Science_Flight_20151201

February 22, 2016

In this report, we'll review the science flight of the ER-2 starting on 12/01/2015. This was a ~5-h flight that overflew both orographic precipitation ahead of a weak cold front. First, let's import all the needed modules and ingest and process the raw data.

In [1]:
```
from __future__ import print_function
import numpy as np
import matplotlib.pyplot as plt
import datetime as dt
import os
import glob
import pyart
import rawpyampr
import pyampr
from awot.graph.common import create_basemap
from awot.graph.flight_level import FlightLevel
from pyart_tools import plot_list_of_fields
%matplotlib inline
```

In [2]:
```
import warnings
warnings.filterwarnings('ignore')
def delete_file(fname):
    try:
        os.remove(fname)
    except:
        pass
```

In [3]:
```
datadir = './'
files = glob.glob(datadir + '*.dat')
print(files)
fname = os.path.basename(files[0])[:-4]
```

```
['./AMPR-20151201-180836.dat', './AMPR-20151201-203906.dat', './AMPR-20151202-010843.dat']
```

In [4]:
```
payload = rawpyampr.ampr_payload.AMPR_Payload(files)
l1file = fname + '_L1.nc'
l2file = fname + '_L2.nc'
delete_file(l1file)
payload.writeLevel1B(l1file)
L1B = rawpyampr.ampr_level1b.AMPR_QC(l1file)
delete_file(l2file)
L1B.writeLevel2B(l2file)
```

```
All of file: ./AMPR-20151201-180836.dat Read Successfully
End of data stream reached
All of file: ./AMPR-20151201-203906.dat Read Successfully
```

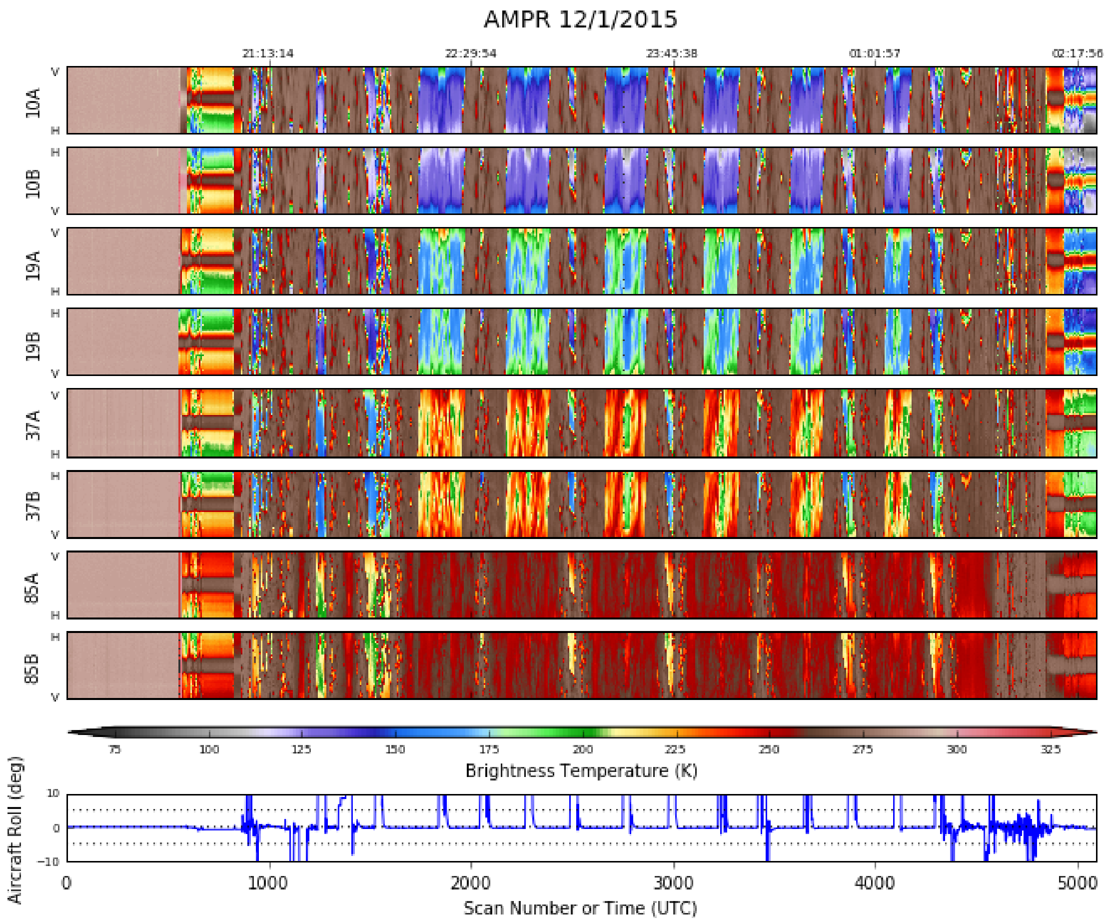
```
End of data stream reached
All of file: ./AMPR-20151202-010843.dat Read Successfully
End of data stream reached
Interpreting Navigation Records as: IWG1
 No navigation file found
Navigating pixels using internal recording of nav data.
Number points to converge: 4
Writing to output file:  AMPR-20151201-180836_L1.nc
Found Navigation Data!
Writing to output file: AMPR-20151201-180836_L2.nc
File containing water fraction not on path
```

Now we are ready to read in and display the L2 geolocated brightness temperatures.

```
In [5]: data = pyampr.AmprTb(l2file)
        data.plot_ampr_channels()
```

```
********************
read_ampr_tb_level2b(): Reading AMPR-20151201-180836_L2.nc
Assuming OLYMPEX data structure.
Change to proper project if incorrect, otherwise errors will occur.
Currently available field projects: OLYMPEX, IPHEX, MC3E, TC4, TCSP, JAX90, COARE,
CAMEX1, CAMEX2, CAMEX3, CAMEX4, TRMMLBA, KWAJEX, TEFLUNA, FIRE3ACE, CAPE
Default: project = 'OLYMPEX'
Found Navigation Data!
(5090,)
********************


********************
plot_ampr_channels():
Available scans = 1 to 5090
Available times = 18:08:40 - 02:24:52
********************
```

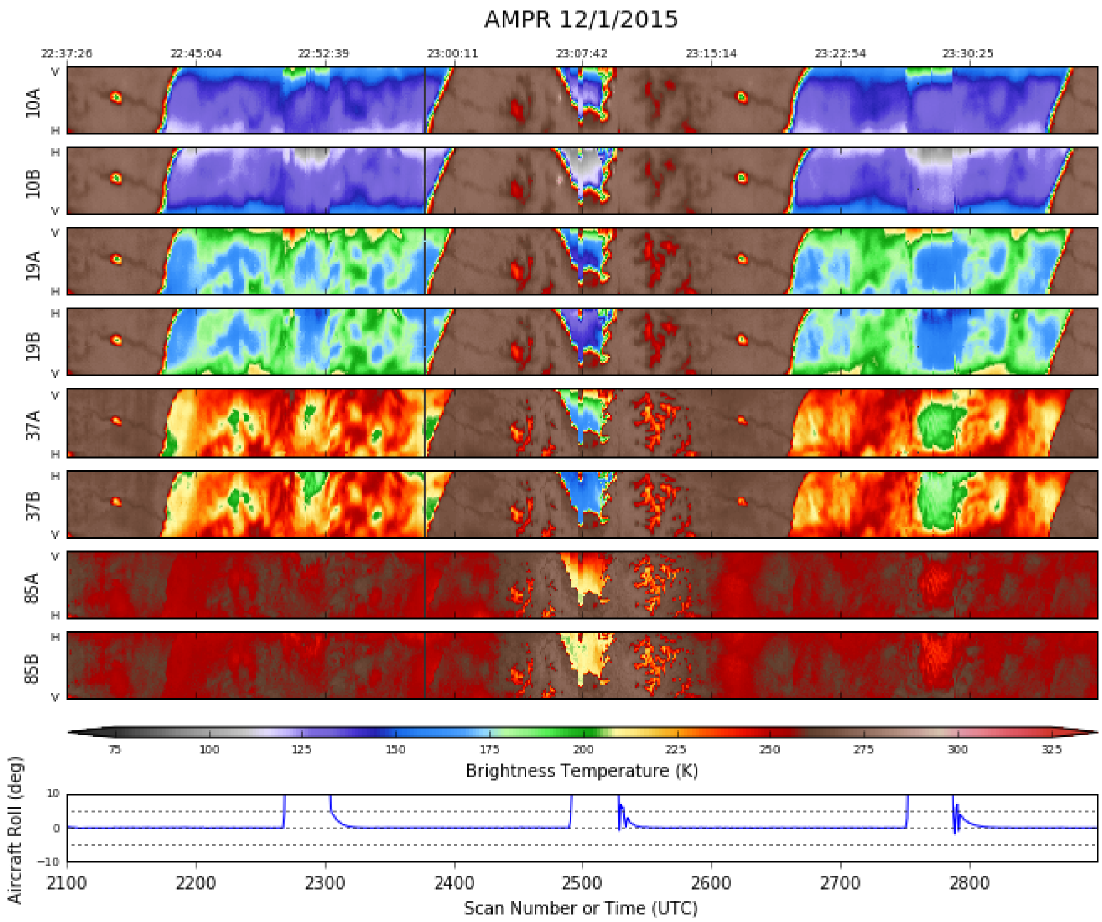


Overall, this looks really good. All channels behaved well. The early part of the chart consists of engineering test data, which is why the channels look so uniform at first.

We will focus on the science. The ER-2, after gaining altitude, essentially did just one pattern - orbits that overflew stratiform precipitation that was moving off the water and interacting with the mountains. The overall pattern repeated itself, so let's just look at a single orbit.

```
In [7]: data.plot_ampr_channels(scanrange=[2100, 2900])
```

```
********************
plot_ampr_channels():
Available scans = 1 to 5090
Available times = 18:08:40 - 02:24:52
********************
```



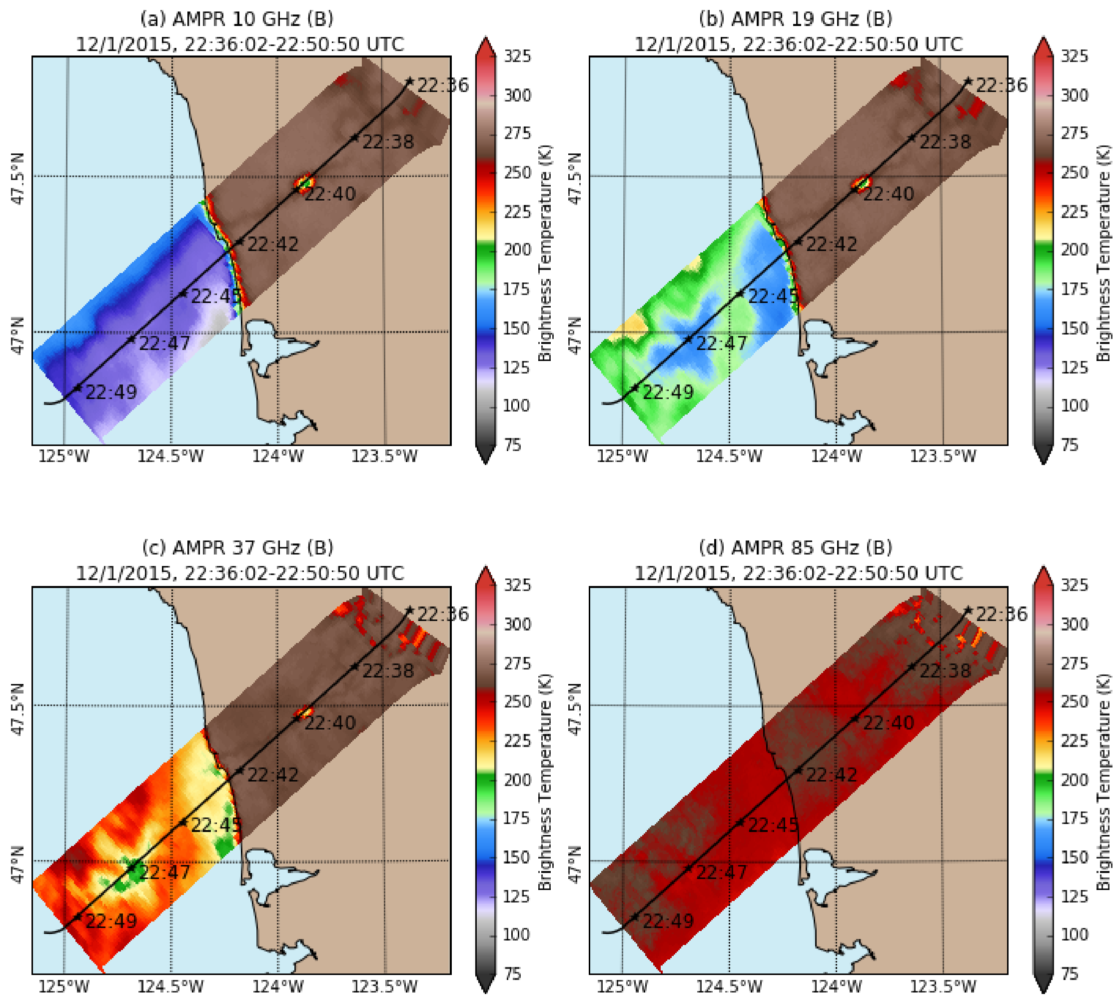
There was a very short data outage during this orbit, maybe a couple seconds. Otherwise, what we see is a very typical pattern for this flight. The 10-37 GHz channels were largely insensitive to the stratiform precipitation over land, but did sense emission over the water. Meanwhile, the 85 GHz channels detected precipitation over the land (as well as the water), except for the highest peaks, which were either in the rain shadow or experiencing snowfall.

Let's show this in greater detail using geolocated imagery.

```
In [14]: # Import the ER-2 nav into AWOT (https://github.com/nguy/AWOT)
         # This simplifies plotting the track with time stamps
         flight = pyampr.read_aircraft_nav_into_awot(data)
         tst = '22:36:00'
         ted = '22:51:00'
         start = '2015-12-01 ' + tst
         end = '2015-12-01 ' + ted
         offs = (0.03, -0.03)
```

```
In [16]: display = data.plot_ampr_track_4panel(
             chan='b', timerange=[tst, ted], maneuver=False, return_flag=True,
             meridians=0.5, parallels=0.5, resolution='h',
             show_grid=True)
```

```
f2 = FlightLevel(flight, basemap=display.basemap)
for ax in [display.ax1, display.ax2, display.ax3, display.ax4]:
    f2.plot_trackmap(min_altitude=50., lw=2.5, start_time=start,
                     end_time=end, ax=ax)
    f2.time_stamps(start_time=start, end_time=end,
                   labelspacing=30, ax=ax, label_offset=offs)
```



Very nice land/ocean contrast in the lower frequency channels, while the scene looks like an amorphous soup in the 85 GHz channels, except for the highest terrain. Note the colder temperature signature from the snow fields there. Lake Quinault (where the DOW radar is) also shows up nicely in all channels but 85 GHz, which was more sensitive to the stratiform precipitation instead.

To sum up, this was an interesting dataset from AMPR. Nice stratiform precipitation signal in 85 GHz over both land and ocean, while the lower frequency channels mainly only detected the precipitation over water. Notable land surface features were also detectable by AMPR. No apparent significant quality control problems in the dataset.

In [ ]: