Status of the New ARM Lidars

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Current ARM Lidar Inventory

- **Doppler Lidar** (winds, aerosol attenuated backscatter)
  - SGP
  - TWP-Darwin
  - AMF1 (awaiting deployment to India)
- **Raman Lidars** (water vapor, aerosol backscatter, optical depth, temperature)
  - SGP
  - TWP-Darwin
- **High Spectral Resolution Lidars** (aerosol backscatter, optical depth)
  - AMF2 (currently in Steamboat Springs)
  - NSA-Barrow
- MPLs and Ceilometers at most sites

Doppler Lidar Specifications

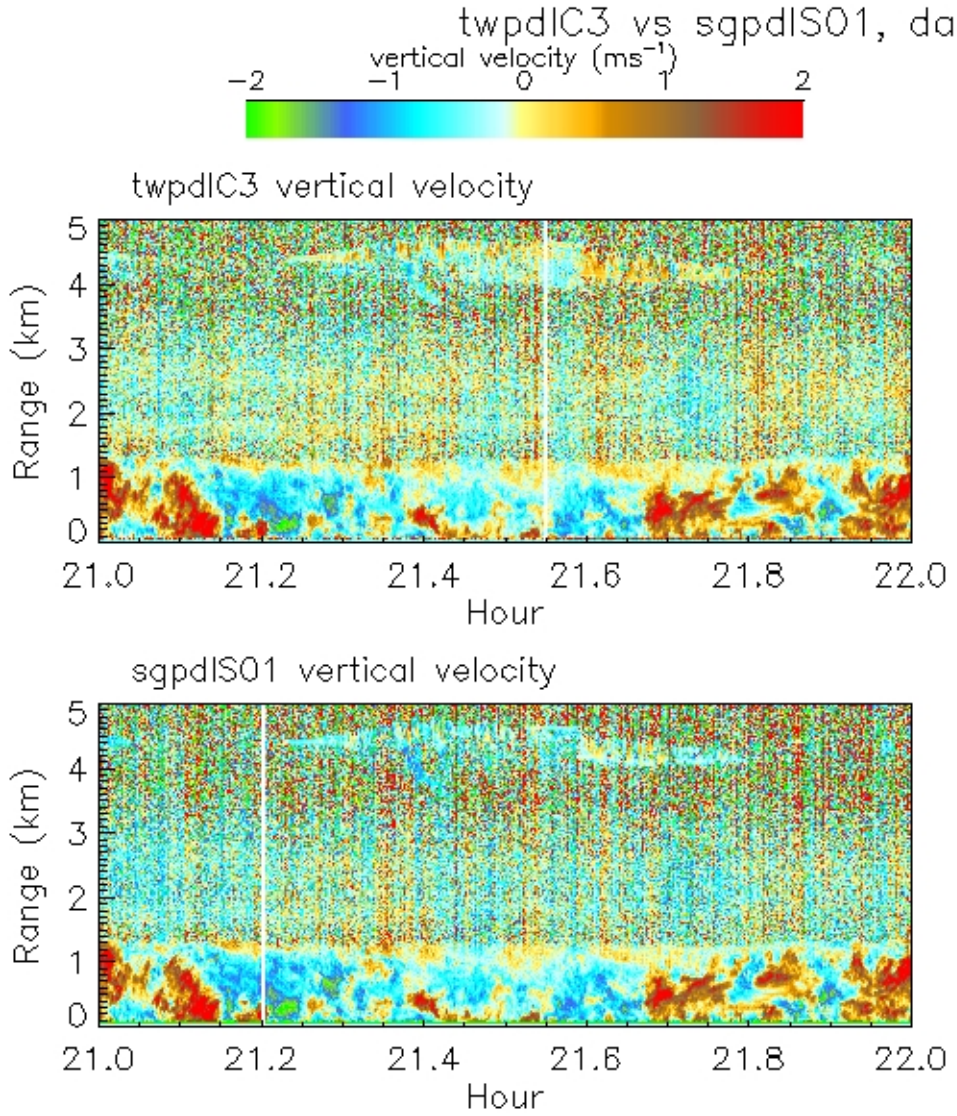
Manufacturer	Halo Photonics (UK)
Pulse width	150 ns (22.5 m)
Pulse Energy	100 μJ
Wavelength	1.5 μm
Pulse rate	15 kHz
Minimum range	75m
Range for data collection	Standard: 0.06-10km
Range gate length	20-50m
Scanner	Fully programmable, two axis, step-stare scanner
Primary Scattering Mechanism	Aerosol

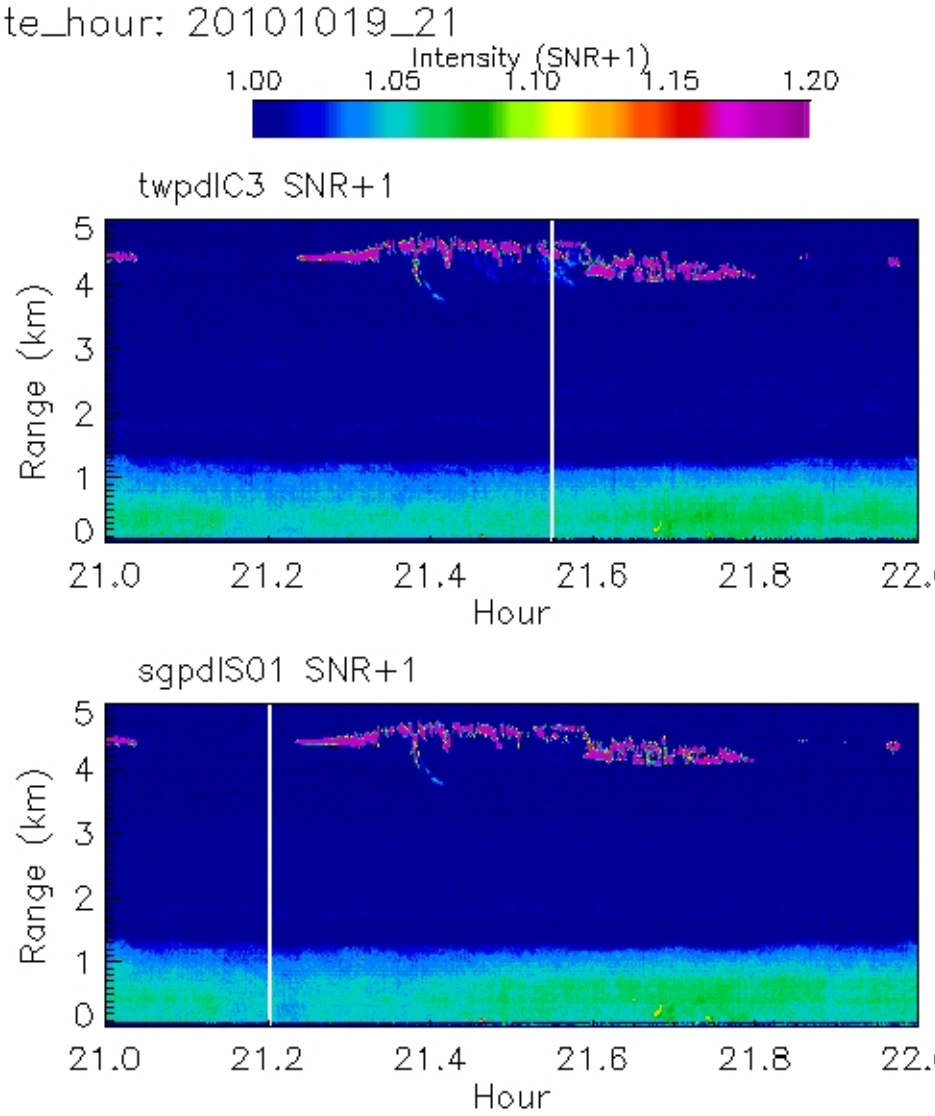
- Uses heterodyne detection to measure Doppler shift of return
- Unaffected by solar
- Primarily limited to boundary layer measurement, elevated aerosol layers, optically thin clouds or cloud bases of optically thick clouds up to 10 km.
- Data products: radial velocity, attenuated backscatter, SNR

AMFDL vs TWPDL

21-22 UTC, 19 October 2010

Vertical Velocity (left); Signal Intensity (right)

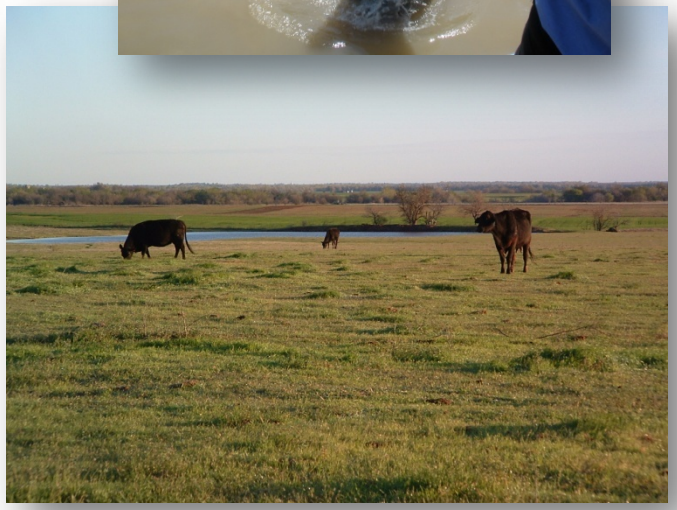




Doppler Lidar Status

- SGPDL
  - Operated fine from October to December
  - Experienced intermittent computer failures in December.
  - System was shipped back to vendor and repaired, and will be back on-site in early April 2011
- TWPDL has been continuously operational since initial deployment in December 2010
- AMFDL is awaiting deployment to India for GVAX

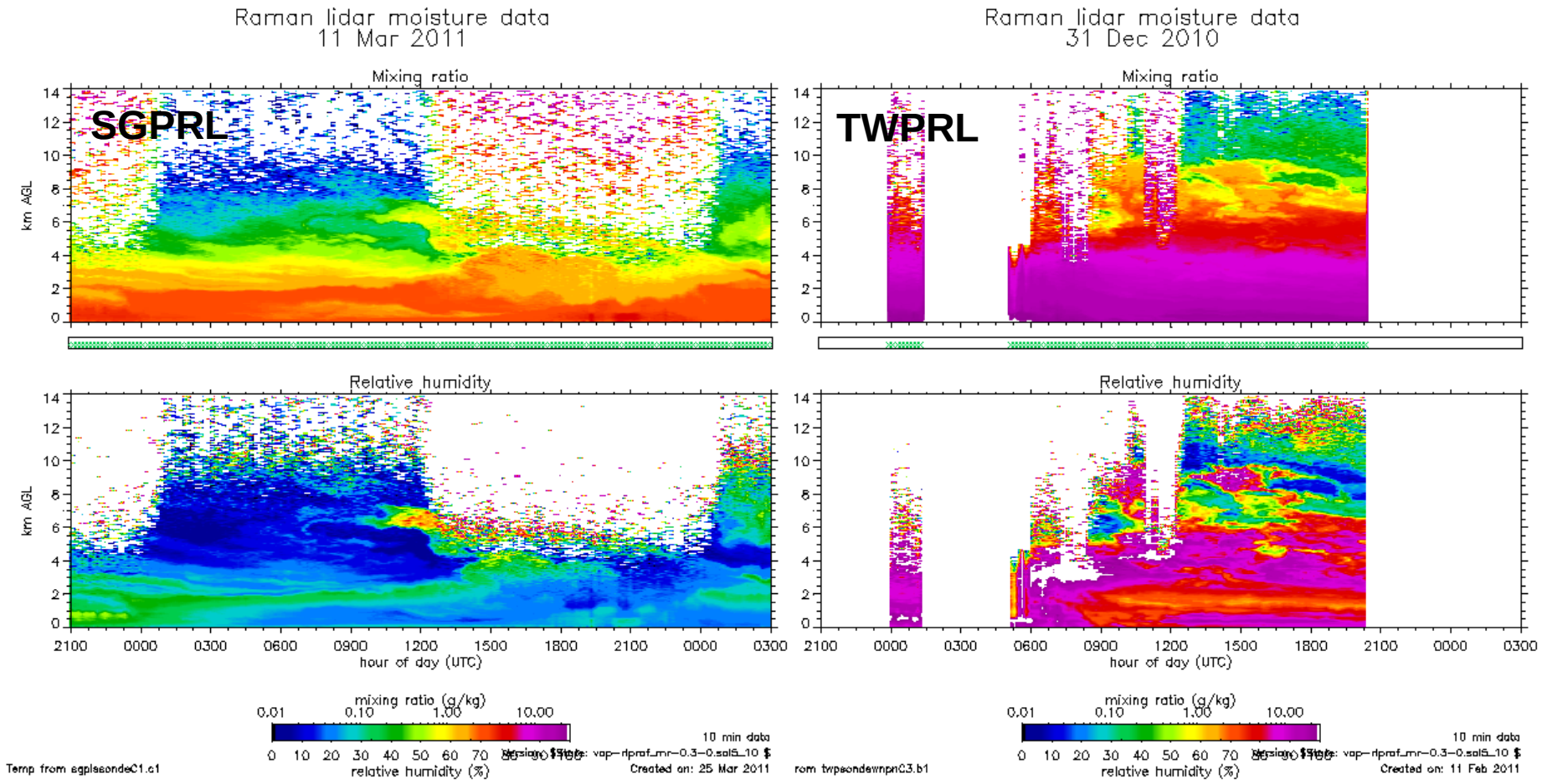
Raman Lidars



Raman Lidars

- ARM now has two Raman Lidars
  - SGP, SGPRL (aka CARL)
  - TWP-Darwin, TWPRL (aka DARL)
- Essentially identical designs (TWPRL doesn't have a liquid water channel)
  - 355 nm, 300 mJ, 30 Hz
  - Two FOVs (WFOV and NFOV)
  - 9 detection channels (10 for the SGPRL)
    - 3 Elastic, 355 nm (WFOV unpolarizied, NFOV copol and depol)
    - 2 Nitrogen, 387nm, (WFOV and NFOV)
    - 2 Water, 408 nm, (WFOV and NFOV)
    - 2 Rotational Raman (NFOV only)
      - 353 nm
      - 354 nm
- Data products: water vapor mixing ratio, aerosol backscatter, optical depth, extinction, depolarization and temperature

SGPRL vs TWPRL



Raman Lidar Deployment and Status

- SGPRL was upgraded and sensitivity improved in March 2011

- TWPRL was installed at Darwin in December 2010. No data since 7 March due to power supply failure, new power supply has arrived in Darwin.

High Spectral Resolution Lidars (HSRL)

HSRL Specifications

- Design copies the GV HSRL (for NCAR Gulfstream V aircraft)
  - New generation of the AHSRL (Arctic HSRL)
  - Components repackaged for ground-based operation
- Major Specs:
  - Wavelength = 532 nm
  - Min/Max range: 100 m/30 km
  - Time resolution: 2.5 sec
  - Range resolution: 7.5 m
  - Autonomous, 24/7 mode of operation
  - FOV :100 μRad
  - Four Detection Channels
    - Aerosol + Molecular copolarization (high and low gain)
    - Aerosol + Molecular cross polarization
    - Molecular only (from iodine absorption filter)
- Data Products: aerosol optical depth, backscatter, circular depolarization ratio

HSRL Deployments and Status

- AMFHSRL
  - Deployed to Steamboat Springs in January 2011
  - Data “flowing” to DMF on 21 Janurary 2011

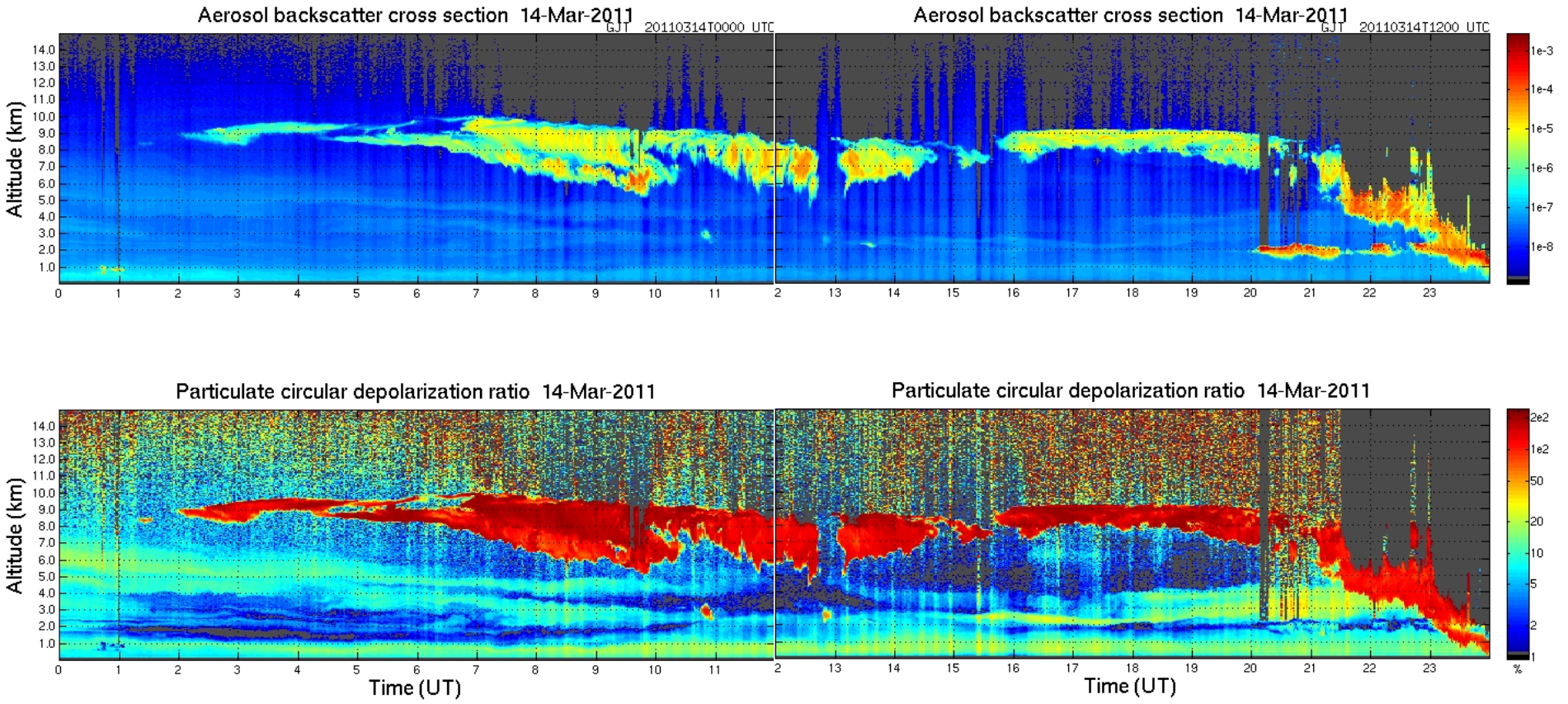

Steamboat Springs

- NSAHSRL
  - Deployed to NSA-Barrow on ~18 March 2011
  - Data “flowing” to the DMF on 20 March

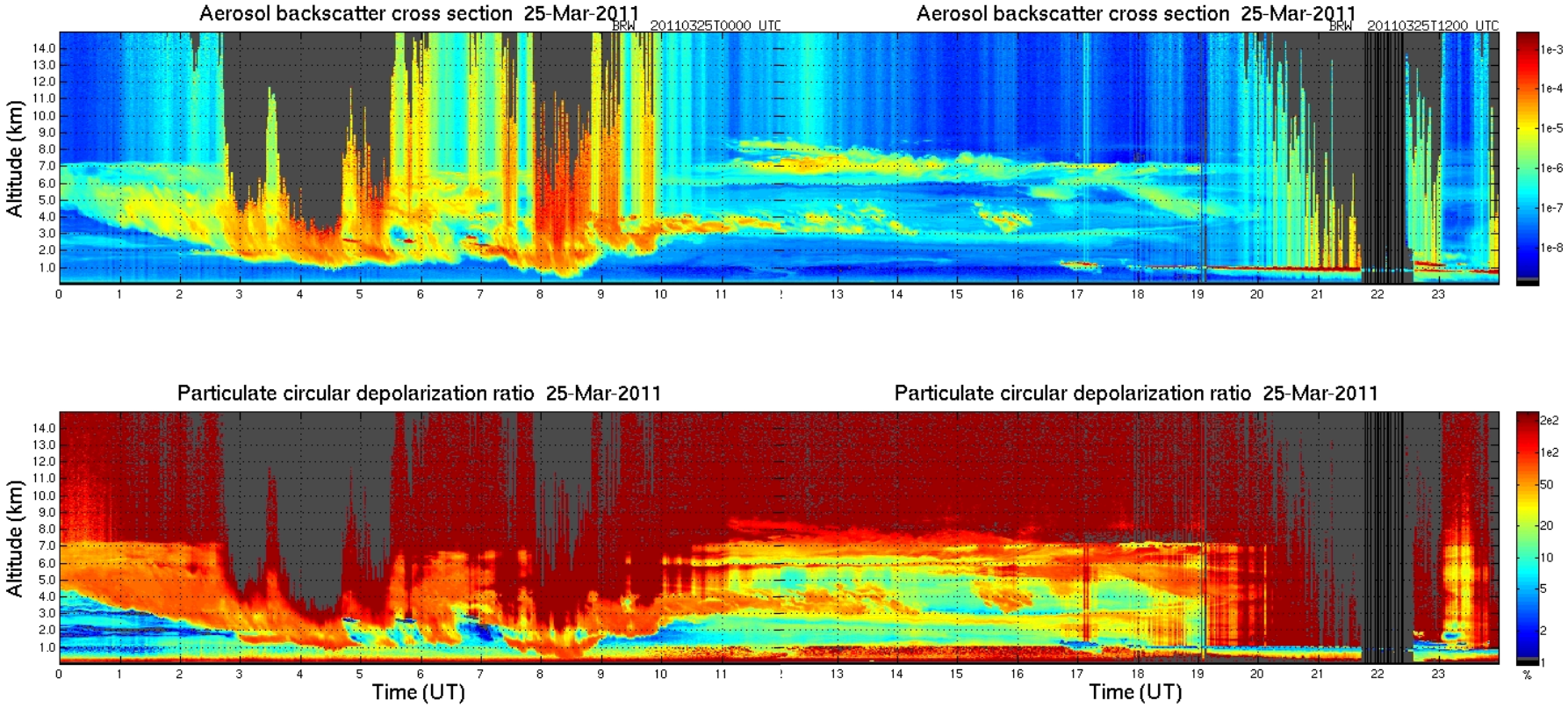

Barrow

- Currently working on the integration of the existing HSRL data processing system into the DMF

AMFHSRL


Aerosol backscatter cross section 14-Mar-2011
GJT 20110314T0000 UTC
Aerosol backscatter cross section 14-Mar-2011
GJT 20110314T1200 UTC
Altitude (km)
Particulate circular depolarization ratio 14-Mar-2011
Particulate circular depolarization ratio 14-Mar-2011
Time (UT)
Time (UT)
%

NSAHSRL


Aerosol backscatter cross section 25-Mar-2011
BRW 20110325T0000 UTC
Aerosol backscatter cross section 25-Mar-2011
BRW 20110325T1200 UTC
Altitude (km)
1e-3
1e-4
1e-5
1e-6
1e-7
1e-8
Particulate circular depolarization ratio 25-Mar-2011
Particulate circular depolarization ratio 25-Mar-2011
Altitude (km)
2e2
1e2
50
20
10
5
2
1
%
Time (UT)
Time (UT)

Questions?