

VORTEX-SE Sounding Cleanup

TODO

- Add town name parameters to sounding class.
- Write out data in common file format - fill out last method in class.

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
Pscl	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

/Users/ebruning/anaconda/lib/python2.7/site-packages/matplotlib/font
_manager.py:273: UserWarning: Matplotlib is building the font cache
using fc-list. This may take a moment.
    warnings.warn('Matplotlib is building the font cache using fc-list
. This may take a moment.')

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'), ('Pscl','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), heig
ht (m AGL), pressure (mb), temp (deg C), mixing ratio (g/kg), wind spe
ed (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.sou
nding.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], d
    ateparser)
    self.location = location
    #print self._file_header()
    #    print("Launch at {}".format(self.launch))
    self.filename = filename
    self.data=read_tsv(filename,skip=40)
    self.filters = defaultdict(lambda:np.zeros(self.data.shape, dt
    ype=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 tse
        c]
        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']

```

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        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(un
its.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)

@property
def azran(self):
    filt = self.filters['azran']
    az, ran = self.data['AZ']*units.degree, self.data['Range']*uni
ts.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']*uni
ts.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)):
#
            filt |= np.ones_like(lat, dtype=bool)
        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 lmatoools.coordinateSystems import MapProjection, Geograph
icSystem
    mapSys = MapProjection(projection='aeqd', ctrLat=ctr_lat, ctrl
on=ctr_lon, lat_ts=ctr_lat,
                           lon_0=ctr_lon, lat_0=ctr_lat, lat_1=ct
r_lat, ellipse='WGS84', datum='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_like(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)

#     hodo_mask = (self.p > 200*units.millibar) &(self.p<891.00024
41*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.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 Shallowwater'
        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(),
                      index=False,
                      float_format=' %10.6f')
        outfile.close()

```

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

```
../TTUBOLT_160218_173905.sounding.tsv
../TTUBOLT_160314_060223.sounding.tsv
../TTUBOLT_160314_080125.sounding.tsv
../TTUBOLT_160314_090209.sounding.tsv
../TTUBOLT_160324_162758.sounding.tsv
../TTUBOLT_160324_213159.sounding.tsv
../TTUBOLT_160331_200311.sounding.tsv
../TTUBOLT_160331_220853.sounding.tsv
../TTUBOLT_160331_233133.sounding.tsv
../TTUBOLT_160401_010108.sounding.tsv
../TTUBOLT_160401_020455.sounding.tsv
../TTUBOLT_160427_200037.sounding.tsv
../TTUBOLT_160427_230601.sounding.tsv
../TTUBOLT_160429_211028.sounding.tsv
../TTUBOLT_160429_225500.sounding.tsv
../TTUBOLT_160430_160552.sounding.tsv
../TTUBOLT_160430_180023.sounding.tsv
../TTUBOLT_160430_200014.sounding.tsv
../TTUBOLT_160430_214048.sounding.tsv
../TTUBOLT_160501_163014.sounding.tsv
../TTUBOLT_160501_173014.sounding.tsv
../TTUBOLT_160501_184237.sounding.tsv
../TTUBOLT_160501_193016.sounding.tsv
../TTUBOLT_160501_203018.sounding.tsv
```

```
In [7]: mar14_06 = '../TTUBOLT_160314_060223.sounding.tsv'
mar14_08 = '../TTUBOLT_160314_080125.sounding.tsv'
mar14_09 = '../TTUBOLT_160314_090209.sounding.tsv'
mar24_16 = '../TTUBOLT_160324_162758.sounding.tsv'
mar24_21 = '../TTUBOLT_160324_213159.sounding.tsv'
mar31_20 = '../TTUBOLT_160331_200311.sounding.tsv'
mar31_22 = '../TTUBOLT_160331_220853.sounding.tsv'
mar31_23 = '../TTUBOLT_160331_233133.sounding.tsv'
apr01_01 = '../TTUBOLT_160401_010108.sounding.tsv'
apr01_02 = '../TTUBOLT_160401_020455.sounding.tsv'
apr27_20 = '../TTUBOLT_160427_200037.sounding.tsv'
apr27_23 = '../TTUBOLT_160427_230601.sounding.tsv'
apr29_21 = '../TTUBOLT_160429_211028.sounding.tsv'
apr29_23 = '../TTUBOLT_160429_225500.sounding.tsv'
apr30_16 = '../TTUBOLT_160430_160552.sounding.tsv'
apr30_18 = '../TTUBOLT_160430_180023.sounding.tsv'
apr30_20 = '../TTUBOLT_160430_200014.sounding.tsv'
apr30_21 = '../TTUBOLT_160430_214048.sounding.tsv'
may01_16 = '../TTUBOLT_160501_163014.sounding.tsv'
may01_17 = '../TTUBOLT_160501_173014.sounding.tsv'
may01_18 = '../TTUBOLT_160501_184237.sounding.tsv'
may01_19 = '../TTUBOLT_160501_193016.sounding.tsv'
may01_20 = '../TTUBOLT_160501_203018.sounding.tsv'
```

March 13-14 2016

DARTS at Muscle Shoals Airport, just outside south fence gate

- 34.74022972, -87.61192000 146.94

Soundings at Lexington AL Church of Christ, with PIPS DSD

- 34.9612 -87.37034

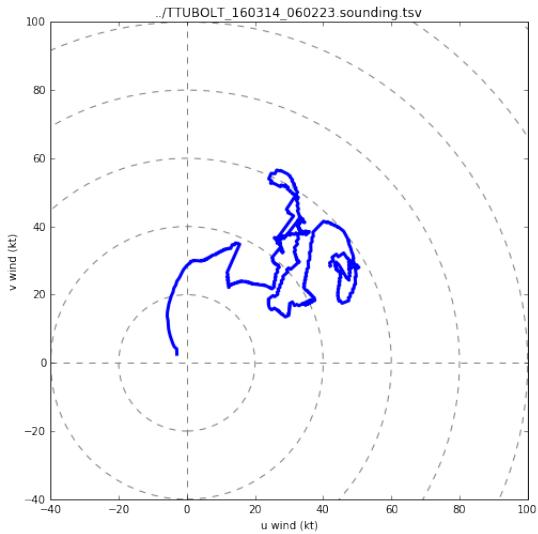
Launches

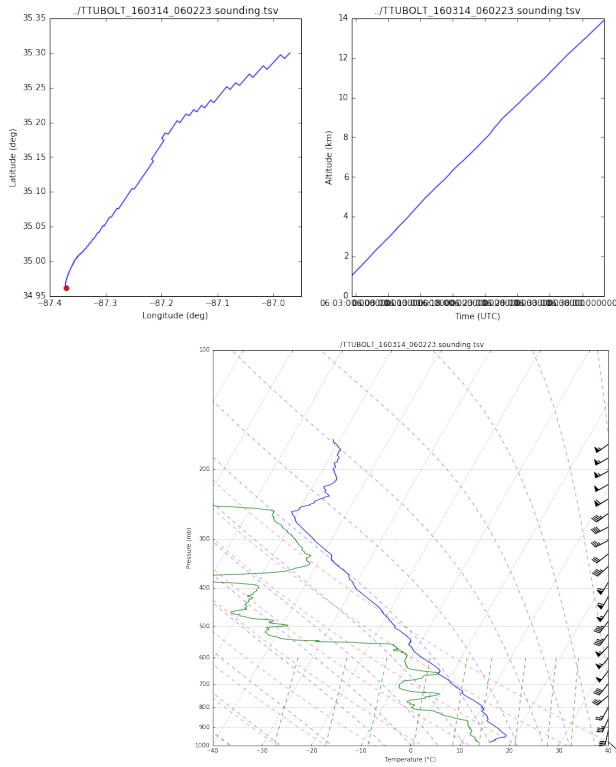
- 0602 UTC
- 0801 UTC

```
In [8]: snd = SoundingPostProcessor(mar14_06, start_latlon=(34.9612, -87.37034),
), location='Lexington, AL')
snd.plot_hodo()
snd.plot_track()
snd.plot_skewt()
# print(snd.print_raw_data(0, 10))
# print(snd.print_filtered_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
# 2016-03-14, 0602 UTC, Lexington, 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.



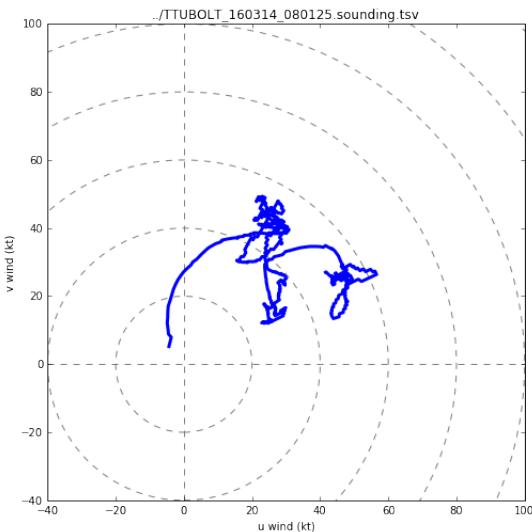


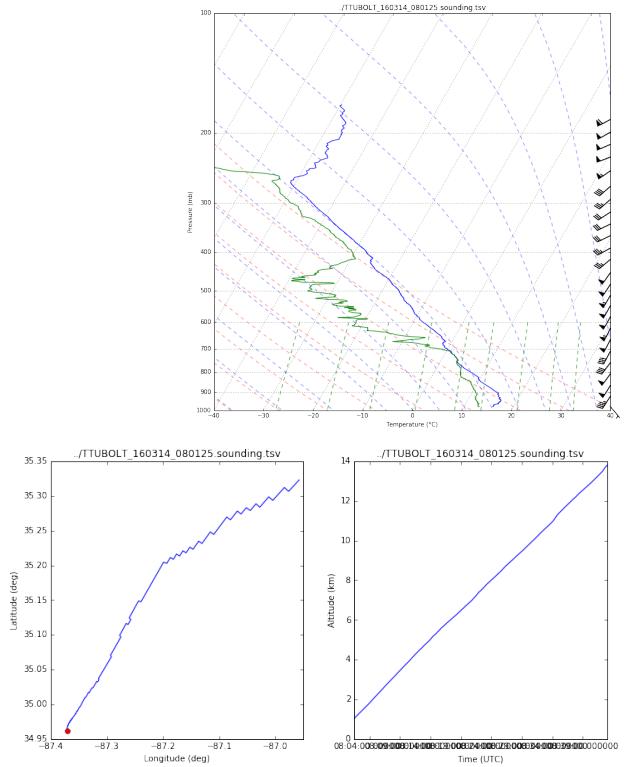
```
In [9]: snd = SoundingPostProcessor(mar14_08, start_latlon=(34.9612, -87.37034),
), location='Lexington, AL')
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 20)

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
2016-03-14, 0801 UTC, Lexington, 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.





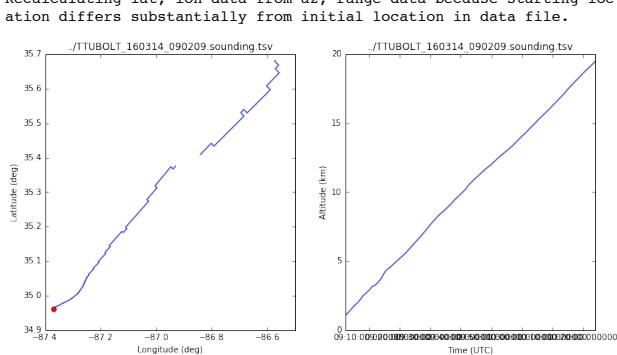
```
In [10]: snd = SoundingPostProcessor(mar14_09, start_latlon=(34.9612, -87.37034),
), location='Lexington, AL')
# u, v = snd.uv
# spd = np.sqrt(u*u+v*v)
# wind_mask = spd > (200*units.knot)
# snd.filters['uv'] = wind_mask

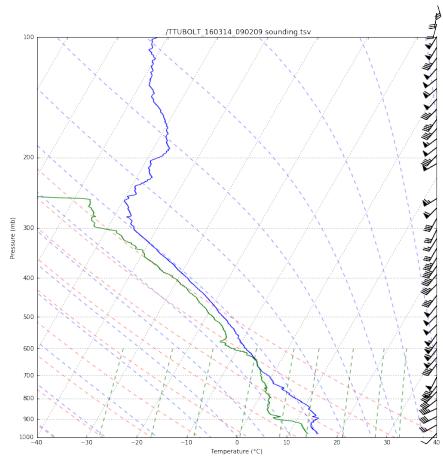
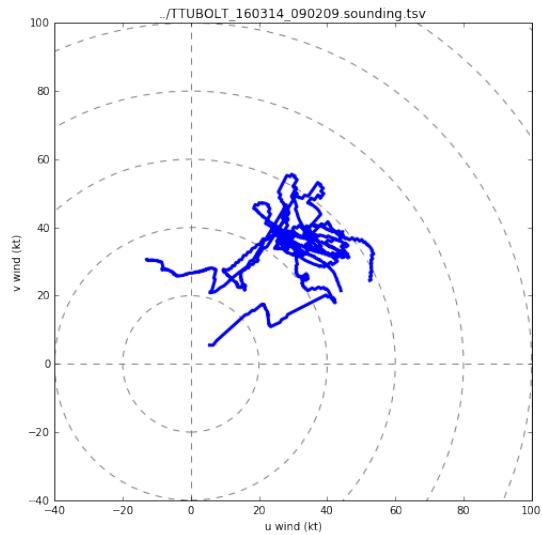
snd.plot_track()
snd.plot_hodo()
snd.plot_skewt()
# snd.print_raw_data(0, 20)

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
# 2016-03-14, 0902 UTC, Lexington, 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 24 2016

DARTS at Moulton Rec Center. Talked to facility manager, aka Bird.

- 34.47935, -87.30890 Deployed ~1355 UTC, undeployed 2230 UTC

Sounding at Danville Middle School

- 34.417262, -87.092507, 634 feet elevation
- Launch at 1625 UTC

Sounding north of Hartselle, AL

- 34.34202, -86.93706
- Launch at 2131 UTC

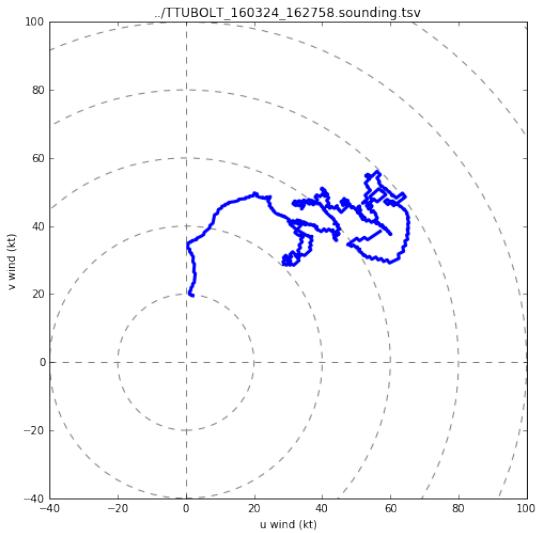
```
In [11]: snd = SoundingPostProcessor(mar24_16, start_latlon=(34.417262, -87.092
507), location="Danville, AL")
uv_filt = snd.filters['uv']
uv_filt[[0,1,2,3,4]] = True
snd.filters['uv'] = uv_filt

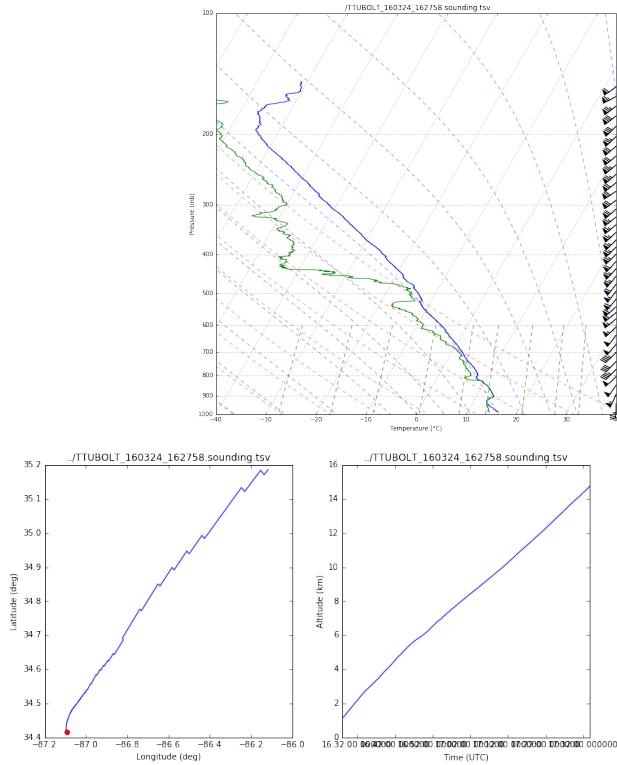
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 20)

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

# VORTEX-SE TTU Radiosonde Data
# 2016-03-24, 1627 UTC, Danville, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), he
ight (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 loc
ation differs substantially from initial location in data file.
Recalculating lat, lon data from az, range data because starting loc
ation differs substantially from initial location in data file.
```

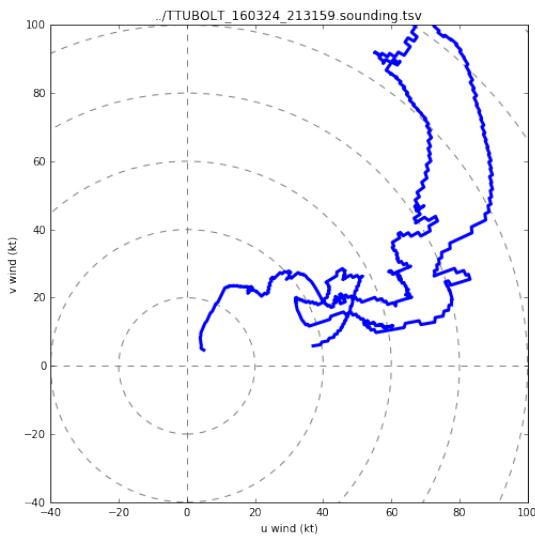


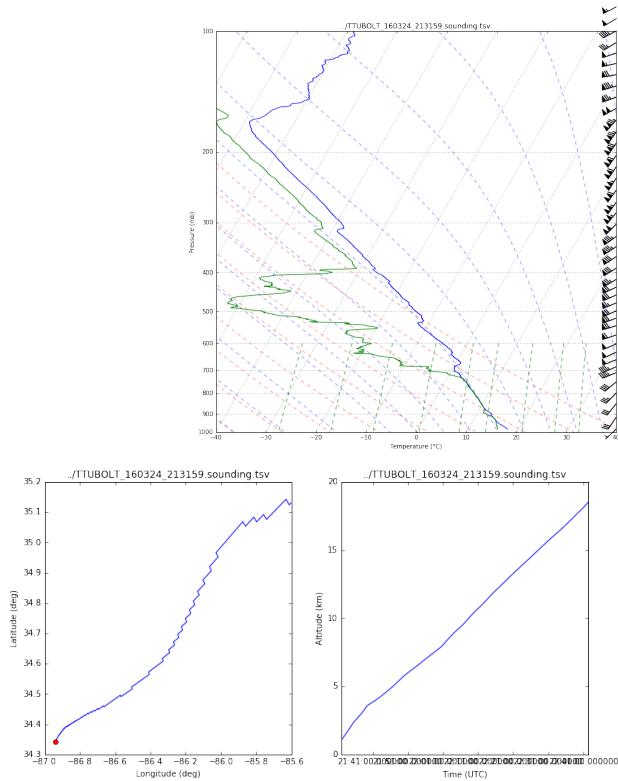


```
In [12]: snd = SoundingPostProcessor(mar24_21, start_latlon=(34.34202, -86.93706), location="Hartselle, AL")
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 20)
outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(", ", "")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2016-03-24, 2131 UTC, Hartselle, 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 31 2016

DARTS at Muscle Shoals Airport. Deployed ~16 UTC

Purdue and TTU teams ferried together throughout the day.

Sounding at Russelville, AL

- 34.484175, -87.714565 (BOLT log, parking lot on south side of ball fields)
- Launches at
 - 2002 UTC
 - 2208 UTC
 - 2331 UTC

West Moulton, AL

- 34.484003, -87.434229
- Launch of Purdue sonde at 0001

Hartselle, AL 34.447600, -86.898953 (from ops ctr log; Cracker Barrel parking lot)

- Launch at 0101 UTC

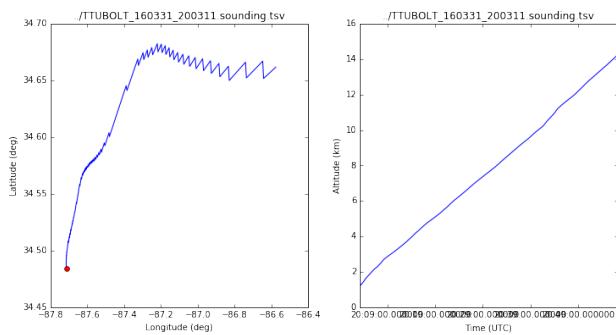
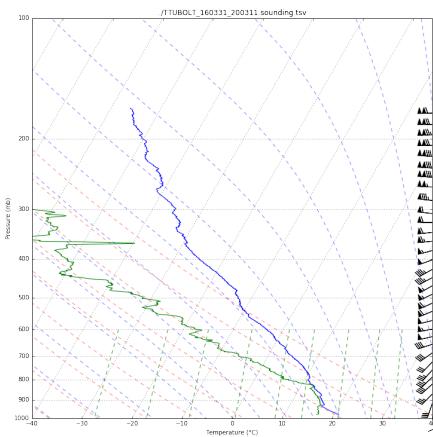
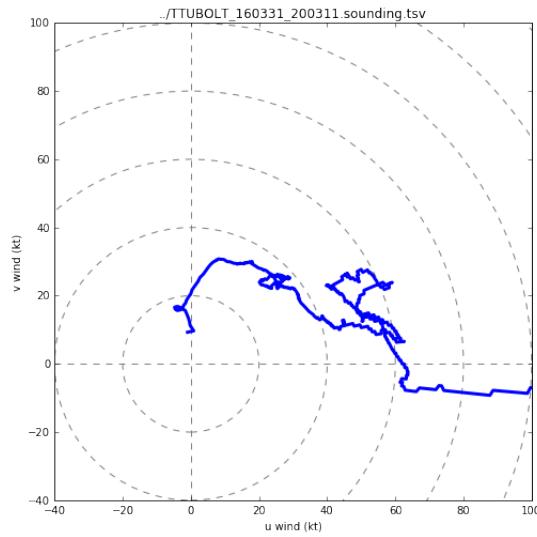
Sounding NW of Cullman, exit 310.

- 34.208442, -86.881505 (from ops ctr log)
- Launch at 0205 UTC

```
In [13]: snd = SoundingPostProcessor(mar31_20, start_latlon=(34.484175, -87.714565), location="Russelville, AL")
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 20)
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
# 2016-03-31, 2003 UTC, Russelville, 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.
```

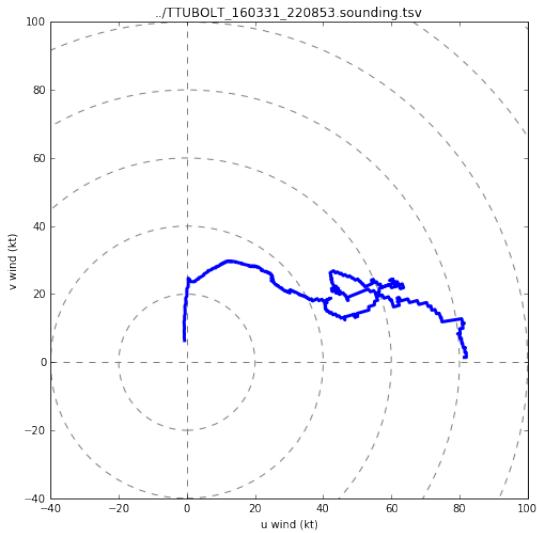


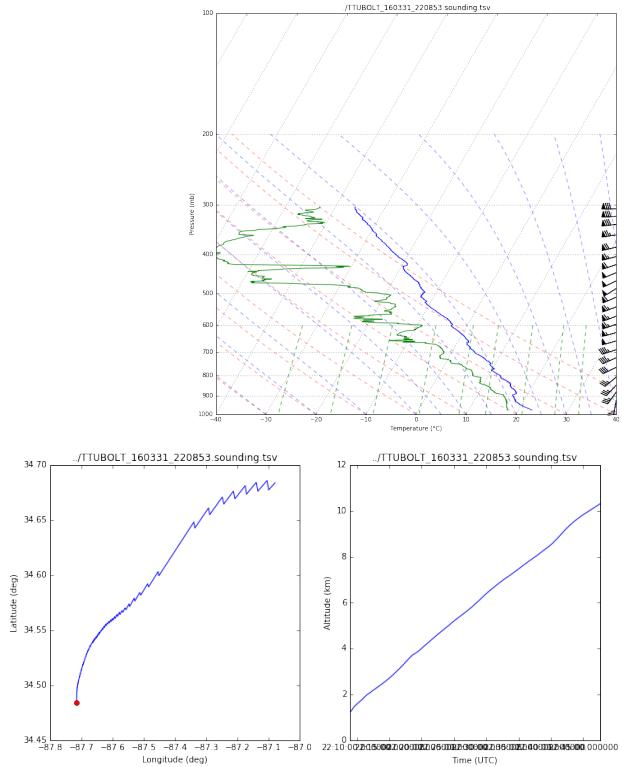
```
In [14]: snd = SoundingPostProcessor(mar31_22, start_lation=(34.484175, -87.714
565), location="Russelville, AL")
uv_filt = snd.filters['uv']
uv_filt[[0,1,2]] = True
snd.filters['uv'] = uv_filt

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 20)
# snd.print_raw_data(-10, -1, 1)
outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.lo
cation.replace(" ", "").replace(", ", "")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2016-03-31, 2208 UTC, Russelville, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), he
ight (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 loc
ation differs substantially from initial location in data file.
Recalculating lat, lon data from az, range data because starting loc
ation differs substantially from initial location in data file.
```



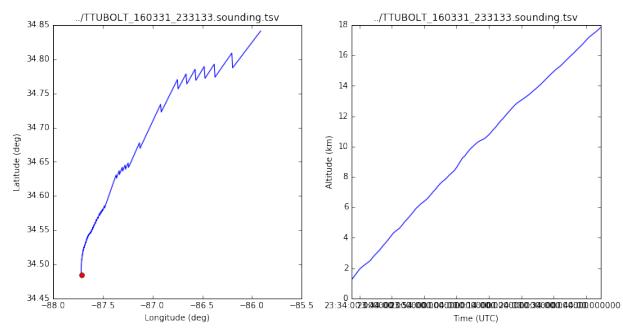
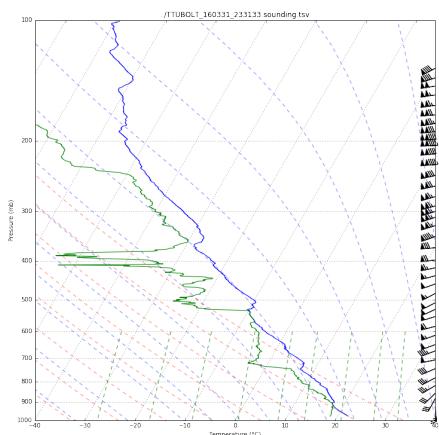
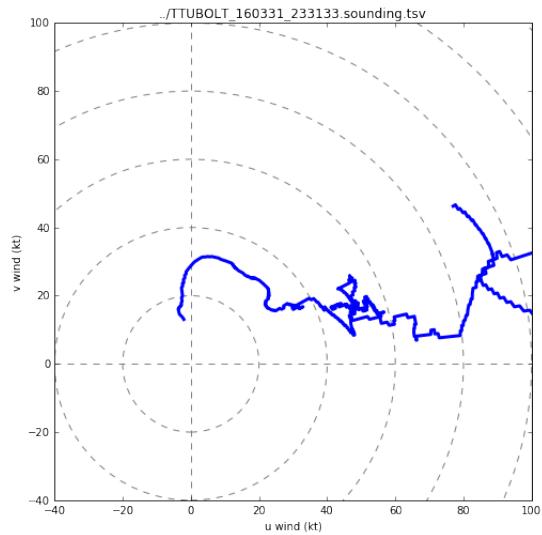


```
In [15]: snd = SoundingPostProcessor(mar31_23, start_latlon=(34.484175, -87.714565), location="Russelville, AL")
uv_filt = snd.filters['uv']
uv_filt[[0,1,2,3,4,5,6,7,8,9,10,11,12]] = True
snd.filters['uv'] = uv_filt

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 20)
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
# 2016-03-31, 2331 UTC, Russelville, 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.
```



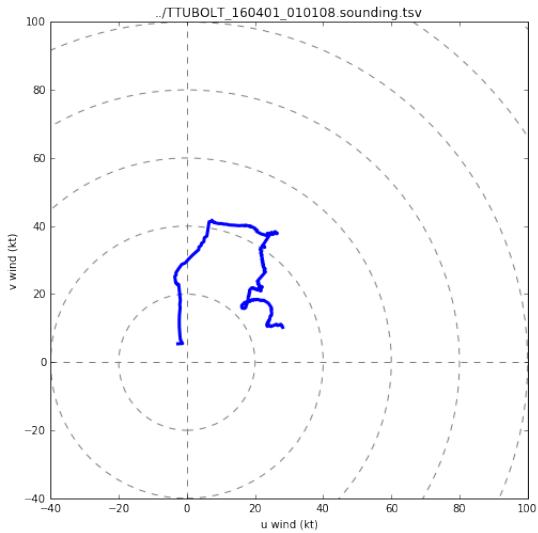
```
In [16]: snd = SoundingPostProcessor(apr01_01, start_latlon=(34.447600, -86.898
953), location="Hartselle, AL")
RH_filt = snd.filters['RH']
RH_filt[range(397,411,1)] = True
snd.filters['RH'] = RH_filt
snd.filters['Td'] = RH_filt

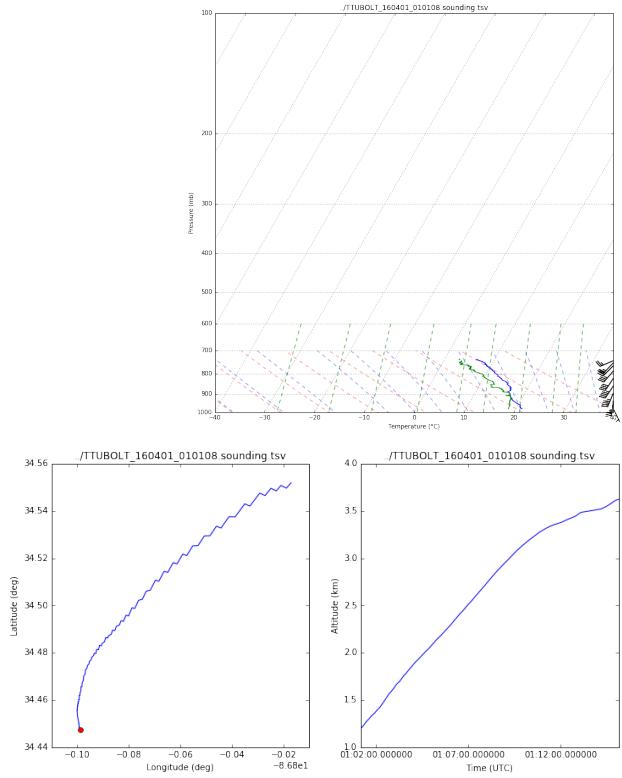
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 20)

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

# VORTEX-SE TTU Radiosonde Data
# 2016-04-01, 0101 UTC, Hartselle, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), he
ight (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 loc
ation differs substantially from initial location in data file.
Recalculating lat, lon data from az, range data because starting loc
ation differs substantially from initial location in data file.
```

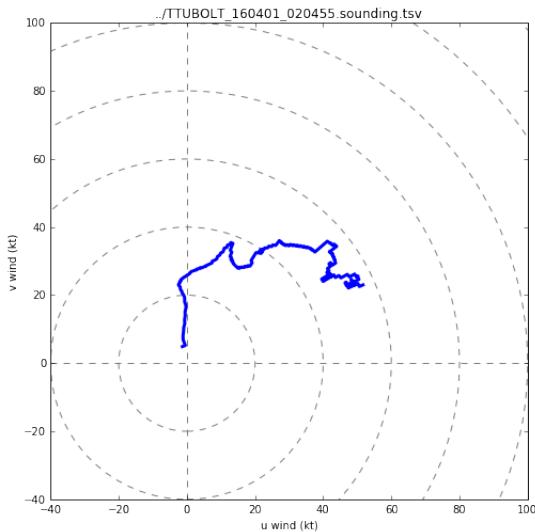


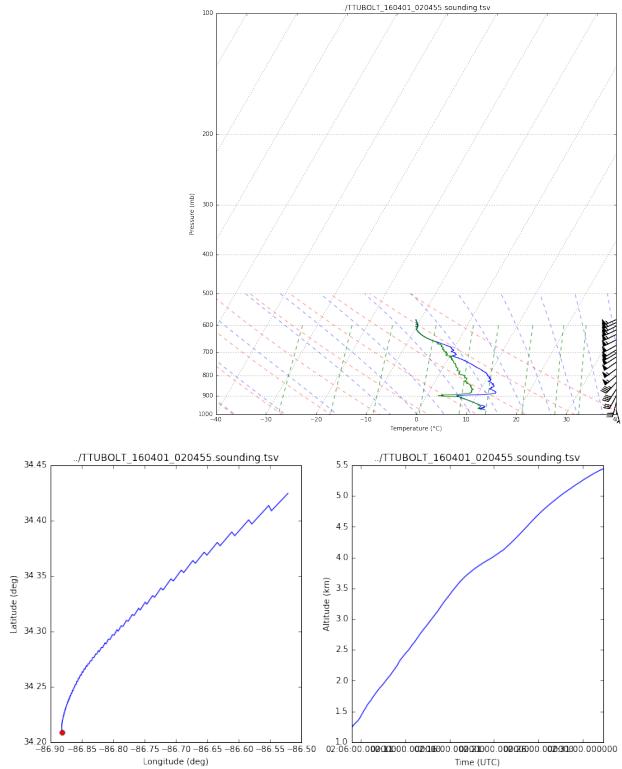


```
In [17]: snd = SoundingPostProcessor(apr01_02, start_latlon=(34.208442, -86.881505), location="Cullman, AL")
# --- thermo on this sounding is sketchy --- probably don't want to distribute.
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 20)
outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(", ", "")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2016-04-01, 0204 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)
```

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 27 2016

DARTS at Moulton Rec Ctr

- 34.4800 -87.3081
- Deployed 1920 UTC

Sounding at Trinity, AL Municipal Services / Ballfields with Purdue

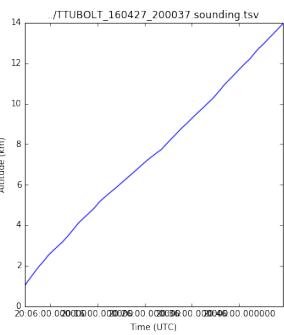
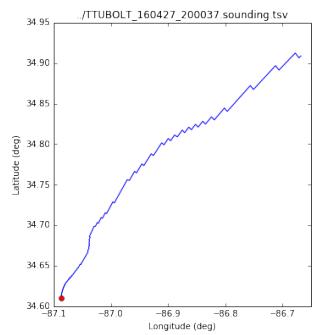
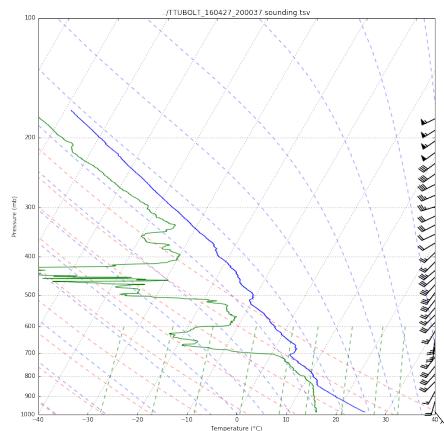
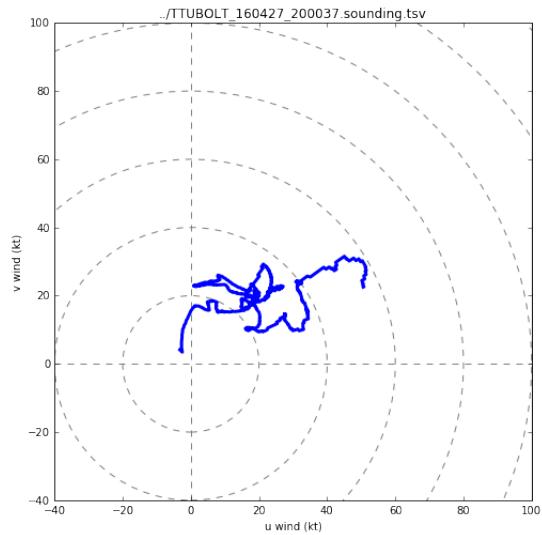
- 34.6104, -87.0861
- Launches
 - PUR 1808 UTC
 - TTU 2000 UTC
 - PUR 2059 UTC
 - TTU 2306 UTC

```
In [18]: snd = SoundingPostProcessor(apr27_20, start_latlon=(34.6104, -87.0861)
, location="Trinity, AL")

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 30)
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
# 2016-04-27, 2000 UTC, Trinity, 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.
```

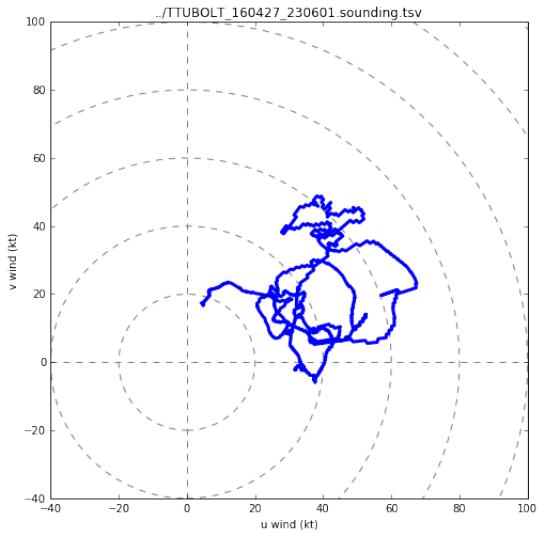


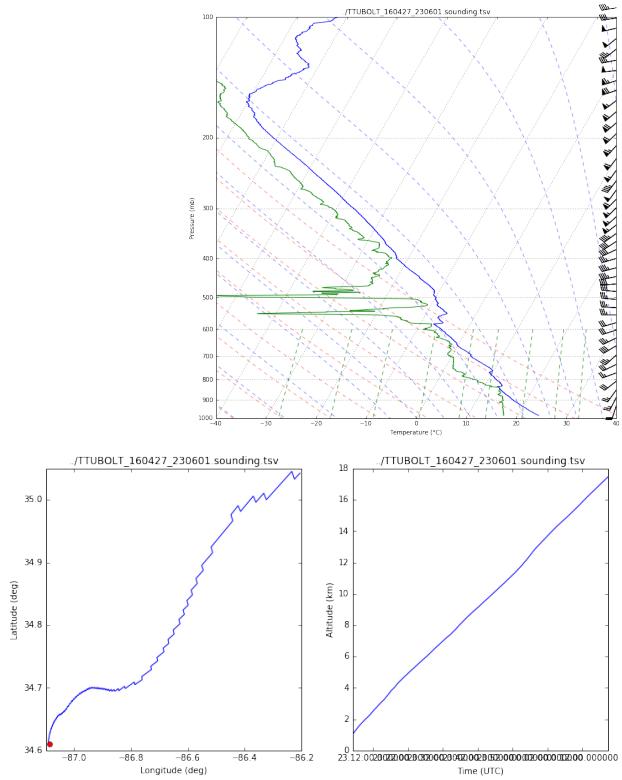
```
In [19]: snd = SoundingPostProcessor(apr27_23, start_lation=(34.6104, -87.0861)
, location="Trinity, AL")
uv_filt = snd.filters['uv']
uv_filt[range(0,30)] = True
snd.filters['uv'] = uv_filt

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 35)
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
# 2016-04-27, 2306 UTC, Trinity, 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 29 2016

DARTS at Moulton Rec Ctr

- 34.4792 -87.3043 Deployed 1945 UTC

Sounding in near inflow south of Eldridge, AL

- 33.842762, -87.648562
- Launch at 2109 UTC

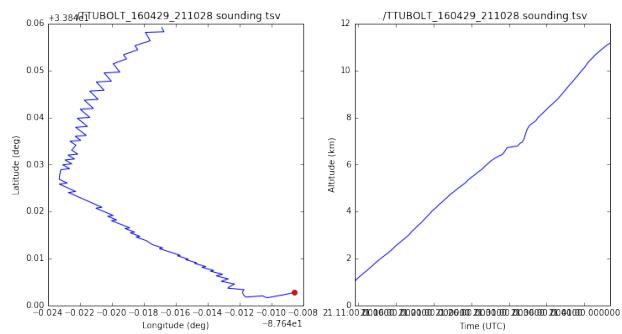
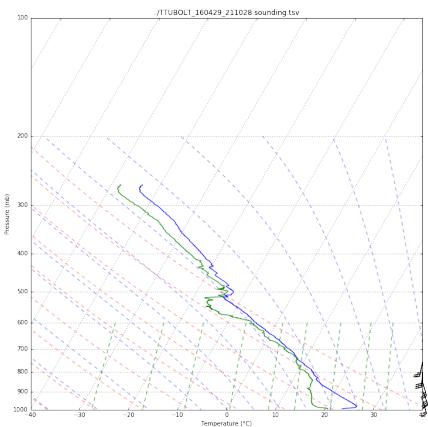
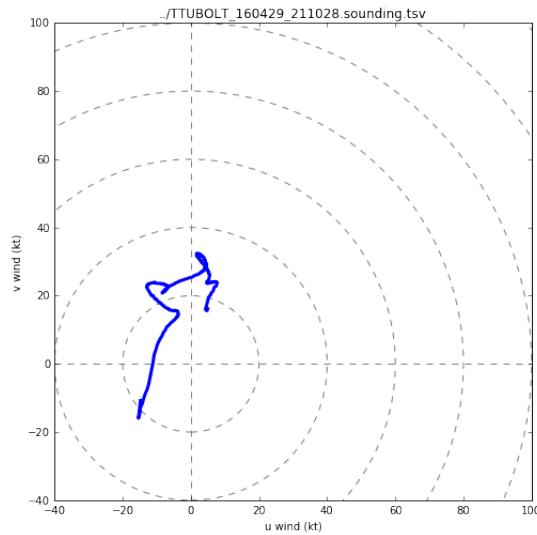
Sounding in cold pool on AL 13, which runs south from Bankston and Berry, AL

- 33.5757, -87.6586
- Launch at 2255 UTC

```
In [20]: snd = SoundingPostProcessor(apr29_21, start_latlon=(33.842762, -87.648562), location="Eldridge, AL")
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 30)
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
# 2016-04-29, 2110 UTC, Eldridge, 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 [21]: TSVdummyHeader=(
"""
Information about map: EDT
=====
Map name (internal)      : EDT000
Sounding set (internal)  :
RS-Number                 :
Data record length        :
```

```

Number of data records   :
Max filemap size        :
Data header size         :
Free space in map        :
Status flag (not used)  :

Record name:      Unit:      Data type:      Divisor: Offset
:
-----
-- time          sec       float (4)      1           0
Pscl           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

*****
*****
```

"""
)

```

from metpy.calc import dewpoint_rh, get_wind_components

def read_recovered_write_tsv(filename, filename_out, skip=2):
    data_in = np.loadtxt(filename, dtype=[('time','f4'), ('Height','f4'),
    '),
                           ('P','f4'), ('T','f4'), ('RH','f4'),
                           ('wspd','f4'),('wdir','f4'),
                           ], skiprows=skip)

    data = np.zeros_like(data_in, dtype=tsv_dtype)
    for name in data.dtype.names:
        data[name] = -32768

    for name in data_in.dtype.names:
        data[name] = data_in[name]

    T_K = (data['T'] * units.celsius).to(units.kelvin)
    Td = dewpoint_rh(T_K, data['RH'] * units.percent)
    Td_K = Td.to(units.kelvin)
    u, v = get_wind_components(data['wspd'] * units.meter / units.second,
    data['wdir'] * units.degree)
    data['Td'] = Td_K
    data['T'] = T_K
    data['u'] = u
    data['v'] = v

    np.savetxt(filename_out, data, fmt='%.2f', delimiter='\t', header
=TSVdummyHeader)

    return data

recovered_apr29_23 = '../TTUBOLT_160429_225500.sounding.txt'
apr29_23_tsvout = '../TTUBOLT_160429_225500.sounding.tsv'
data = read_recovered_write_tsv(recovered_apr29_23, apr29_23_tsvout)

snd = SoundPostProcessor(apr29_23, start_latlon=(33.5757, -87.6586),
, location="Bankston, AL")

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 10)

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

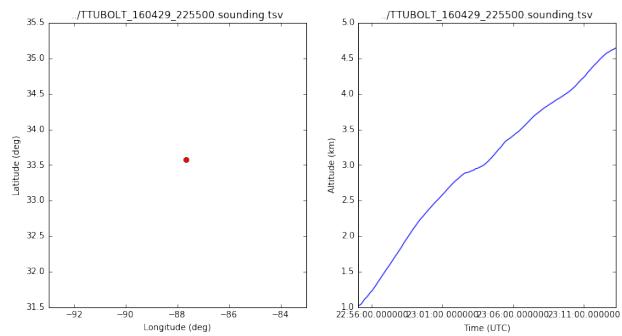
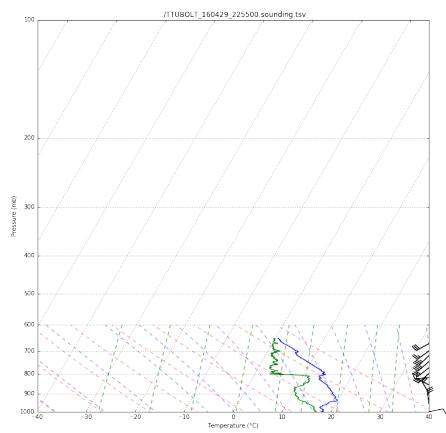
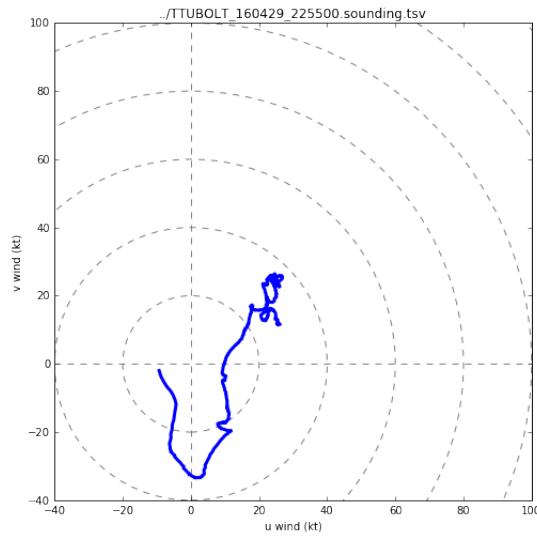
# VORTEX-SE TTU Radiosonde Data
# 2016-04-29, 2255 UTC, Bankston, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), he
ight (m AGL), pressure (mb), temp (deg C), mixing ratio (g/kg), wind
speed (m/s), wind direction (deg)

Recalculating lat, lon data from az, range data because starting loc
```

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 30 2016

DARTS info not in log

Sounding at Tuscumbia / Muscle Shoals Love's

- 34.697462, -87.635408
- Launches at
 - 1606 UTC
 - 1800 UTC
 - 2000 UTC (very full balloon)

Sounding at Cty line on 157 W of Hartselle at/on CR200 near Danville. Near StickNet array.

- 34.394782, -87.118475
- Launch at 2140 UTC

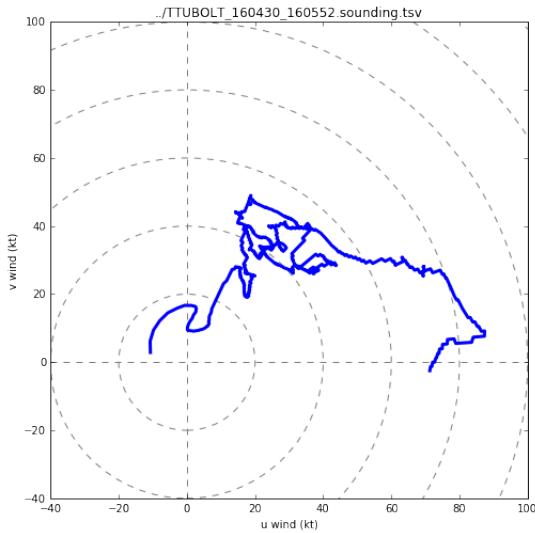
```
In [22]: snd = SoundingPostProcessor(apr30_16, start_latlon=(34.697462, -87.635408), location="Tuscumbia, AL")

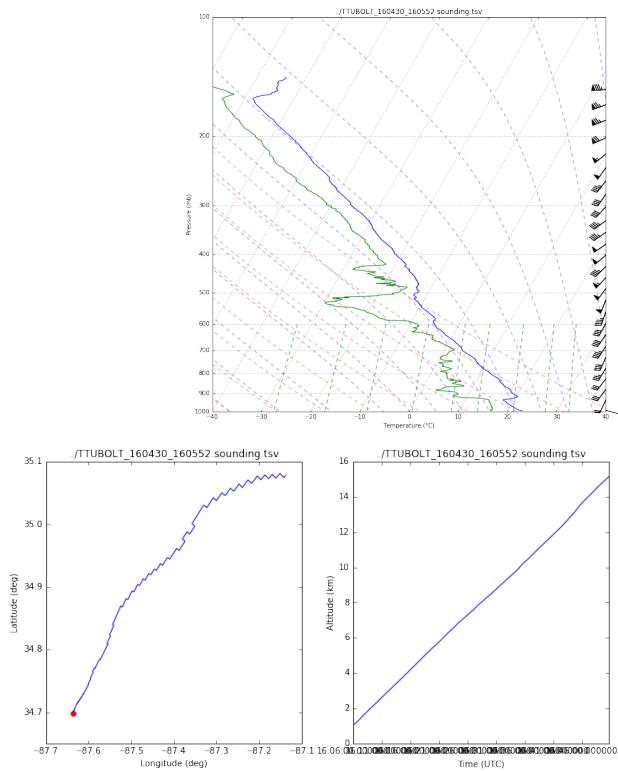
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 10)

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
# 2016-04-30, 1605 UTC, Tuscumbia, 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.





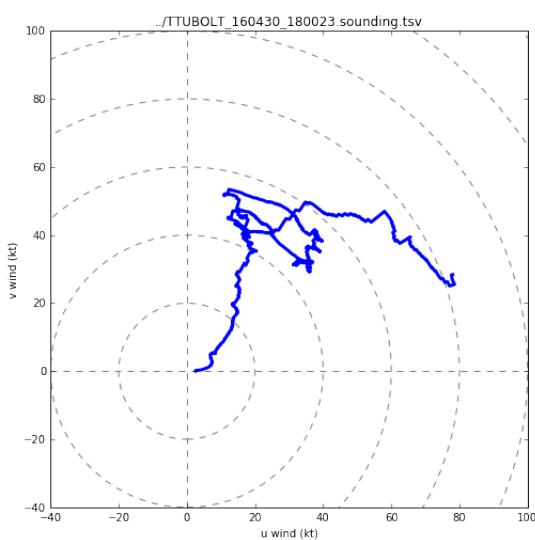
```
In [23]: snd = SoundingPostProcessor(apr30_18, start_latlon=(34.697462, -87.635408), location="Tuscumbia, AL")

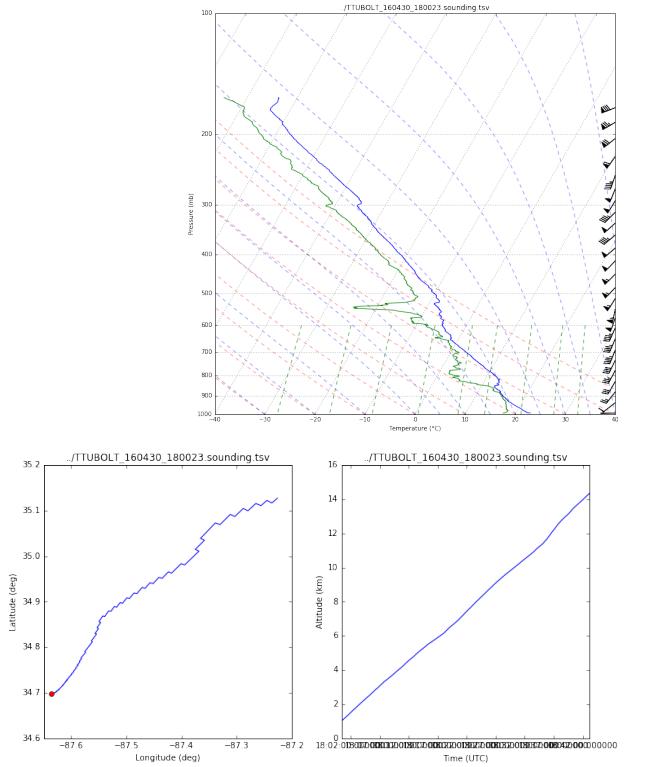
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 10)

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
# 2016-04-30, 1800 UTC, Tuscumbia, 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.
```



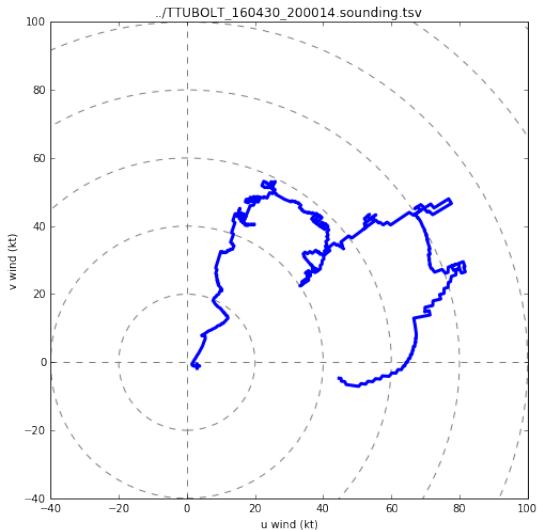


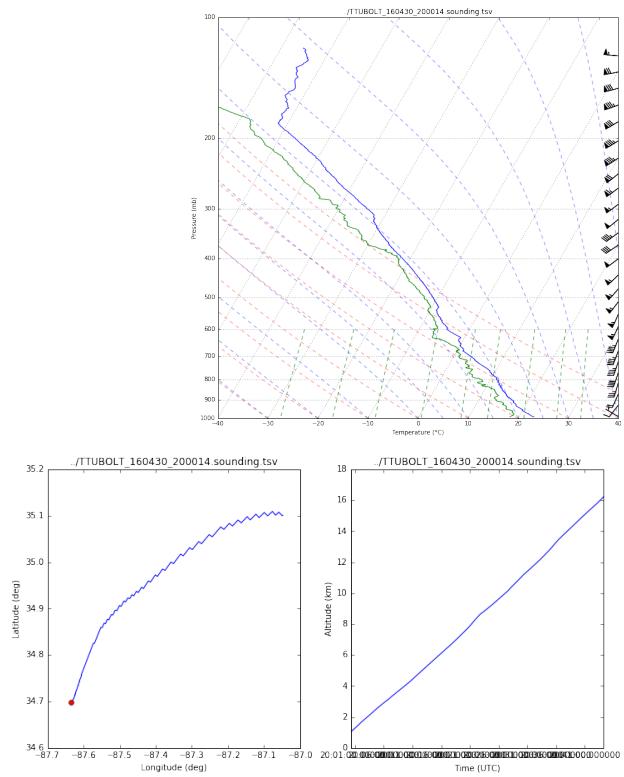
```
In [24]: snd = SoundingPostProcessor(apr30_20, start_latlon=(34.697462, -87.635408), location="Tuscumbia, AL")

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 10)
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
2016-04-30, 2000 UTC, Tuscumbia, 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.



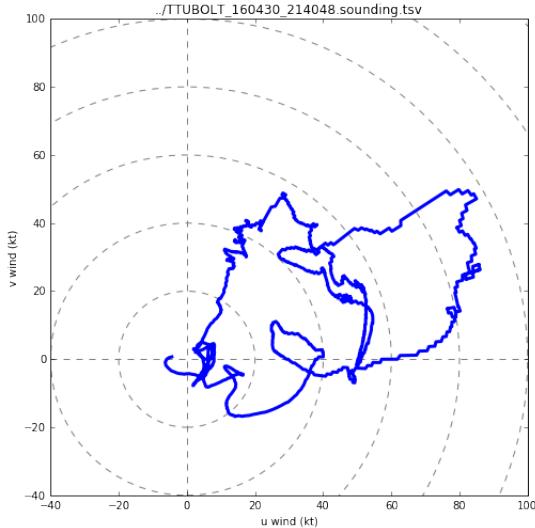


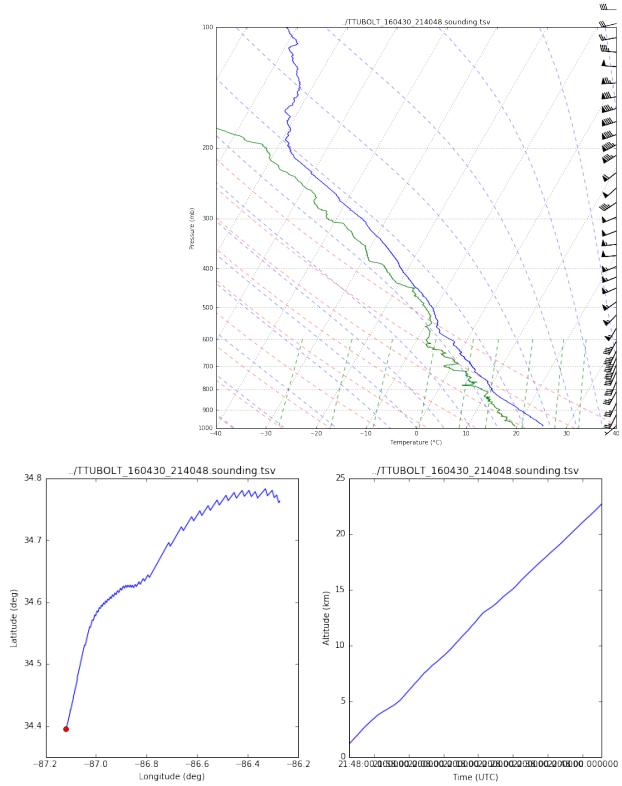
```
In [25]: snd = SoundingPostProcessor(apr30_21, start_latlon=(34.394782, -87.118475), location="Danville, AL")
        snd.plot_hodo()
        snd.plot_skewt()
        snd.plot_track()
#        snd.print_raw_data(0, 10)

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
2016-04-30, 2140 UTC, Danville, 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.





May 1 2016

Boundary layer experiment

Soundings southeast of Pryor Field Regional Airport, at ball fields. Across the river from Decatur, AL.

- 34.643958, -86.940602
- Launches at
 - 1630 UTC
 - 1730 UTC
 - 1842 UTC
 - 1930 UTC
 - 2030 UTC

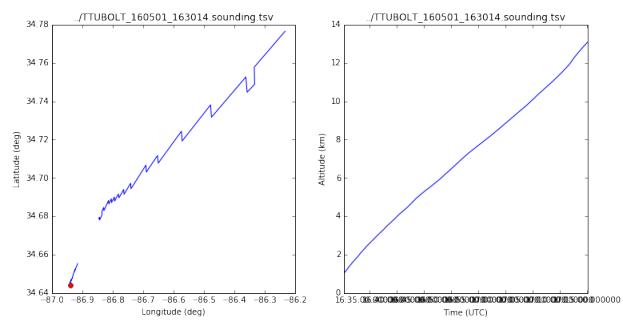
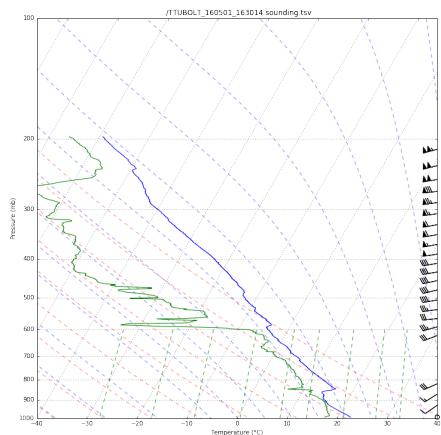
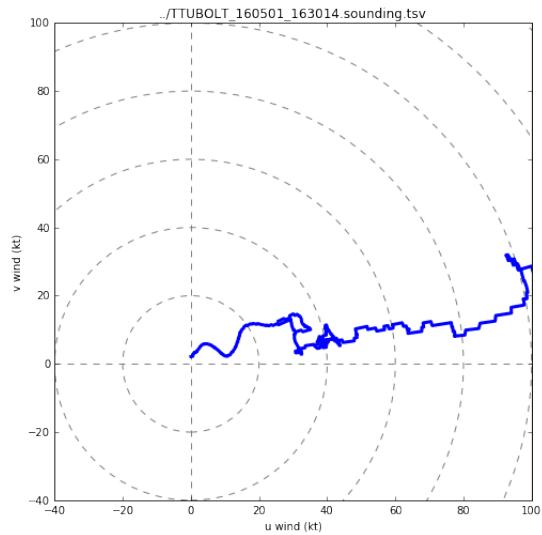
```
In [26]: snd = SoundingPostProcessor(may01_16, start_latlon=(34.643958, -86.940602), location="Pryor Field Decatur, AL")

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 10)

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
# 2016-05-01, 1630 UTC, Pryor Field Decatur, 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.
```

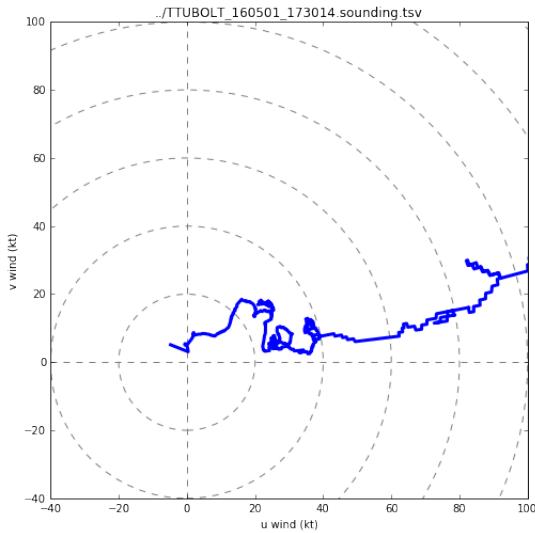


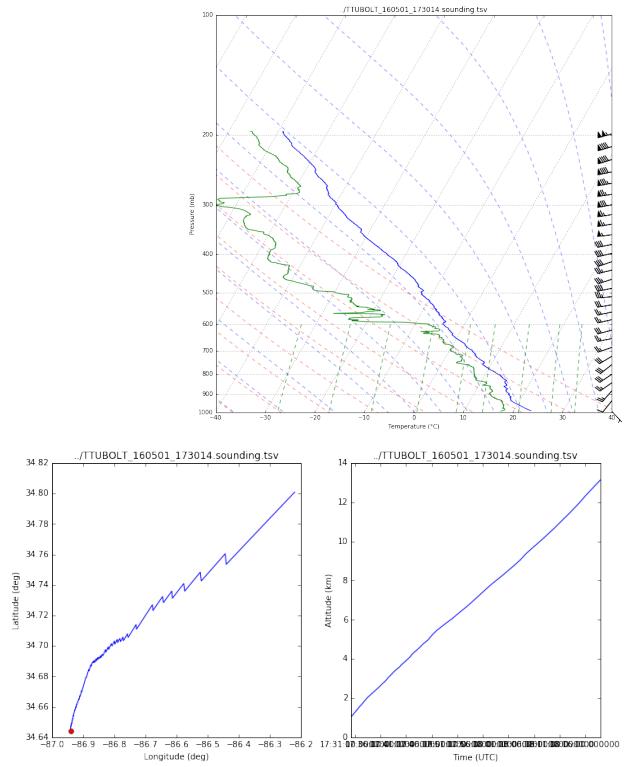
```
In [27]: snd = SoundingPostProcessor(may01_17, start_latlon=(34.643958, -86.940
602), location="Pyror Field Decatur, AL")
T_filt = snd.filters['T']
T_filt[[0,1,2]] = True
snd.filters['T'] = T_filt

snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 10)
outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.lo
cation.replace(" ", "").replace(",","")))
snd.save_filtered(outfile)

# VORTEX-SE TTU Radiosonde Data
# 2016-05-01, 1730 UTC, Pyror Field Decatur, AL
# latitude (deg), longitude (deg), UTC time from launch (HHMMSS), he
ight (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 loc
ation differs substantially from initial location in data file.
Recalculating lat, lon data from az, range data because starting loc
ation differs substantially from initial location in data file.
```

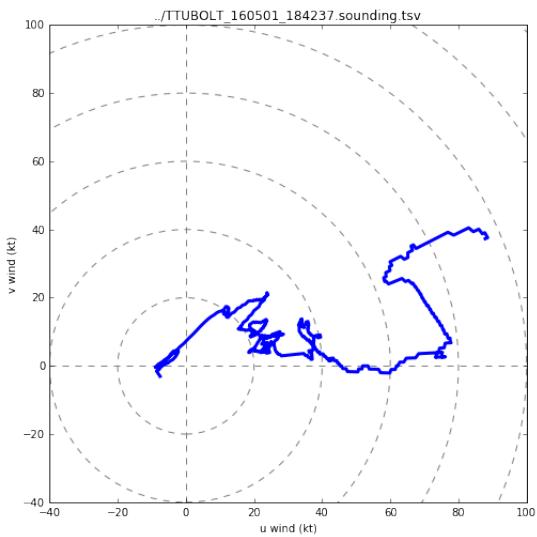


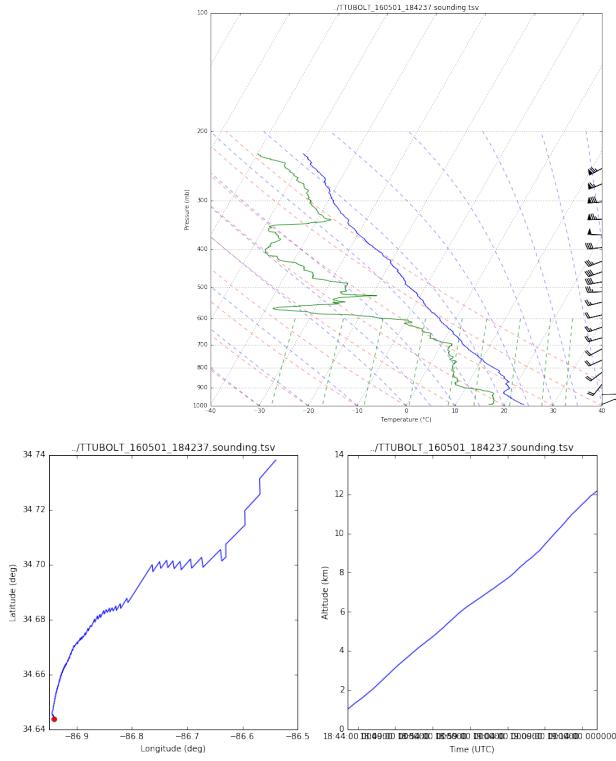


```
In [28]: snd = SoundingPostProcessor(may01_18, start_latlon=(34.643958, -86.940602), location="Pyror Field Decatur, AL")
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 10)
outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(",", "")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2016-05-01, 1842 UTC, Pyror Field Decatur, 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.

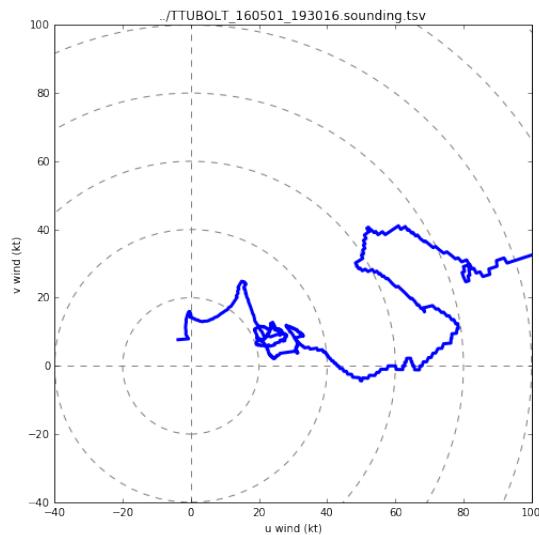


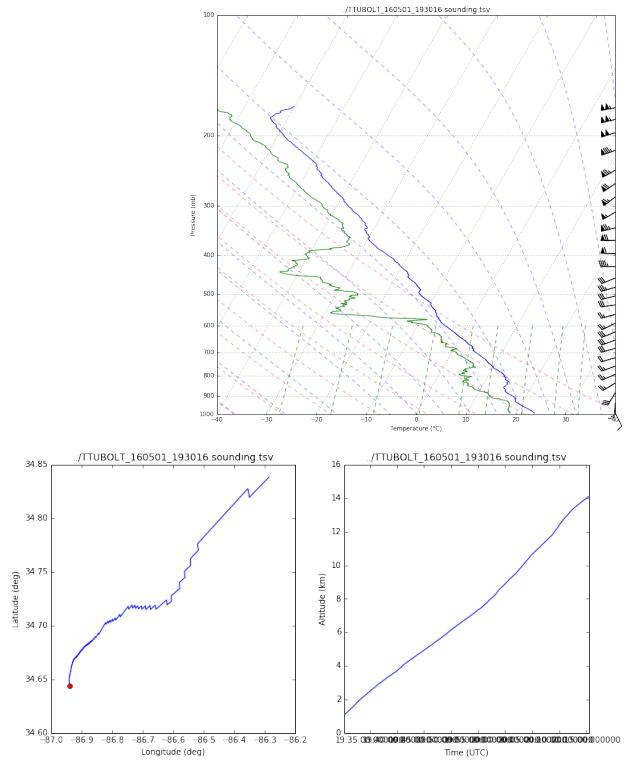


```
In [29]: snd = SoundingPostProcessor(may01_19, start_latlon=(34.643958, -86.940602), location="Pyror Field Decatur, AL")
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 10)
outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(", ", "")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2016-05-01, 1930 UTC, Pyror Field Decatur, 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.

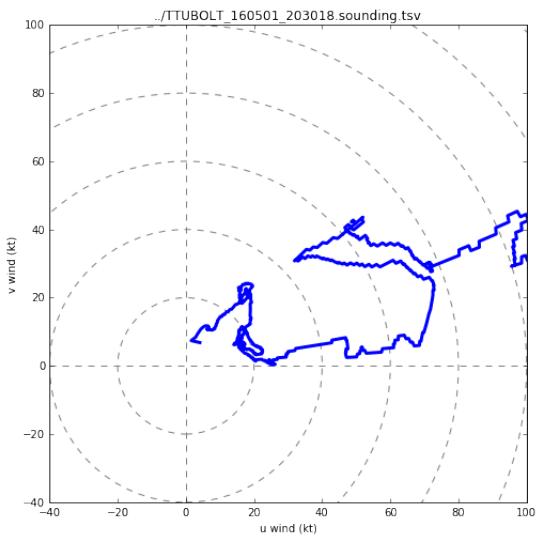


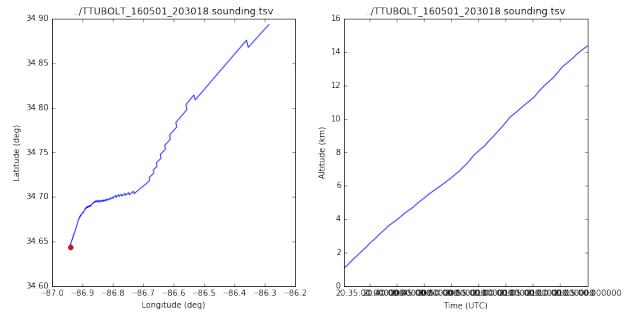
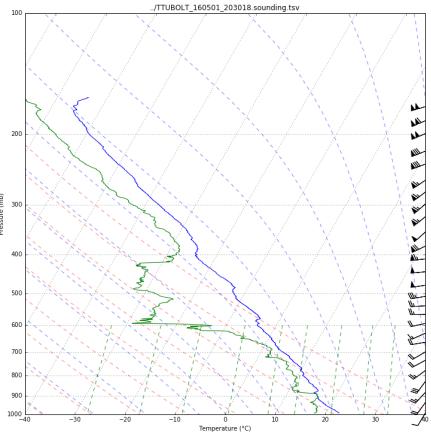


```
In [30]: snd = SoundingPostProcessor(may01_20, start_latlon=(34.643958, -86.940602), location="Pyror Field Decatur, AL")
snd.plot_hodo()
snd.plot_skewt()
snd.plot_track()
# snd.print_raw_data(0, 10)
outfile = snd.launch.strftime("%Y%m%d_%H%MZ_TTU_{0}.txt".format(snd.location.replace(" ", "").replace(", ", "")))
snd.save_filtered(outfile)
```

```
# VORTEX-SE TTU Radiosonde Data
# 2016-05-01, 2030 UTC, Pyror Field Decatur, 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 []:

In []:

In []: