

# The APR-2 algorithm suite and the GRIP experiment dataset

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# Airborne Precipitation Radar (APR-2) - Overview

- Dual-frequency operation with Ku-band (13.4 GHz) and Ka-band (35.6 GHz)
  - Geometry and frequencies chosen to simulate GPM radar
- Measures reflectivity at co- and cross-polarizations, and Doppler
- Range resolution is  $\sim 60$  m
- Horizontal resolution at surface (DC-8 at 11 km altitude) is  $\sim 1$  km

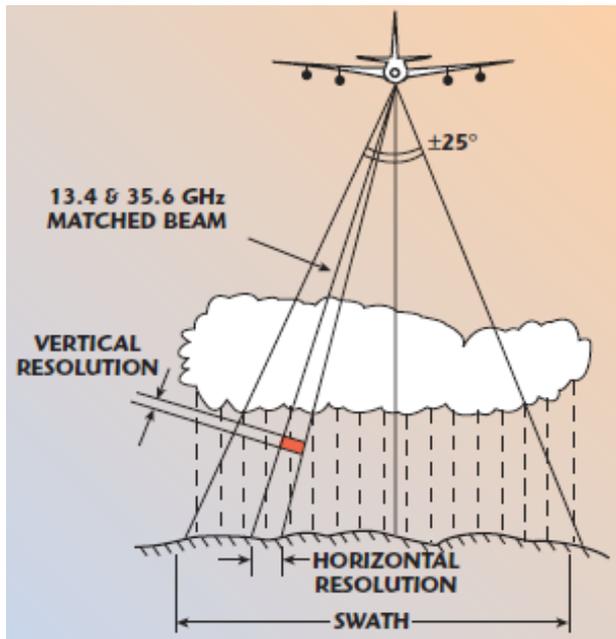
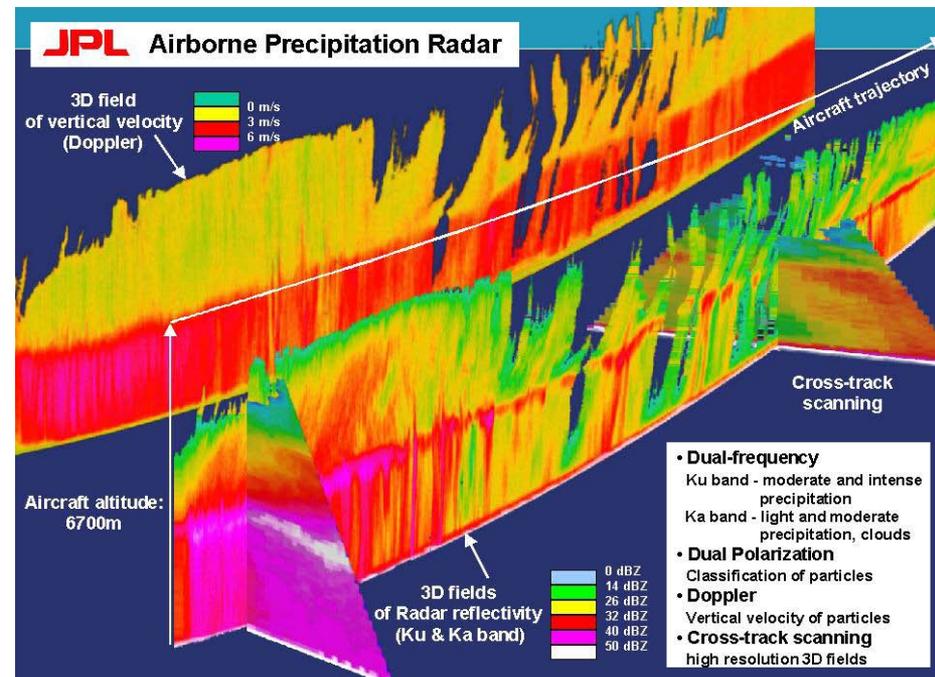


Image below shows 3D nature of APR-2 data; reflectivity or Doppler can be displayed as along-track or cross-track slices



# Data Collected During GRIP

- Table below show each day that APR-2 collected science data, along with total duration and storm name, if applicable

Date	Flight No.	Name	Data Vol.	Comments
8/17	6	Ex TD 5	2 hr	Melting layer spiral
8/24	7	-	4.8 hr	Multiple passes developing cell
8/29	9	Earl	4.4 hr	Cat 1 – developing eye
8/30	10	Earl	3.9 hr	Cat 4
9/1	12	Earl	2.5 hr	Cat 4
9/2	13	Earl	4.3 hr	Collapsing eyewall
9/6	15	Gaston	3.8 hr	Convective cell
9/7	16	Gaston	3.9 hr	Stratiform area
9/12	17	PGI44	4.8 hr	
9/13	18	PGI44	4.7 hr	
9/14	19	PGI44/Karl	2.8 hr	
9/16	20	Karl	3.8 hr	Emerged from Yucatan
9/17	21	Karl	4.4 hr	Landfall – orographic rain
9/21	23	Pre-Matthew	3.6 hr	A-Train underpass
9/22	24	Pre-Matthew	4.5 hr	A-Train underpass

# Performance & Availability

## APR-2 sensitivity during GRIP

T = 10 $\mu$ s	Ku [dBZ]		Ka [dBZ]	
Distance	1- $\sigma$	<b>3-<math>\sigma</math></b>	1- $\sigma$	<b>3-<math>\sigma</math></b>
2 km	-19	<b>-14</b>	-26	<b>-21</b>
5 km	-11	<b>-6</b>	-17	<b>-13</b>
10 km	-5	<b>0</b>	-12	<b>-7</b>

New **Radome** improved Ka-band sensitivity and quality with respect to previous experiments.

New upgrades are expected to bring as much as 10 dB extra sensitivity for upcoming experiments (implementation in progress), and a zenith port (potential).

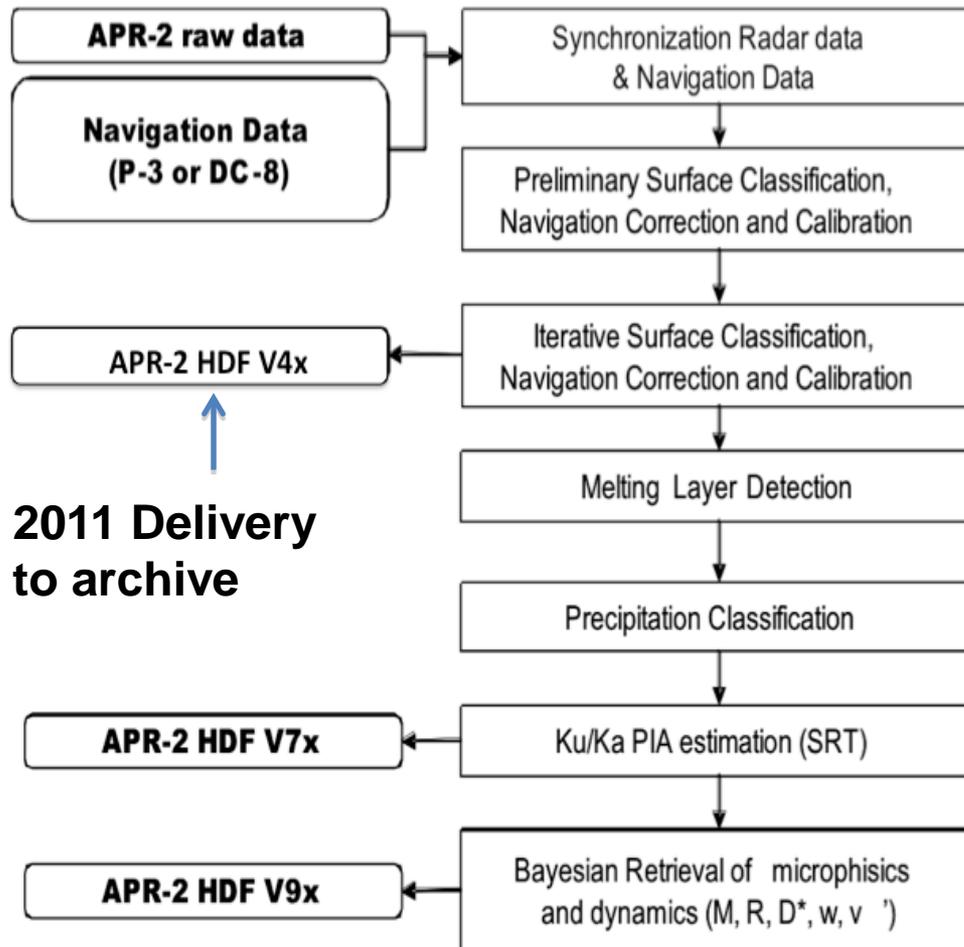
Outage Date	Outage start UTC	Duration [min]	Band
2010/08/24	Take off	Until ~18:50 UTC	Ku LDR loss
2010/09/06	19:56	1	Overflows Ku
2010/09/06	20:26	1	Ka TWTA fault
2010/09/13	23:48	6	Overflows Ku
2010/09/14	20:20	2	Ka TWTA fault
2010/09/17	20:39	1	Ku TWTA fault
2010/09/17	21:29	1	Not scanning
2010/09/21	20:09	1	Ka TWTA fault
2010/09/22	16:24	6	Not scanning
2010/09/22	16:40	5	Not scanning
2010/09/22	17:04	4	Ka TWTA fault
2010/09/22	21:45	32	Not scanning

List of hardware-induced **outages** is included in the APR-2 data document together with the list of known issues.

Please, please, please with a cherry on top, read it. It's only 4 pages plus the browse image handbook.

# Post-Experiment Processing

- The flow-chart below illustrates the processing of APR-2 data post-experiment
- Calibrated reflectivities, Doppler have been delivered to archive 5/12



Thanks to P.Bui & his team's early delivery of **MMS** data, the current release also takes advantage of the MMS 20Hz & GPS for improved geolocation and platform correction.

**2011 Delivery to archive**

Considered for Inclusion in the **BROWSE IMAGES** of the 2011 Delivery

# Calibration and data quality

## **Reflectivity**

Calibration method is the usual for APR-2: Ku-band NRCS targeted at 7 dB @ 10° incidence, temporal variabilities tracked by internal calibration loop, Ka-band calibrated relative to Ku-band in Rayleigh scattering areas. Overall accuracies estimated at +/- 1 dB

## **LDR**

Calibrated with natural surface targets. Overall accuracy estimated at +/- 2dB.

## **Doppler**

Surface Doppler velocity dealiased and removed. Surface Doppler velocity estimated from Navigational data saved also in the dataset.

Doppler velocities dealiased via 3-D unwrapping and multi-frequency consistency.

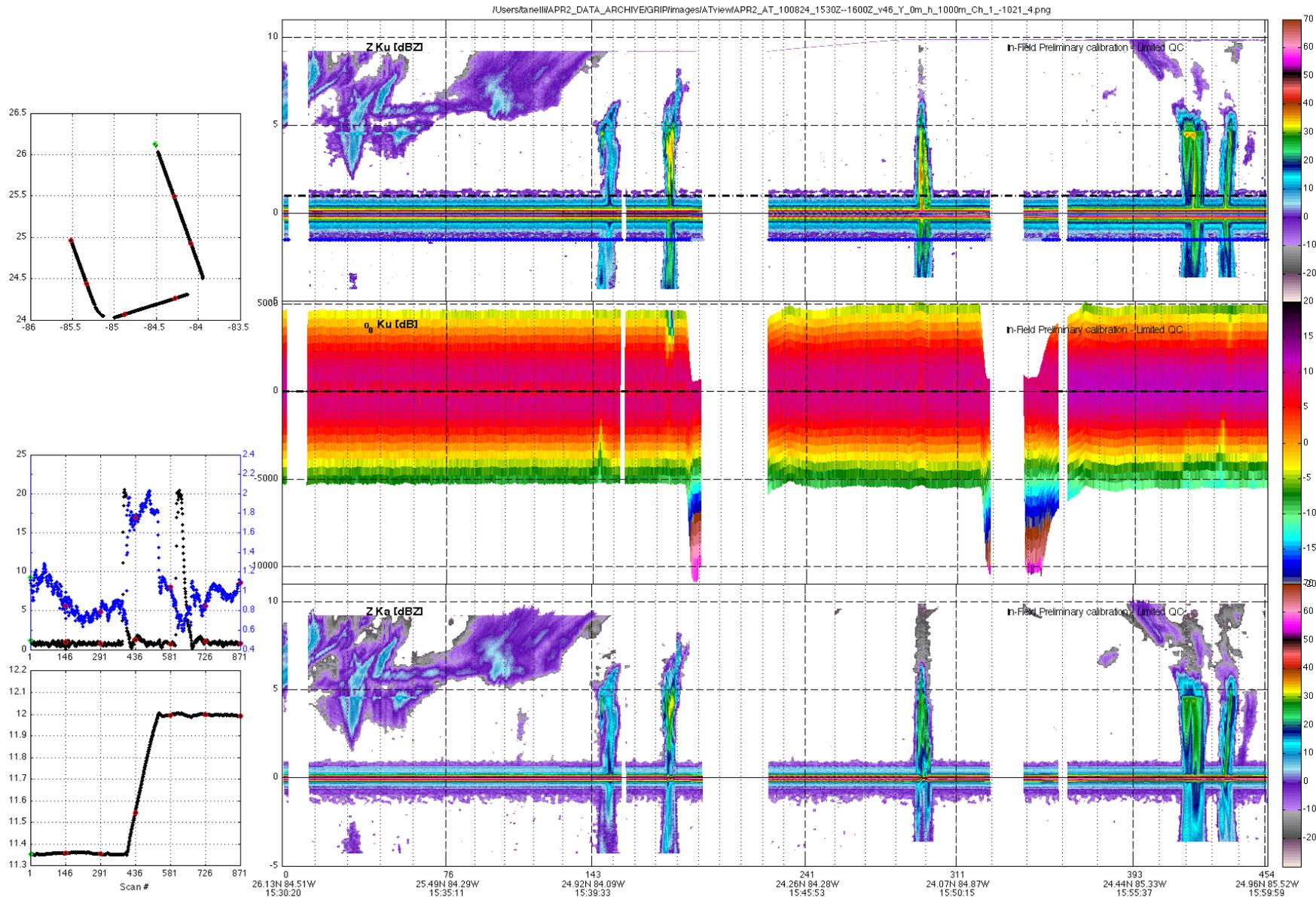
During level flight overall accuracy estimated at 0.35 m/s.

Ingestion of the MMS 20Hz improved significantly performance during aircraft maneuvers, overall performance assessment to be carried out.

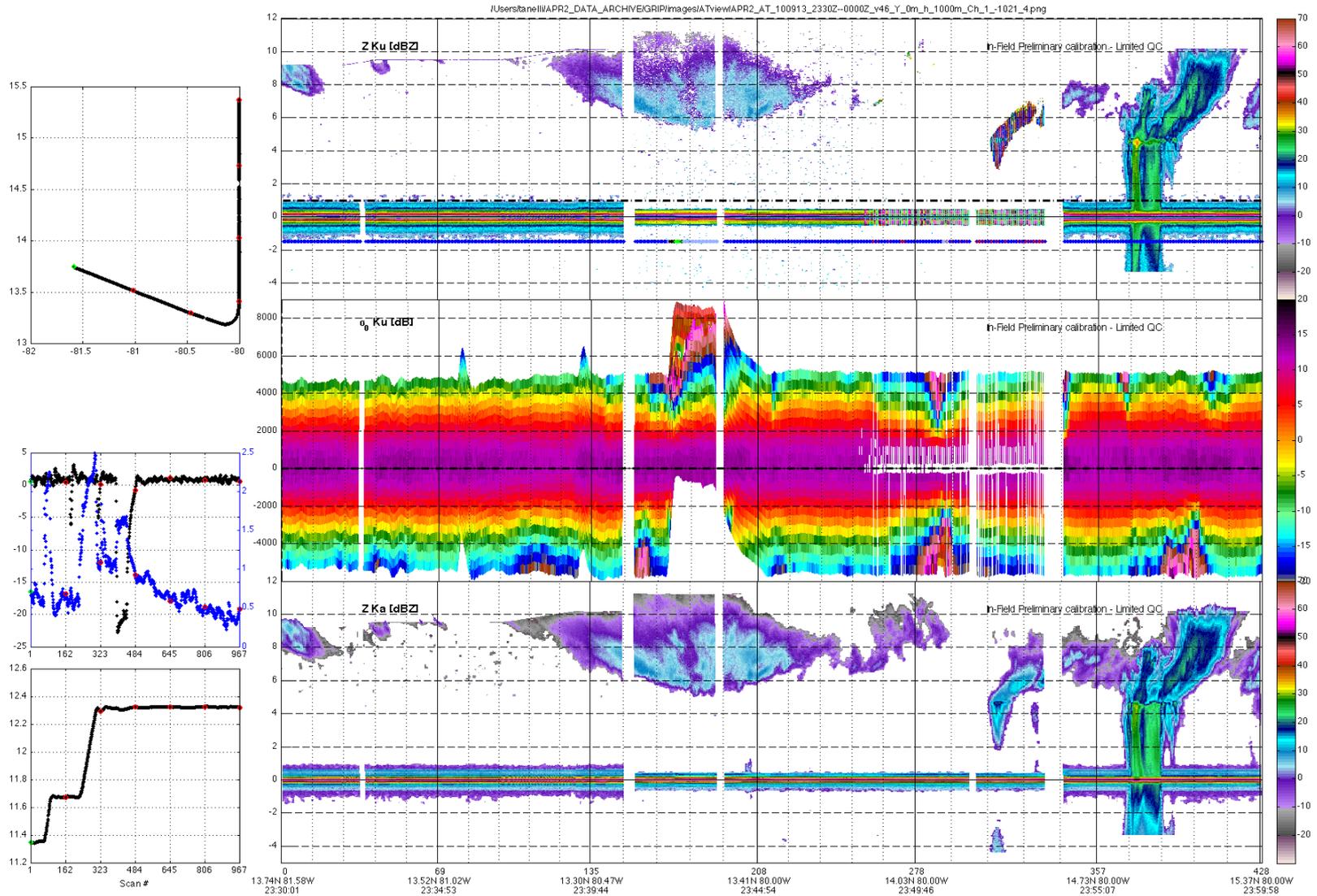
The cross-track wind product algorithm automatically selects viable targets and produces the estimated X-wind together with the departure from the constant-wind fit (metric of reliability).

Ideal cross-validation proposed with HIWRAP (same frequencies): APR-2 has solid reflectivity calibration, HIWRAP will have solid wind velocity measurements. Possible cross-validation of Doppler products also with the other platforms.

# Backup: the warm signatures

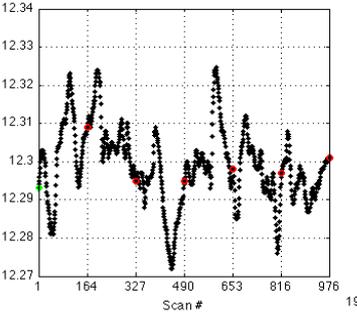
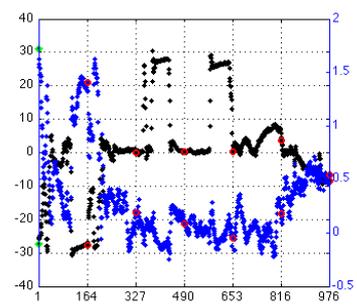
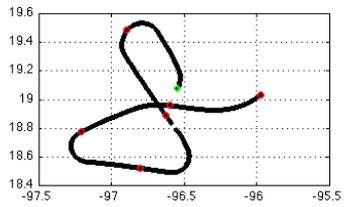
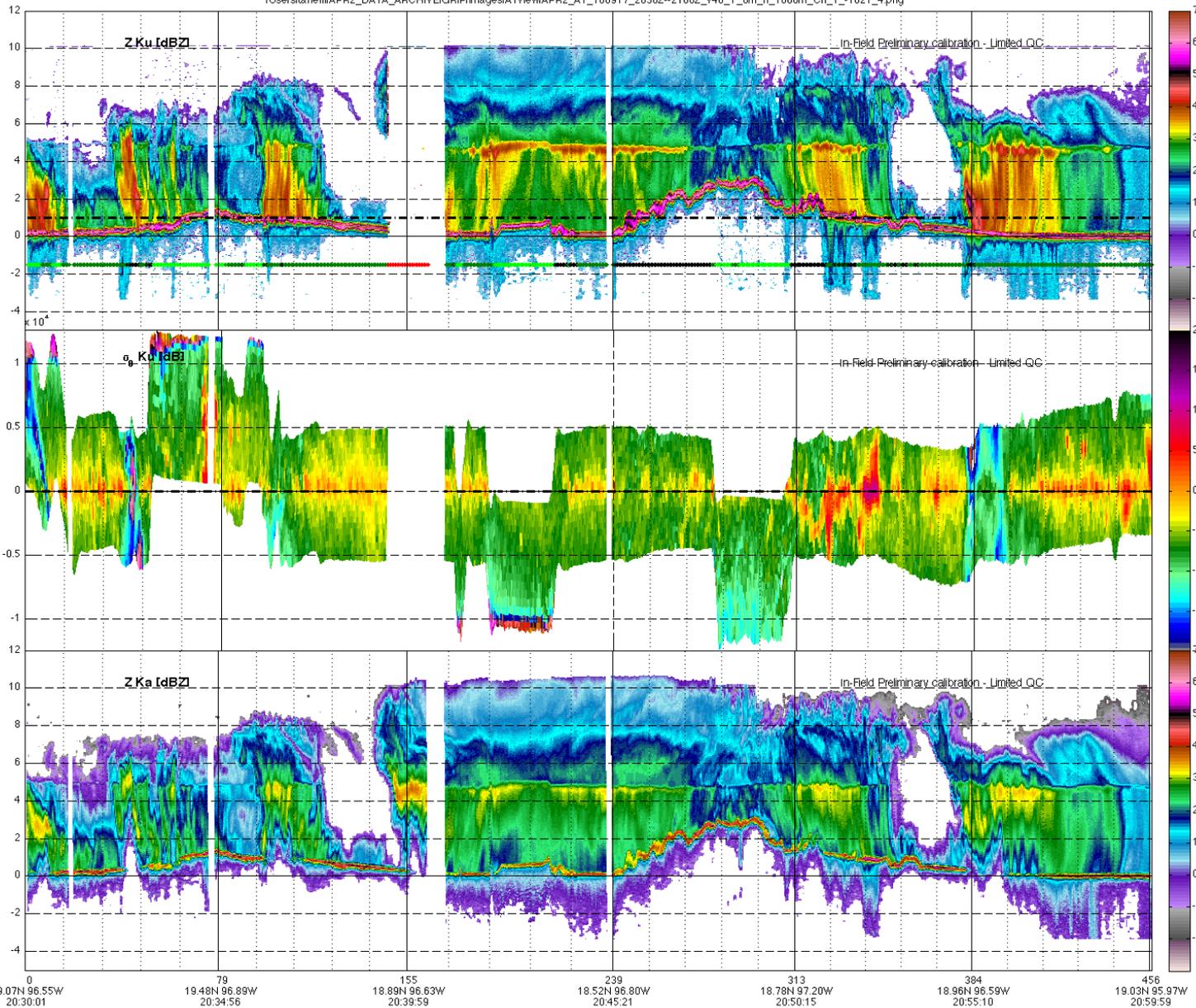


# Backup: the overflows



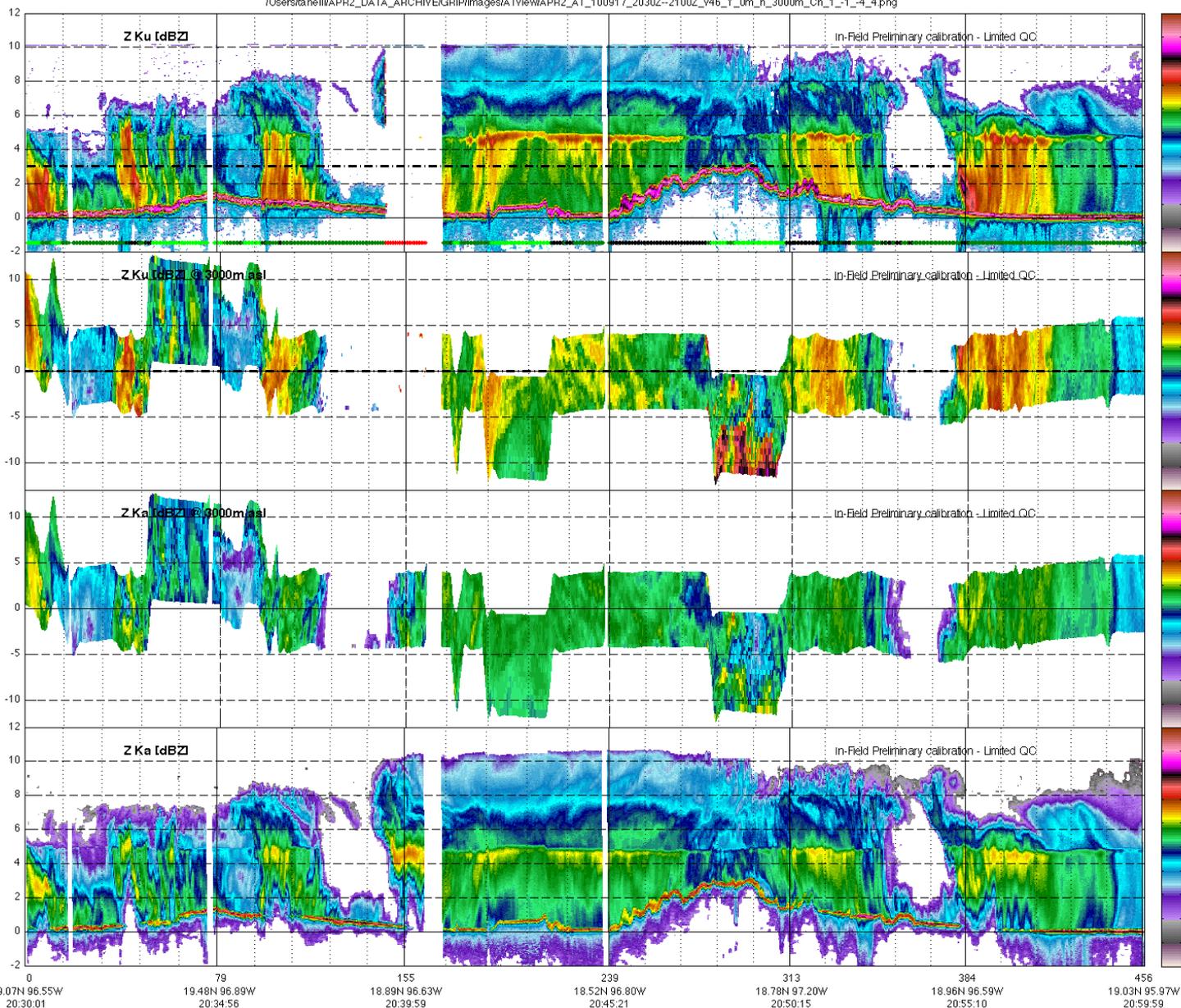
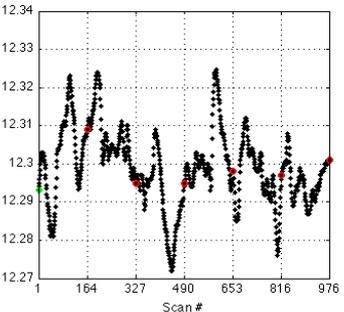
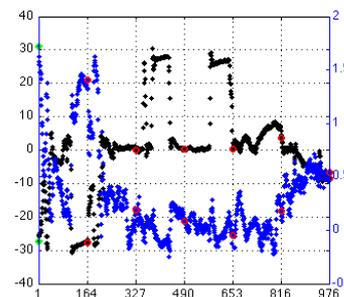
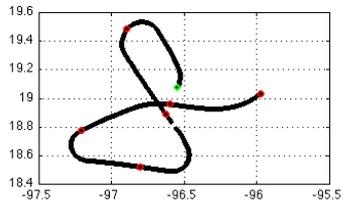
# Browse image 1: Basic availability

I:\Users\stanel\APR2\_DATA\_ARCHIVE\GRIP\Images\ATview\APR2\_AT\_100917\_2030Z--2100Z\_v46\_Y\_0m\_h\_1000m\_Ch\_1\_-1021\_4.png



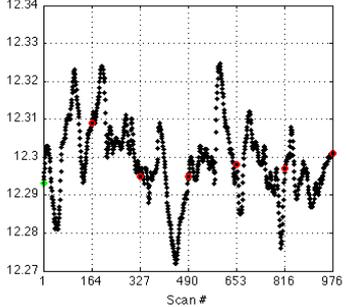
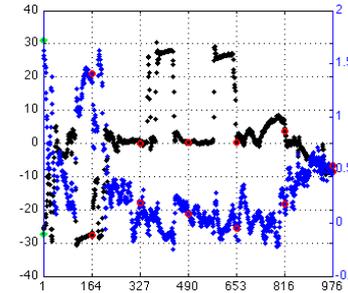
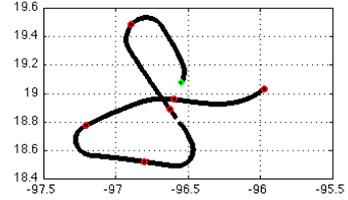
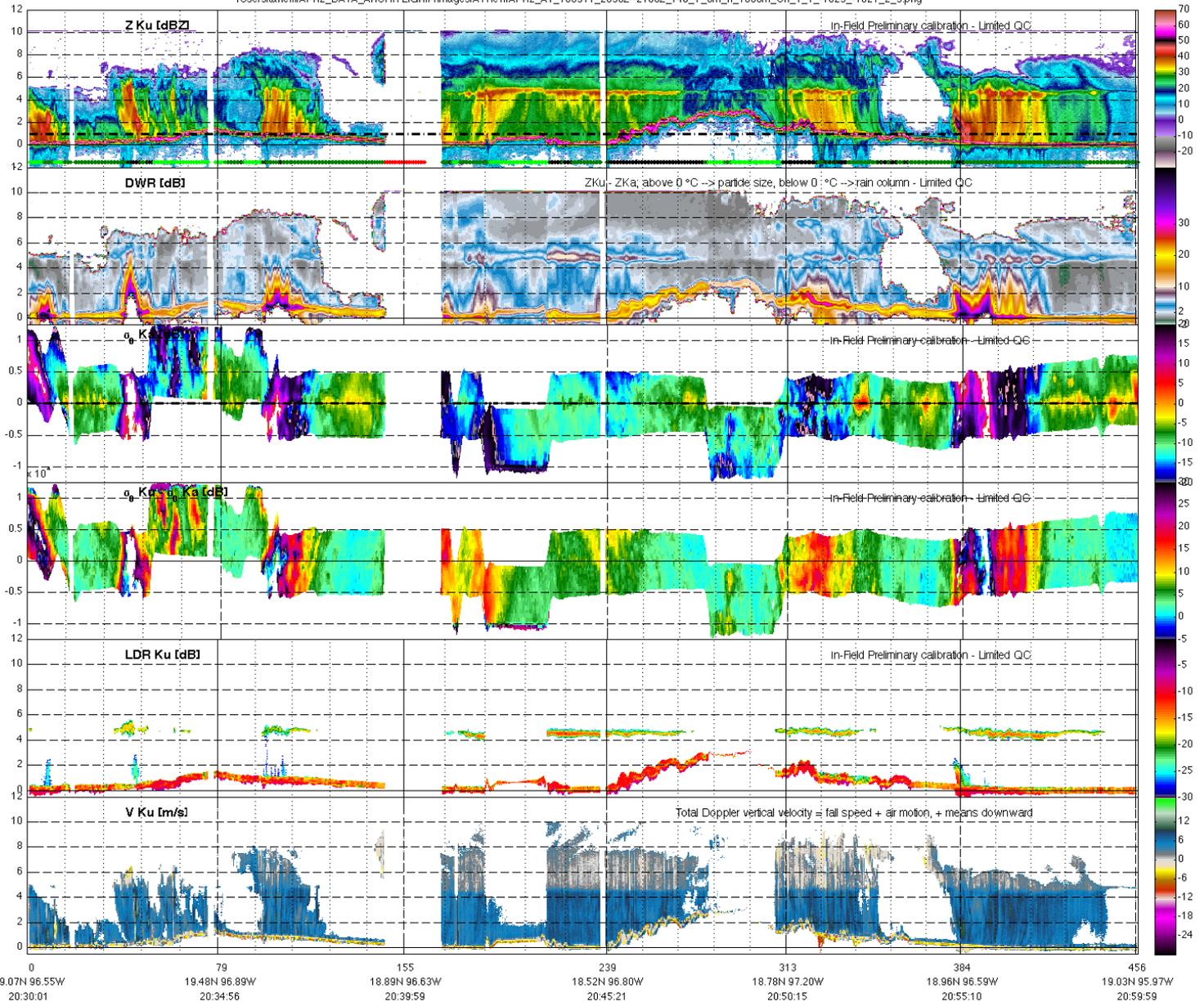
# Browse image 2: dBZ slices

/Users/ta nell/APR2\_DATA\_ARCHIVE/GRIPI/Images/ATView/APR2\_AT\_100917\_2030Z--2100Z\_v46\_Y\_0m\_h\_3000m\_Ch\_1\_1\_4\_4.png



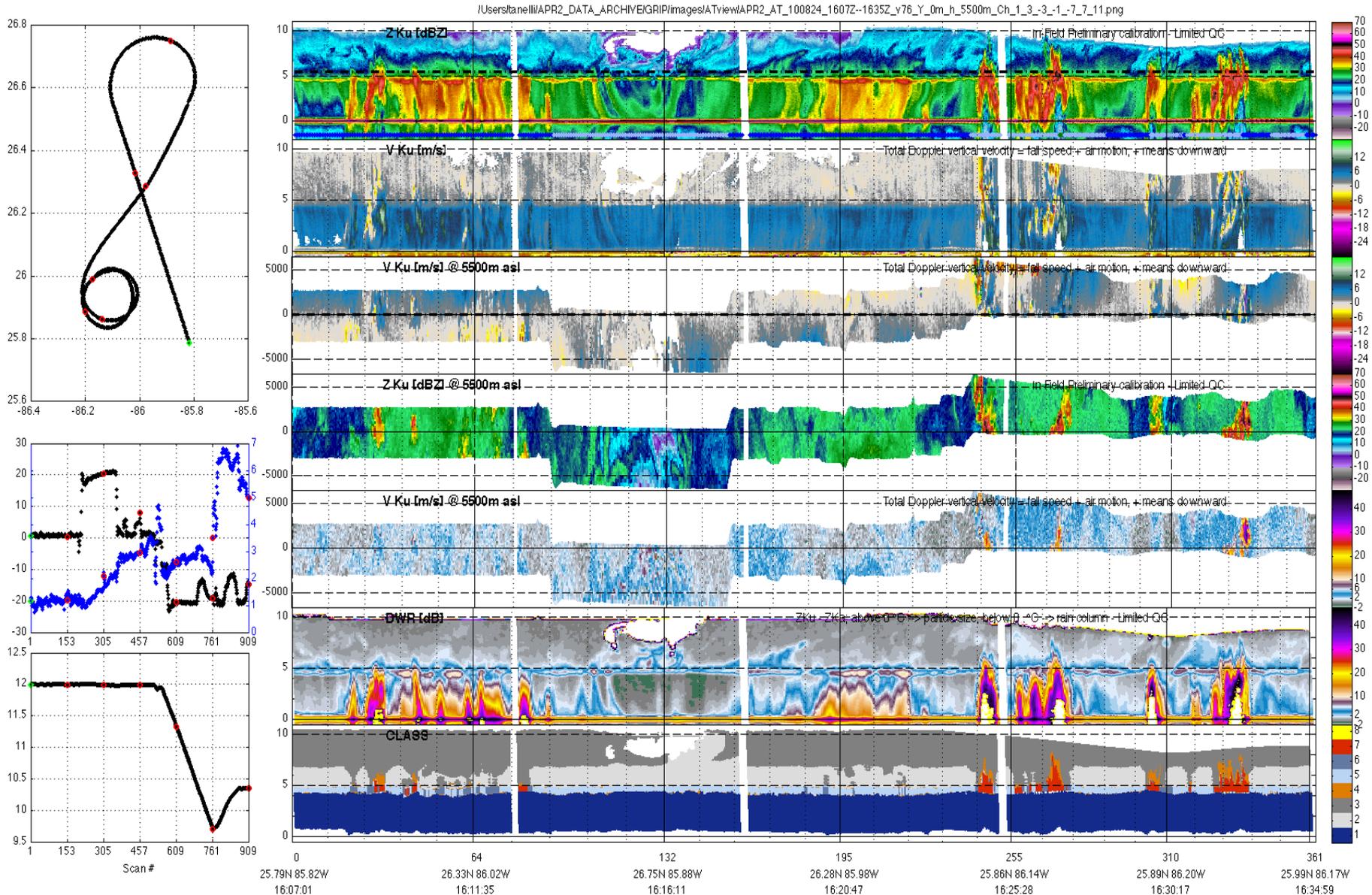
# Browse image 3: other products

Users\stanel\I\APR2\_DATA\_ARCHIVE\GRIPI\Images\AView\APR2\_AT\_100917\_2030Z--2100Z\_v46\_Y\_0m\_h\_1000m\_Ch\_1\_7\_-1023\_-1027\_2\_3.png



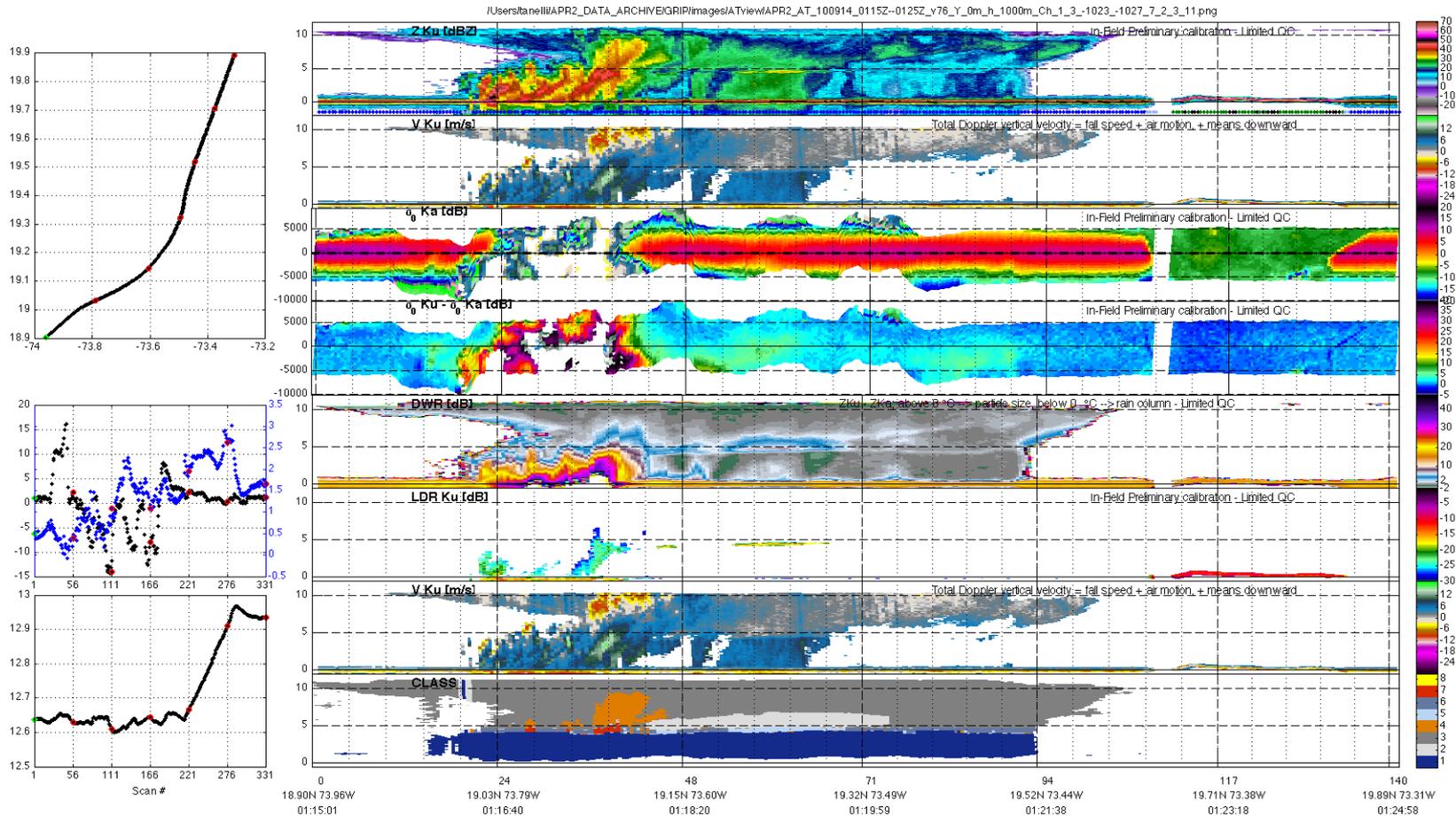
# V7.X preview in 2011 release: BIN CLASS

## (the "5 snapshot" convective cells)

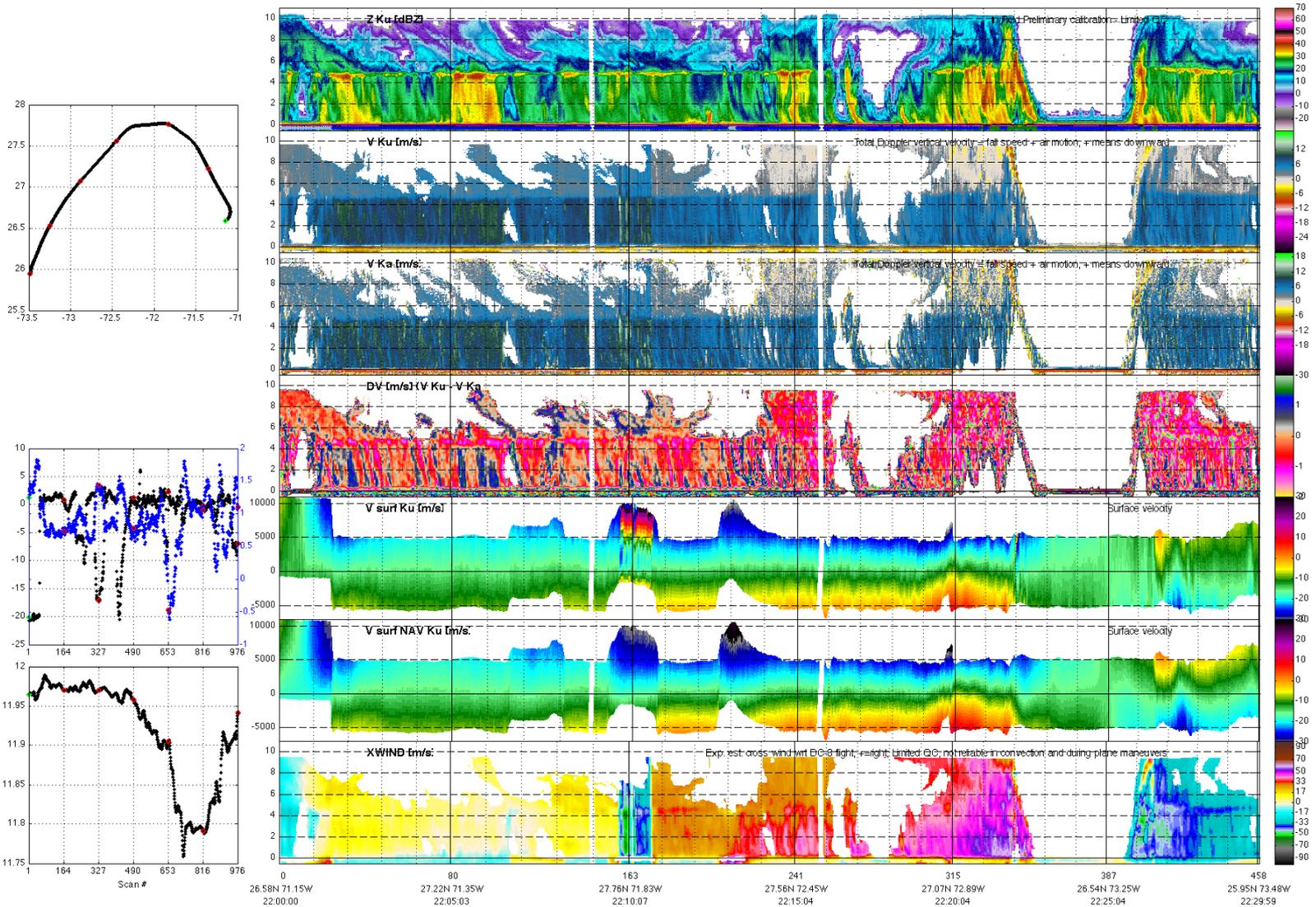


# V7.X preview in 2011 release: BIN CLASS

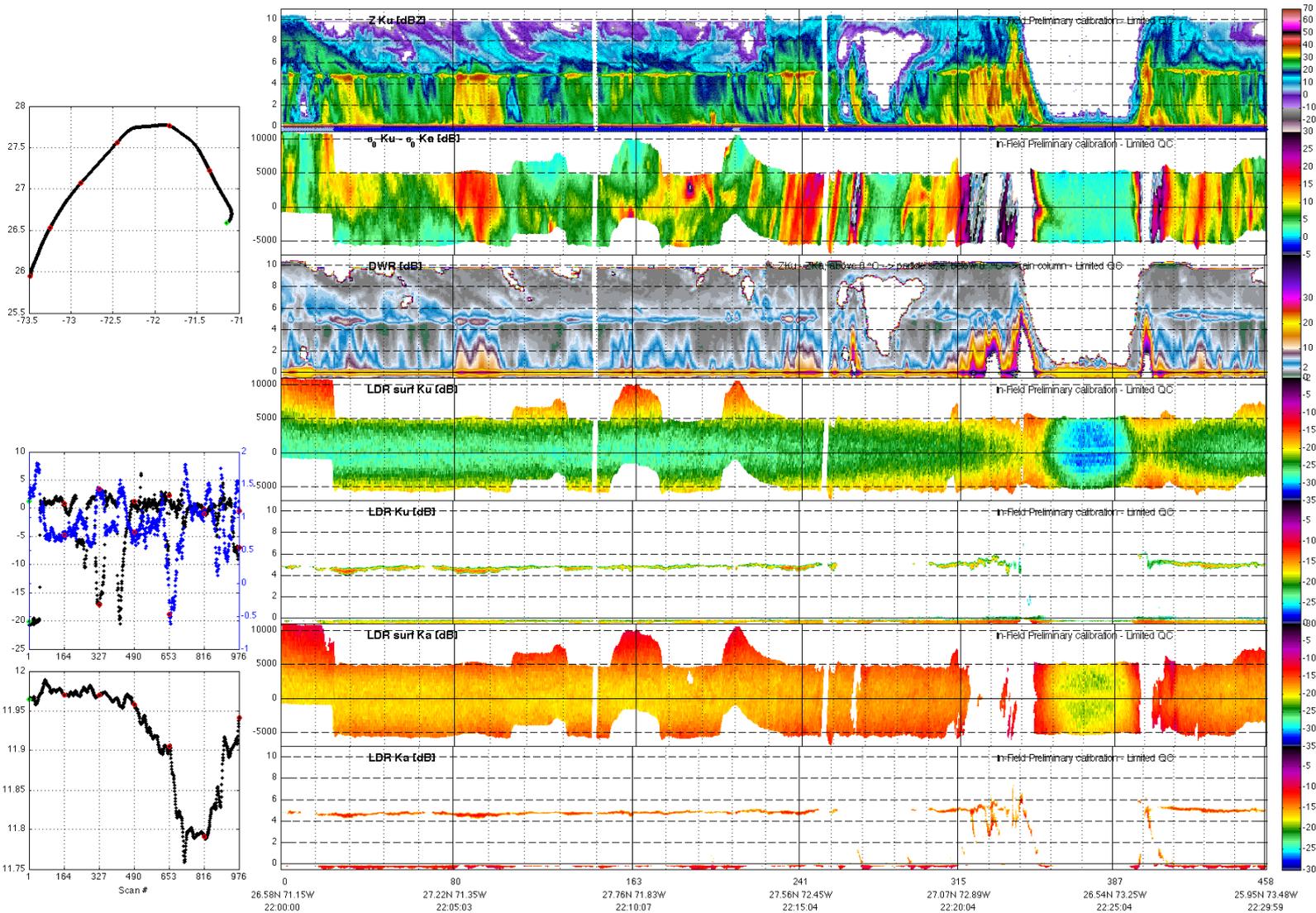
## The "Ubi Maior" convective cell



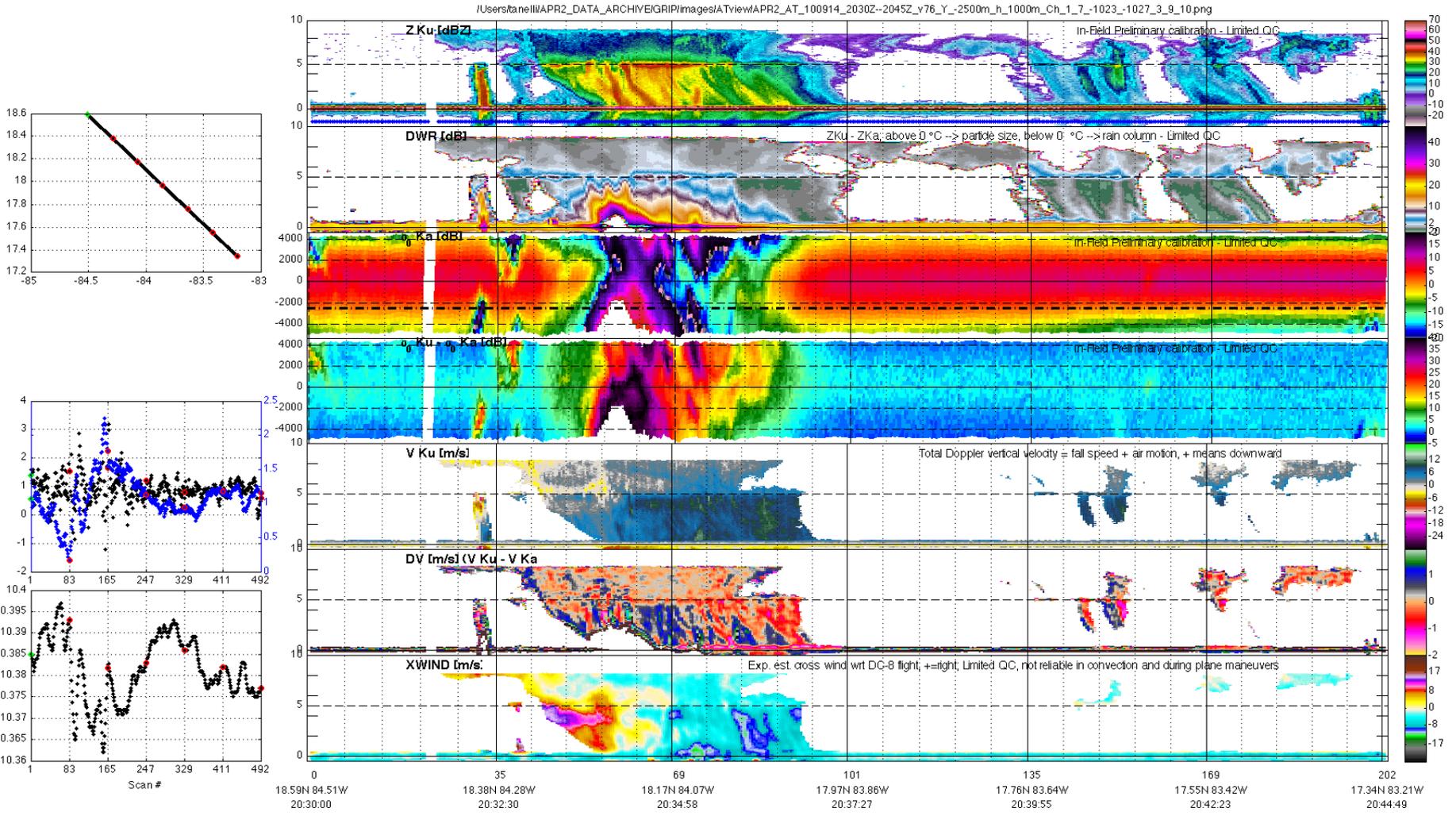
# Additional products not distributed yet



# Additional products not distributed yet



# Karl's genesis



# Haiti's wake

