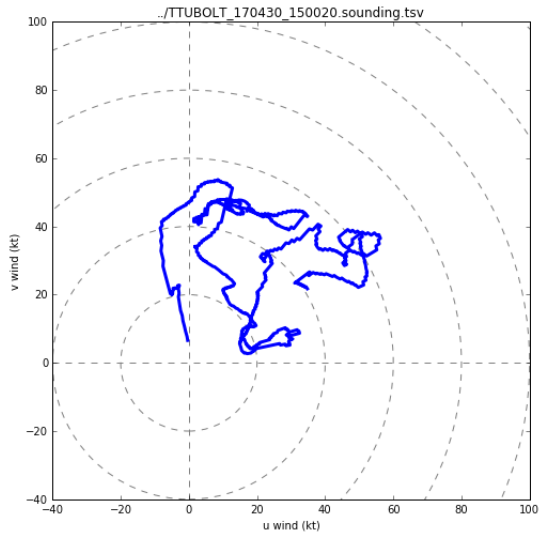
```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```

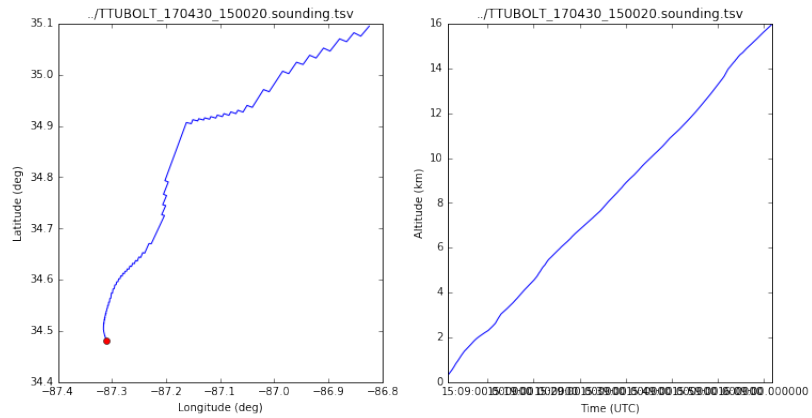
```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```

	T	height	lat	lon	mixr	p \
0	24.050018	0.0	34.480600	-87.310900	13.371941	989.299988
1	23.850006	7.0	34.480600	-87.310900	13.555845	988.500000
2	23.750000	15.0	34.480600	-87.310900	13.568468	987.599976
3	23.649994	21.0	34.480600	-87.310900	13.576896	987.000000
4	23.550018	27.0	34.480600	-87.310900	13.586742	986.299988
5	23.450012	35.0	34.480600	-87.310900	13.600834	985.299988
6	23.350006	45.0	34.480600	-87.310900	13.616367	984.200012
7	23.250000	55.0	34.481501	-87.310938	13.630520	983.200012
8	23.149994	64.0	34.481500	-87.310957	13.557446	982.200012
9	23.050018	73.0	34.481499	-87.310976	13.571564	981.200012

	time	wdir	wspd
0	2017-04-30 15:00:22	NaN	NaN
1	2017-04-30 15:00:24	NaN	NaN
2	2017-04-30 15:00:26	177.0	3.400000
3	2017-04-30 15:00:28	176.0	4.000000
4	2017-04-30 15:00:30	174.0	4.800000
5	2017-04-30 15:00:32	173.0	5.600000
6	2017-04-30 15:00:34	172.0	6.400001
7	2017-04-30 15:00:36	172.0	7.200001
8	2017-04-30 15:00:38	171.0	8.000001
9	2017-04-30 15:00:40	171.0	8.800001

```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





```
In [26]: snd = SoundingPostProcessor(apr30_16, start_latlon=(34.6971, -87.6374), location="Muscle Shoals,
AL")
uv_filt = snd.filters['uv']
uv_filt[[0,1,2,3,4]] = True
snd.filters['uv'] = uv_filt

# T_filt = snd.filters['Td']
# T_filt[[0,]] = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

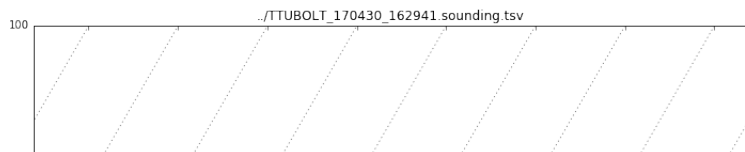
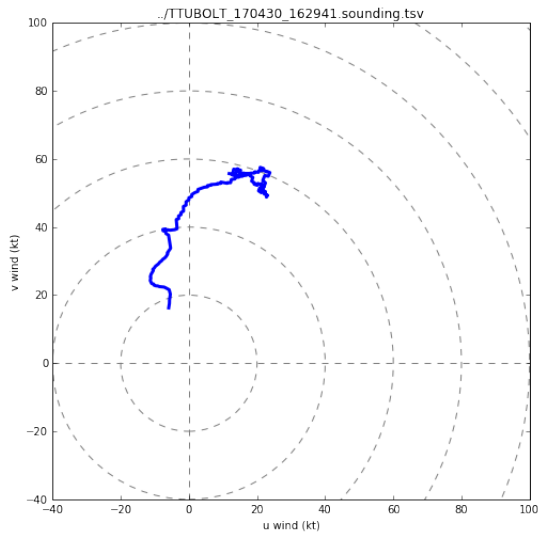
data = snd.print_filtered_data(0, 10)
print(data)

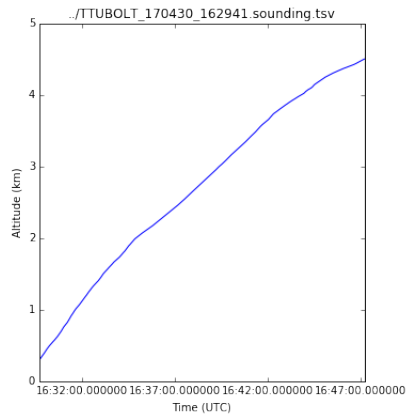
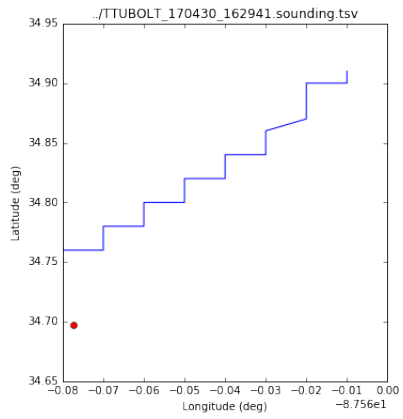
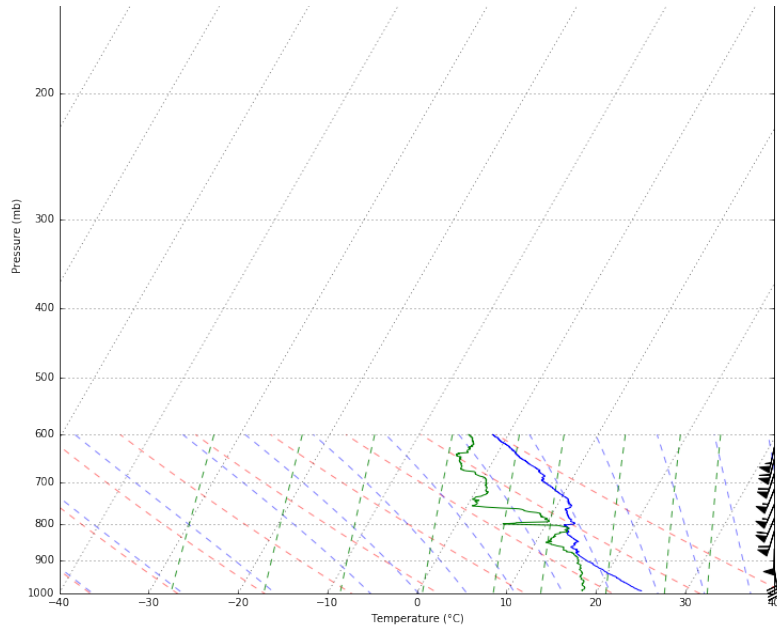
outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2017-04-30, 1629 UTC, Muscle Shoals, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# , temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
```

	T	height	lat	lon	mixr	p \
0	24.950012	0.0	34.700001	-87.639999	13.508369	991.900024
1	24.750000	12.0	34.700001	-87.639999	13.441384	990.500000
2	24.550018	24.0	34.700001	-87.639999	13.459431	989.200012
3	24.450012	35.0	34.700001	-87.639999	13.562855	988.000000
4	24.350006	47.0	34.700001	-87.639999	13.669873	986.599976
5	24.250000	59.0	34.700001	-87.639999	13.688306	985.299988
6	24.050018	70.0	34.700001	-87.639999	13.708213	983.900024
7	23.950012	83.0	34.700001	-87.639999	13.728177	982.500000
8	23.850006	97.0	34.700001	-87.639999	13.663182	980.900024
9	23.750000	111.0	34.700001	-87.639999	13.683141	979.500000

	time	wdir	wspd
0	2017-04-30 16:29:43	NaN	NaN
1	2017-04-30 16:29:45	NaN	NaN
2	2017-04-30 16:29:47	NaN	NaN
3	2017-04-30 16:29:49	NaN	NaN
4	2017-04-30 16:29:51	NaN	NaN
5	2017-04-30 16:29:53	160.0	8.900000
6	2017-04-30 16:29:55	162.0	9.499999
7	2017-04-30 16:29:57	163.0	10.000001
8	2017-04-30 16:29:59	164.0	10.400000
9	2017-04-30 16:30:01	165.0	10.800000





```
In [27]: snd = SoundingPostProcessor(apr30_18, start_latlon=(34.4803, -87.3059), location="Moulton, AL")
uv_filt = snd.filters['uv']
uv_filt[[0,1,2,3,4]] = True
snd.filters['uv'] = uv_filt

# T_filt = snd.filters['Td']
# T_filt[[0,]] = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

data = snd.print_filtered_data(0, 10)
print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(", ", "")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2017-04-30, 1817 UTC, Moulton, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
```

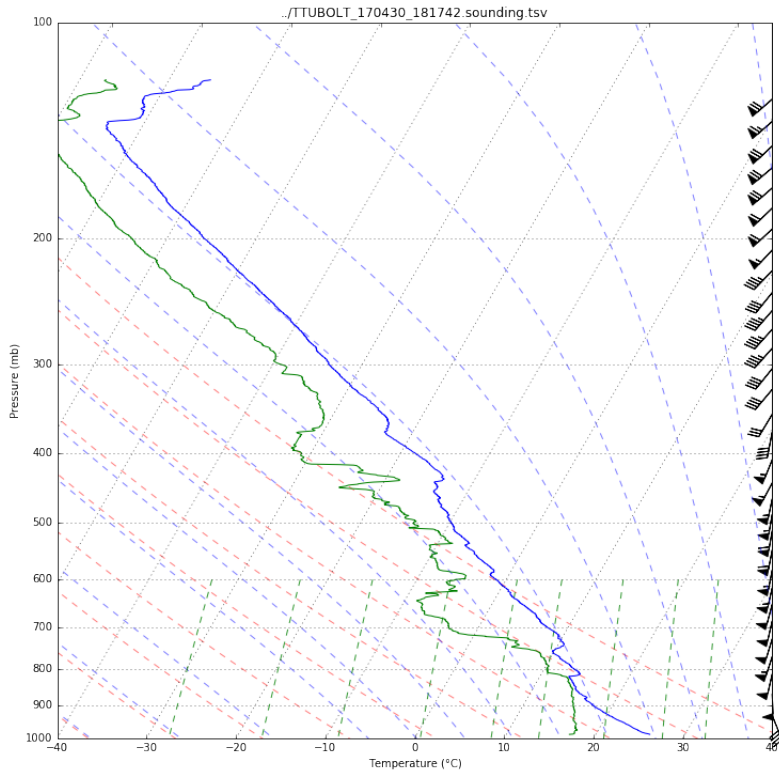
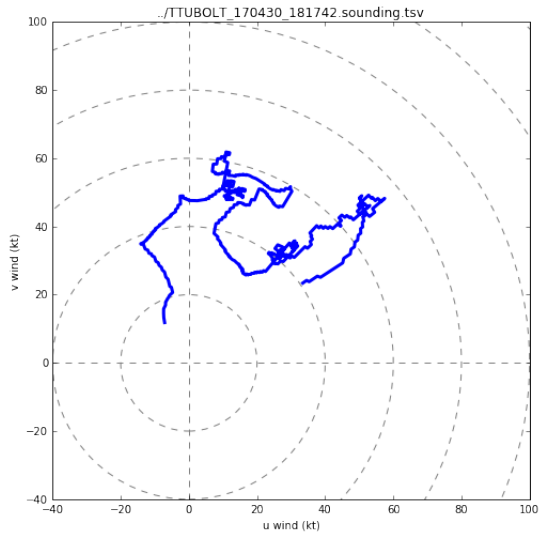
```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```

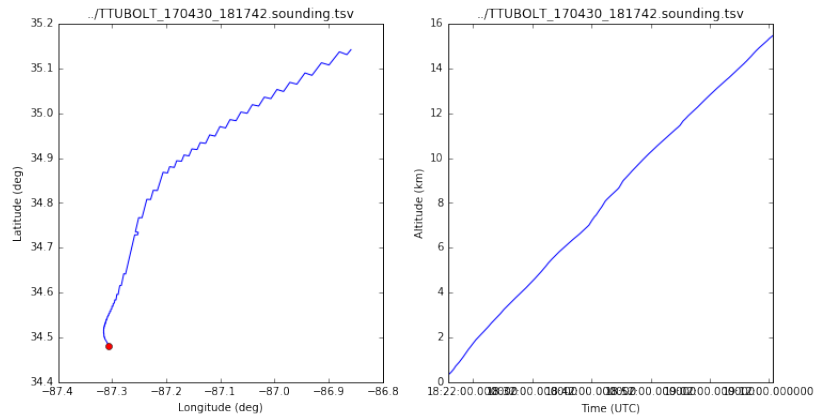
```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```

	T	height	lat	lon	mixr	p \
0	26.050018	0.0	34.480300	-87.305900	12.481595	987.400024
1	25.950012	8.0	34.480300	-87.305900	12.820086	986.500000
2	25.750000	20.0	34.480300	-87.305900	12.920386	985.200012
3	25.450012	33.0	34.480300	-87.305900	12.939156	983.799988
4	25.250000	47.0	34.480300	-87.305900	12.960672	982.200012
5	25.050018	58.0	34.480970	-87.306628	12.893452	981.000000
6	24.950012	67.0	34.480991	-87.306600	12.908225	979.900024
7	24.850006	78.0	34.481020	-87.306555	12.924381	978.700012
8	24.750000	89.0	34.481038	-87.306524	12.940578	977.500000
9	24.649994	100.0	34.481056	-87.306493	12.956815	976.299988

	time	wdir	wspd
0	2017-04-30 18:17:44	NaN	NaN
1	2017-04-30 18:17:46	NaN	NaN
2	2017-04-30 18:17:48	NaN	NaN
3	2017-04-30 18:17:50	NaN	NaN
4	2017-04-30 18:17:52	NaN	NaN
5	2017-04-30 18:17:54	149.0	7.100000
6	2017-04-30 18:17:56	151.0	7.800001
7	2017-04-30 18:17:58	153.0	8.400000
8	2017-04-30 18:18:00	155.0	9.000000
9	2017-04-30 18:18:02	158.0	9.400000

```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





```
In [28]: snd = SoundingPostProcessor(may01_00, start_latlon=(34.4803, -87.3059), location="Moulton, AL")
uv_filt = snd.filters['uv']
uv_filt[[0,1,2,3,4]] = True
snd.filters['uv'] = uv_filt

# T_filt = snd.filters['Td']
# T_filt[[0,]] = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

data = snd.print_filtered_data(0, 10)
print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(", ", "")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2017-05-01, 0001 UTC, Moulton, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
```

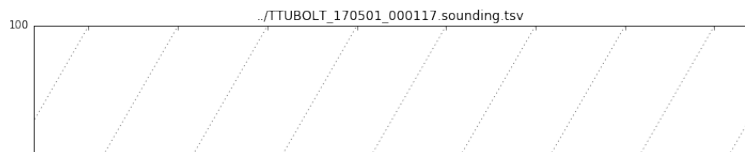
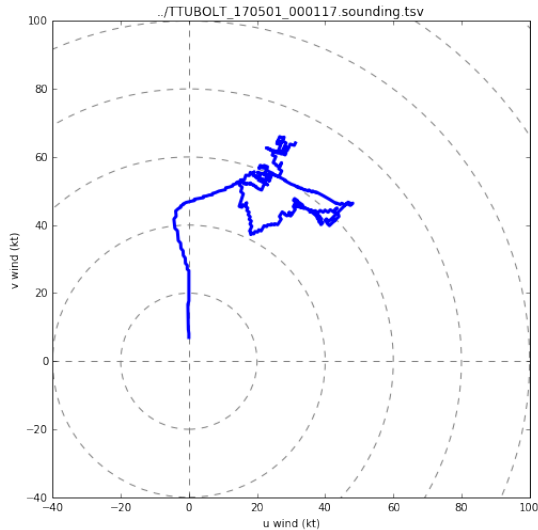
Recalculating lat, lon data from az, range data because starting location differs substantially from initial location in data file.

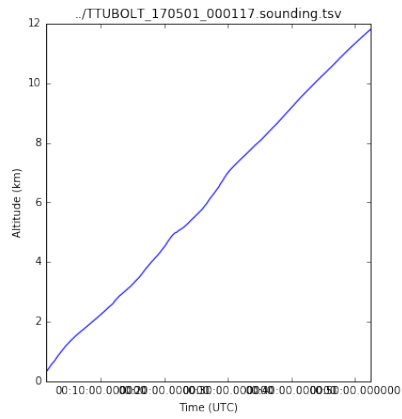
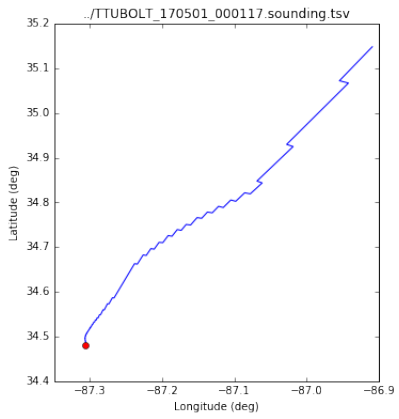
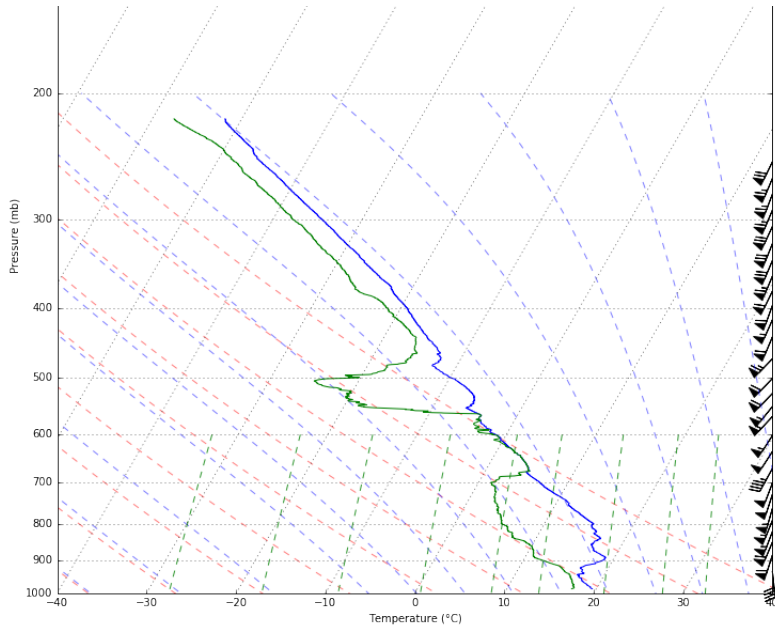
Recalculating lat, lon data from az, range data because starting location differs substantially from initial location in data file.

	T	height	lat	lon	mixr	p \
0	19.550018	0.0	34.480300	-87.305900	12.670099	985.400024
1	19.450012	7.0	34.480300	-87.305900	12.762731	984.599976
2	19.350006	18.0	34.480300	-87.305900	12.861334	983.400024
3	19.250000	29.0	34.480300	-87.305900	12.878712	982.099976
4	19.250000	39.0	34.480300	-87.305900	12.893452	981.000000
5	19.250000	48.0	34.480300	-87.305900	12.823873	980.000000
6	19.149994	59.0	34.480300	-87.305900	12.839919	978.799988
7	19.050018	70.0	34.480300	-87.305900	12.775934	977.400024
8	18.950012	82.0	34.481201	-87.305881	12.793300	976.099976
9	18.850006	92.0	34.481201	-87.305881	12.725543	975.000000

	time	wdir	wspd
0	2017-05-01 00:01:19	NaN	NaN
1	2017-05-01 00:01:21	NaN	NaN
2	2017-05-01 00:01:23	NaN	NaN
3	2017-05-01 00:01:25	NaN	NaN
4	2017-05-01 00:01:27	NaN	NaN
5	2017-05-01 00:01:29	180.0	3.6
6	2017-05-01 00:01:31	180.0	4.2
7	2017-05-01 00:01:33	179.0	4.8
8	2017-05-01 00:01:35	179.0	5.4
9	2017-05-01 00:01:37	179.0	6.1

Recalculating lat, lon data from az, range data because starting location differs substantially from initial location in data file.





```
In [29]: snd = SoundingPostProcessor(may01_03, start_latlon=(34.4803, -87.3059), location="Moulton, AL")
uv_filt = snd.filters['uv']
uv_filt[[0,1,2,3]] = True
snd.filters['uv'] = uv_filt

# T_filt = snd.filters['Td']
# T_filt[[0,]] = True
# snd.filters['T'] = T_filt
# snd.filters['Td'] = T_filt
# snd.filters['p'] = T_filt
# snd.filters['uv'] = T_filt
# snd.filters['height'] = T_filt

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()

data = snd.print_filtered_data(0, 10)
print(data)

outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2017-05-01, 0302 UTC, Moulton, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), height (m AGL), pressure (mb)
# temp (deg C), mixing ratio (g/kg), wind speed (m/s), wind direction (deg)
```

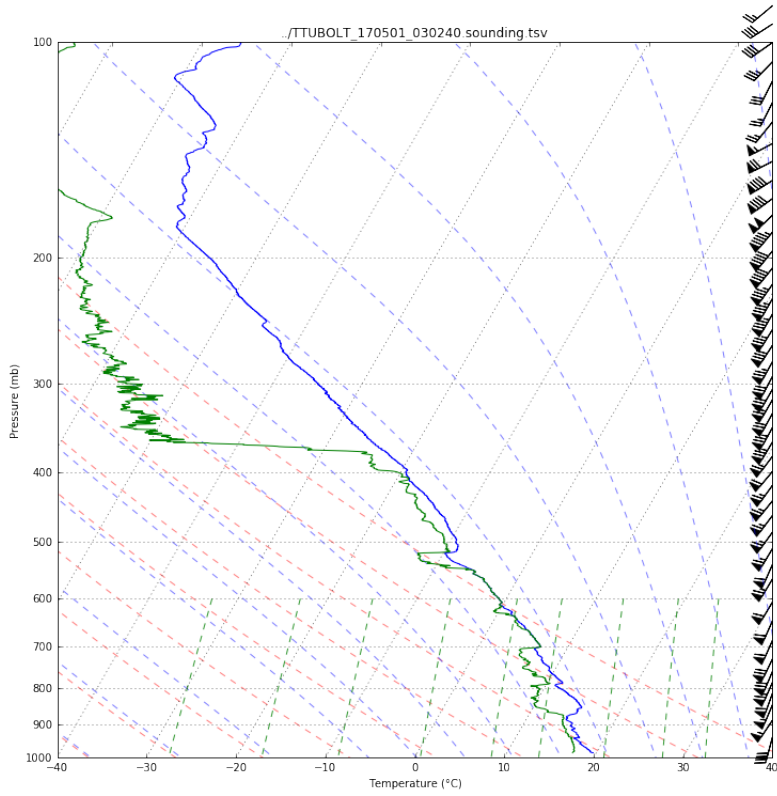
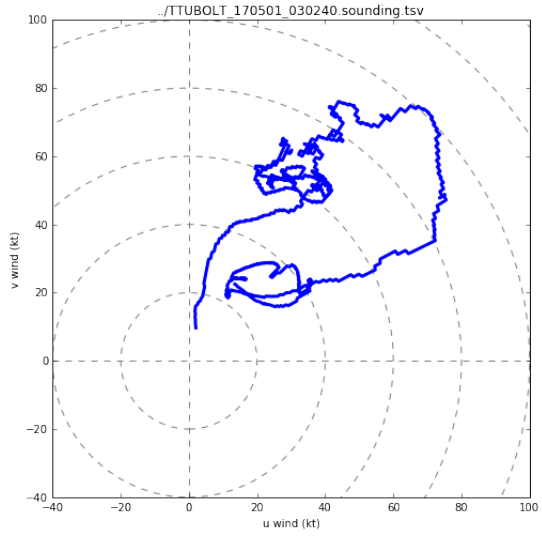
```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```

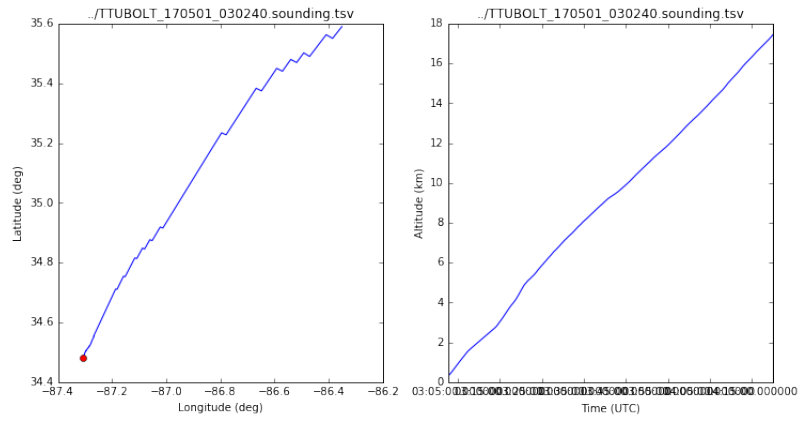
```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```

	T	height	lat	lon	mixr	p \
0	19.649994	0.0	34.480300	-87.305900	12.752155	985.400024
1	19.450012	7.0	34.480300	-87.305900	12.761408	984.700012
2	19.350006	16.0	34.480300	-87.305900	12.775972	983.599976
3	19.250000	26.0	34.480300	-87.305900	12.791899	982.400024
4	19.250000	36.0	34.480300	-87.305900	12.889428	981.299988
5	19.250000	45.0	34.480300	-87.305900	12.902849	980.299988
6	19.149994	53.0	34.481175	-87.305637	12.914952	979.400024
7	19.149994	60.0	34.481178	-87.305655	12.843937	978.500000
8	19.050018	70.0	34.481182	-87.305674	12.857347	977.500000
9	18.950012	80.0	34.481185	-87.305692	12.872132	976.400024

	time	wdir	wspd
0	2017-05-01 03:02:42	NaN	NaN
1	2017-05-01 03:02:44	NaN	NaN
2	2017-05-01 03:02:46	NaN	NaN
3	2017-05-01 03:02:48	NaN	NaN
4	2017-05-01 03:02:50	192.0	5.099999
5	2017-05-01 03:02:52	190.0	5.700000
6	2017-05-01 03:02:54	189.0	6.300001
7	2017-05-01 03:02:56	188.0	6.700000
8	2017-05-01 03:02:58	188.0	7.200000
9	2017-05-01 03:03:00	187.0	7.500000

```
Recalculating lat, lon data from az, range data because starting location differs substantially
from initial location in data file.
```





```
In [30]: import metpy  
metpy.__version__
```

```
Out[30]: u'0.5.1+58.g8053011'
```

```
In [ ]:
```