



RALI products

NAWDEX – Iceland October 2016

French F20 Payload

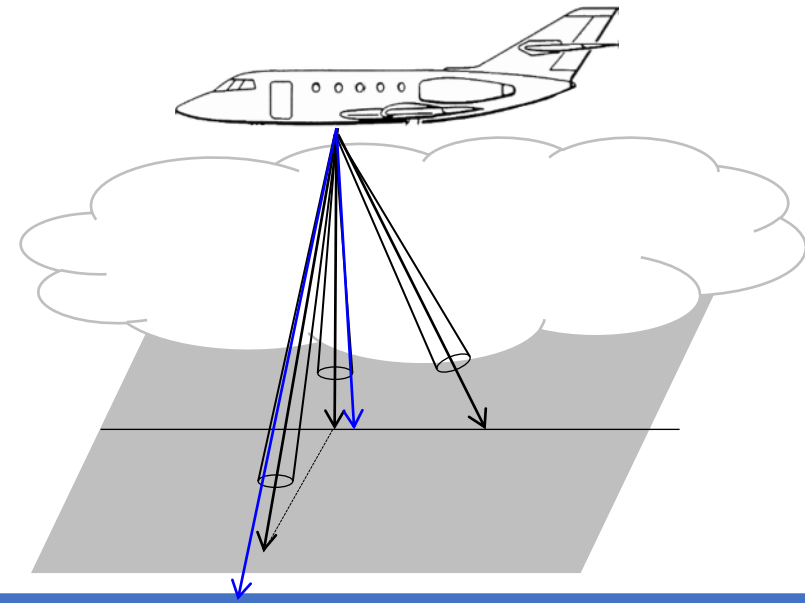
RALI

Aircraft:

- Dassault Falcon 20
- Endurance: **3.5 flight hours**
- Maximum cruising altitude: **13 km**

Payload:

- **High spectral resolution lidar** (355 nm), 532 and 1064 nm
- **Doppler cloud Radar** (95 GHz) – 3 antennas looking down
- IR radiometer CLIMAT (brightness temperature **8-10-12 micron**)
- L/S fluxes
- Drop sonde launching (profiles of T, p, hum, u, v)
- Aircraft measurements (attitude, wind, T, p, hum)



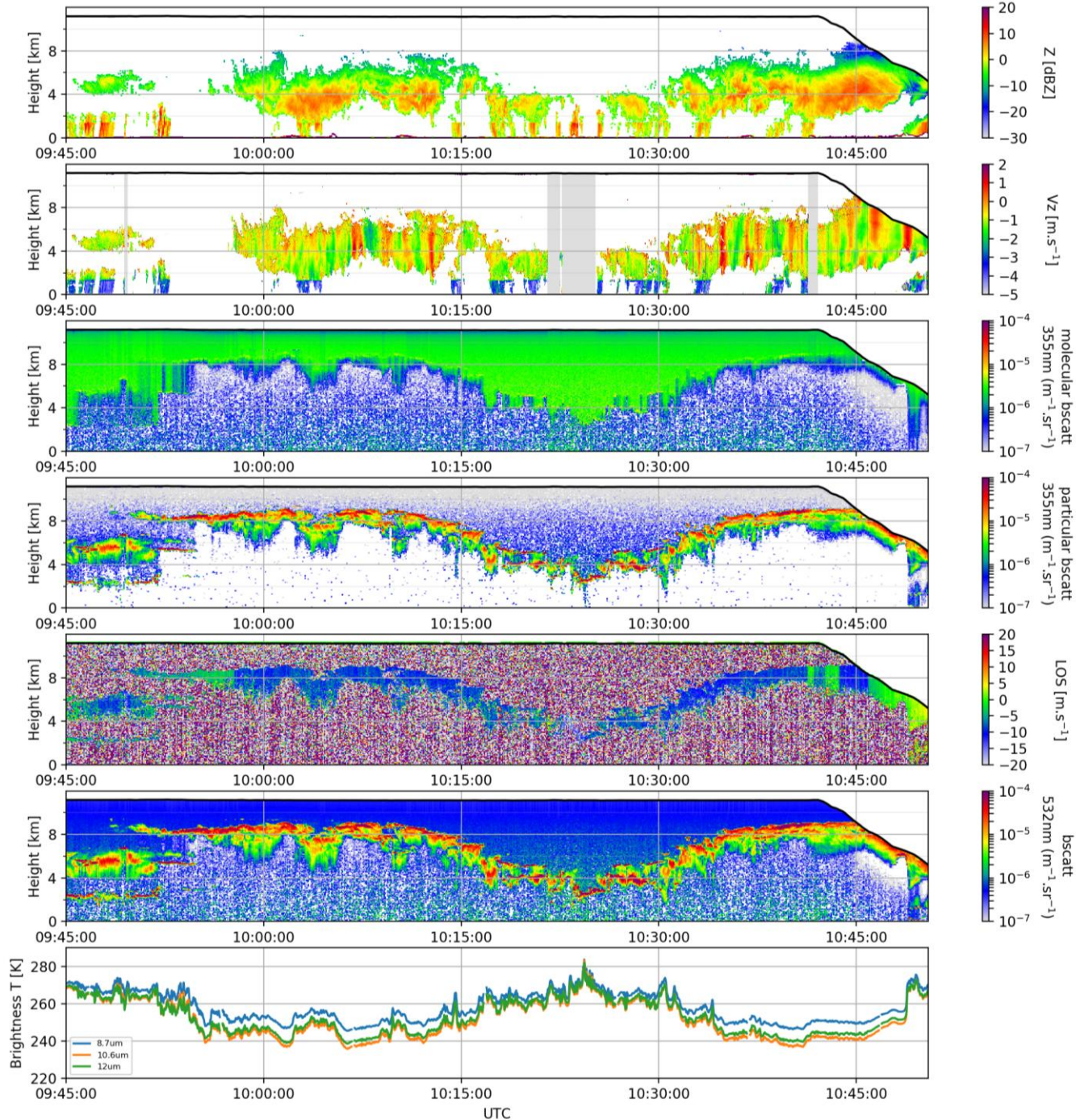
LNG (ND : YAG pulsed 20Hz)

Wavelength (nm)	measurements
355	β , High spectral resolution (MZI), δ , Doppler
532	Backscatter only
1064	Backscatter only

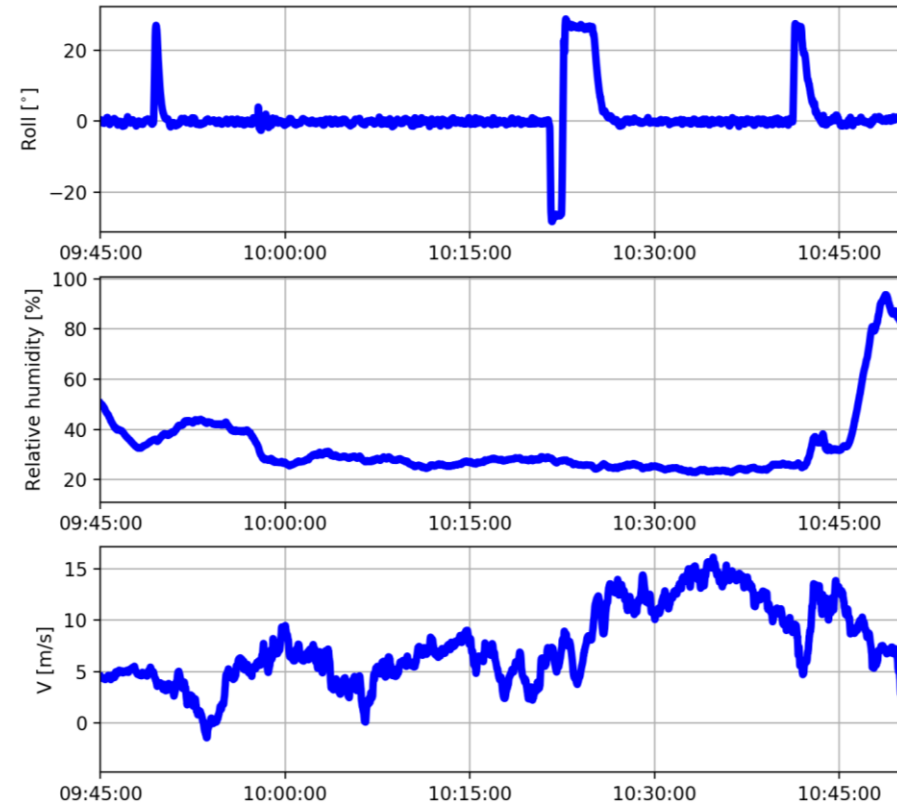
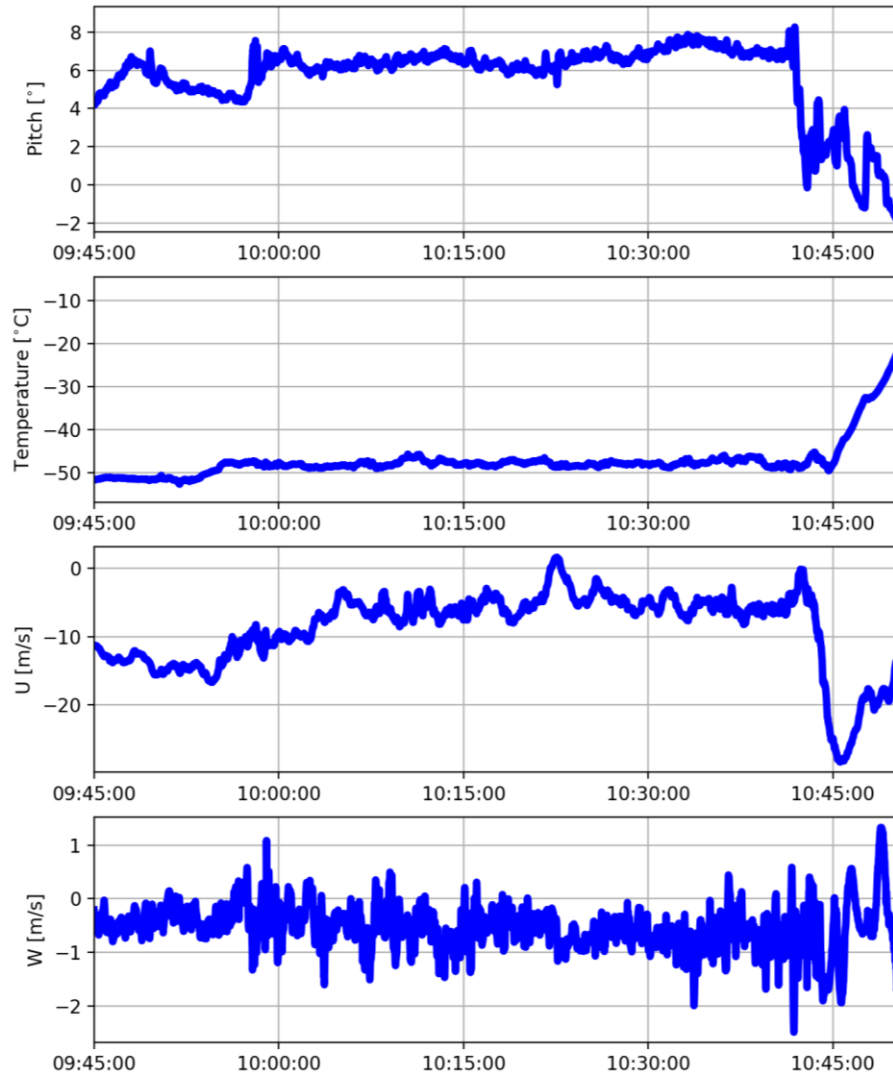
3 antennas	RASTA characteristics
Frequency (GHz)	95 (3.2 mm)
Vertical resolution (m)	60
Horizontal resolution (m)	225 to 300 depending on aircraft speed
Range (km)	15
Integration time (ms)	250 (measurement every 750ms for each antenna)
Energy (kW)	2 (pulse 0.4 μ s)
Ambiguous velocity (m s ⁻¹)	8
Antenna size (cm)	45 (0.5° beam width)
Sensitivity at 1km (dBZ)	Down backward: ~-30 / Nadir: ~-30 / Down transverse: ~-30

RALI measurement

- Radar reflectivity
- Radar vertical velocity (3 ant)
- Molecular $\beta_{355\text{nm}}$
- Particular $\beta_{355\text{nm}}$
- $\text{LOS}_{355\text{nm}}$
- Total $\beta_{532\text{nm}}$
- IR radiances
- Total $\beta_{1064\text{nm}}$ (not shown)



Aircraft measurements and dropsondes



At the altitude of the aircraft

A few products available

- Radar-lidar retrievals (combining different wavelengths) – variational approach based on (Delanoë and Hogan 2008) – similar to DARDAR product but adapted to airborne HRS lidar and Doppler radar (Similar product on HALO – Quitterie/Florian's work)
- Lidar wind Doppler measurements
- Radar wind product (variational approach combining 3 antennas, 3 non co-linear LOS, 3 components of the cloud wind field)
- Radar microphysical products
- Radar spectral analysis product (I and Q stored)
- Dropsondes and aircraft altitude measurements

Where and what?

- <https://owncloud.latmos.ipsl.fr/index.php/s/hTl94qmlh6VEEKN>
- epatandata#

3 directories:

- LNG (LNG only stuff)
- RASTA (RASTA products only, wind and micro)
- RALI (micro+wind low res)

Documentation to be added soon...

RADAR wind retrieval

Variational approach:

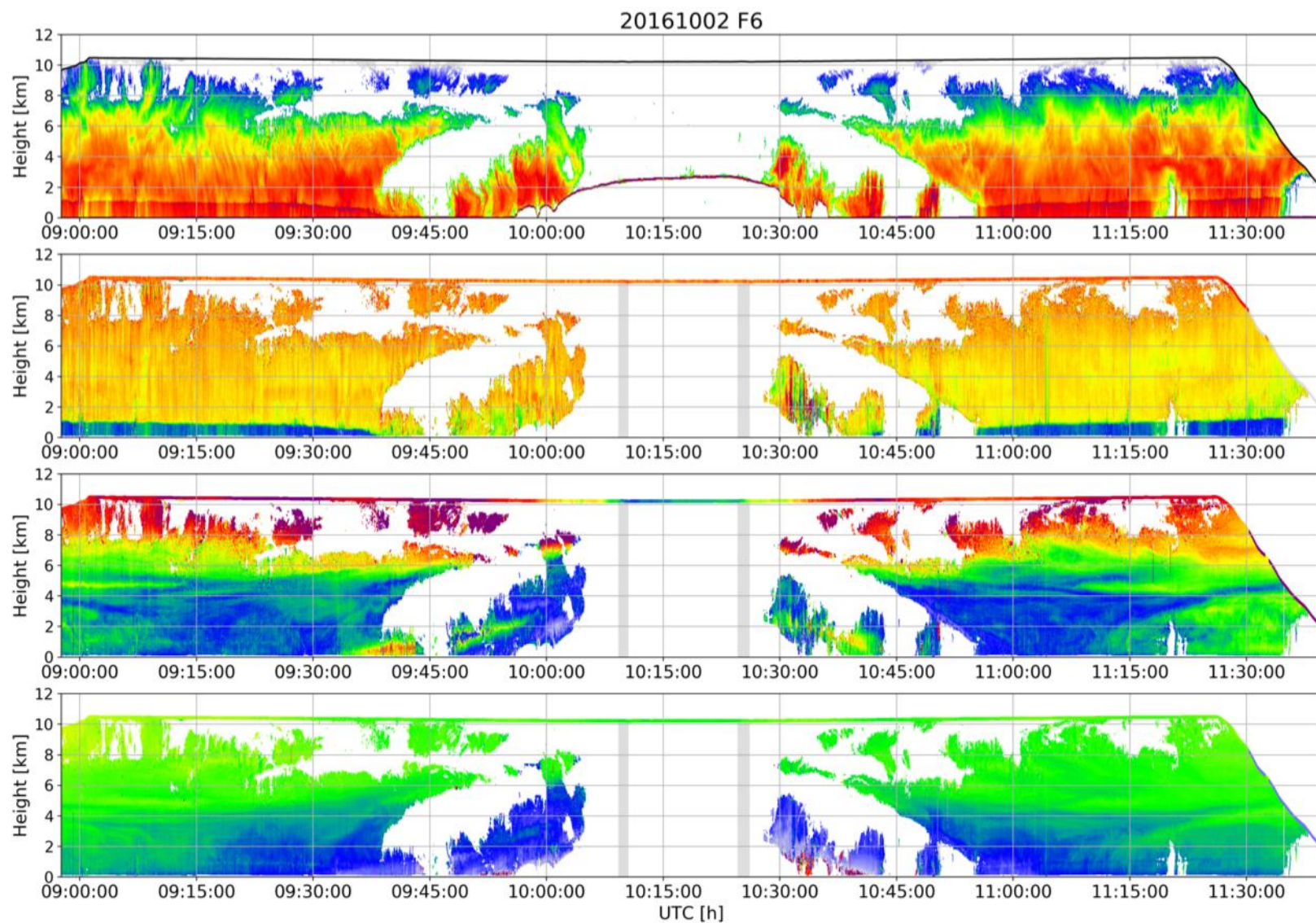
3 measurements are co-located: V_d (Nadir), V_d (backward), V_d (transverse)

3 components of the wind: V_x (along track), V_y (cross track), V_z (vertical)

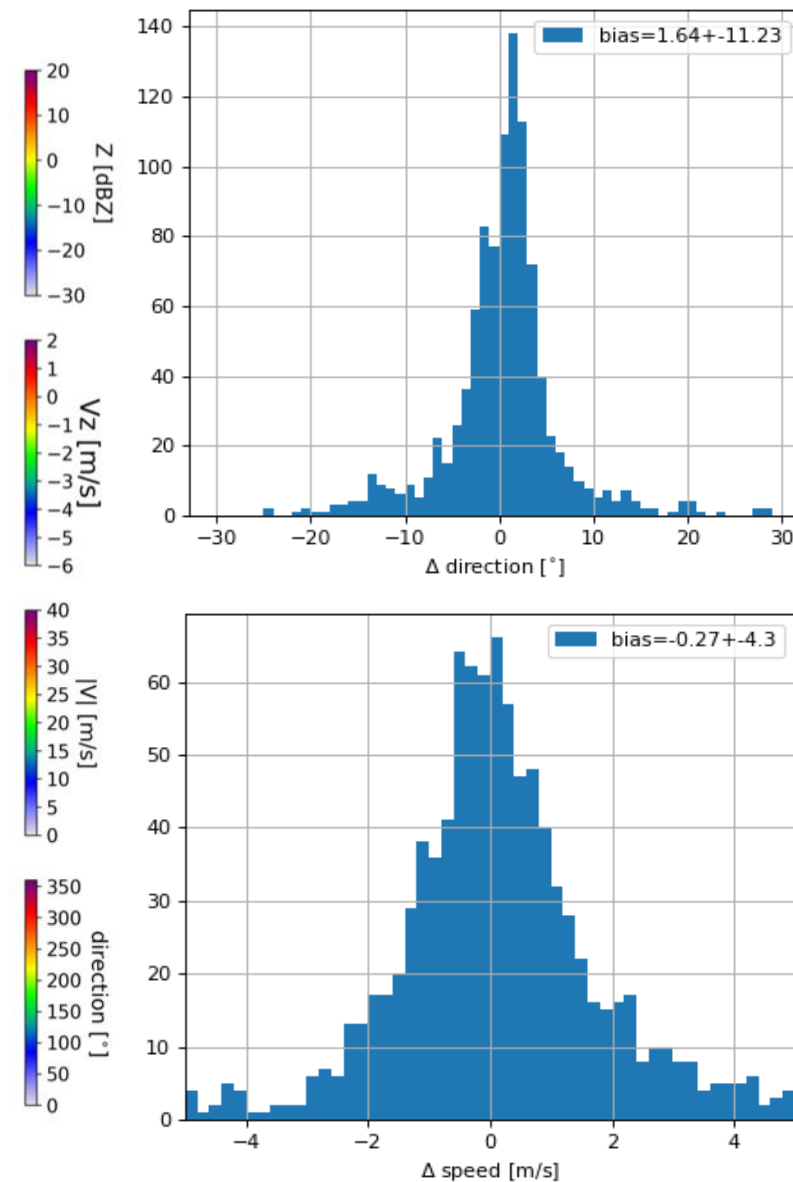
V_x , V_y are used to derive V_N , V_E or V_{dir} and $|V|$

Assumption: volume probed by antennas is homogeneous (volume increasing with distance)

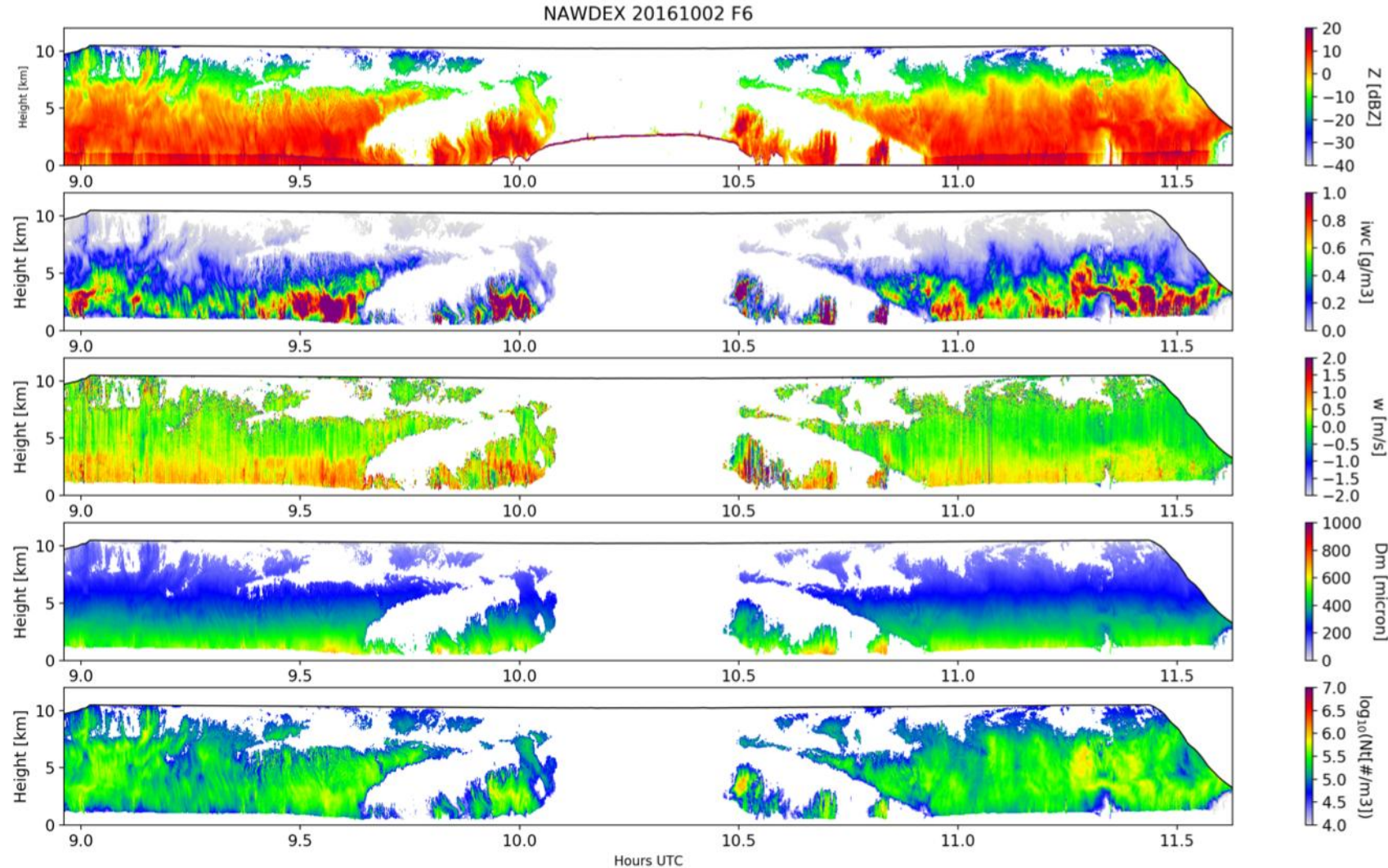
Example and verification



RASTA against DS (all flights)



RASTA microphysical product



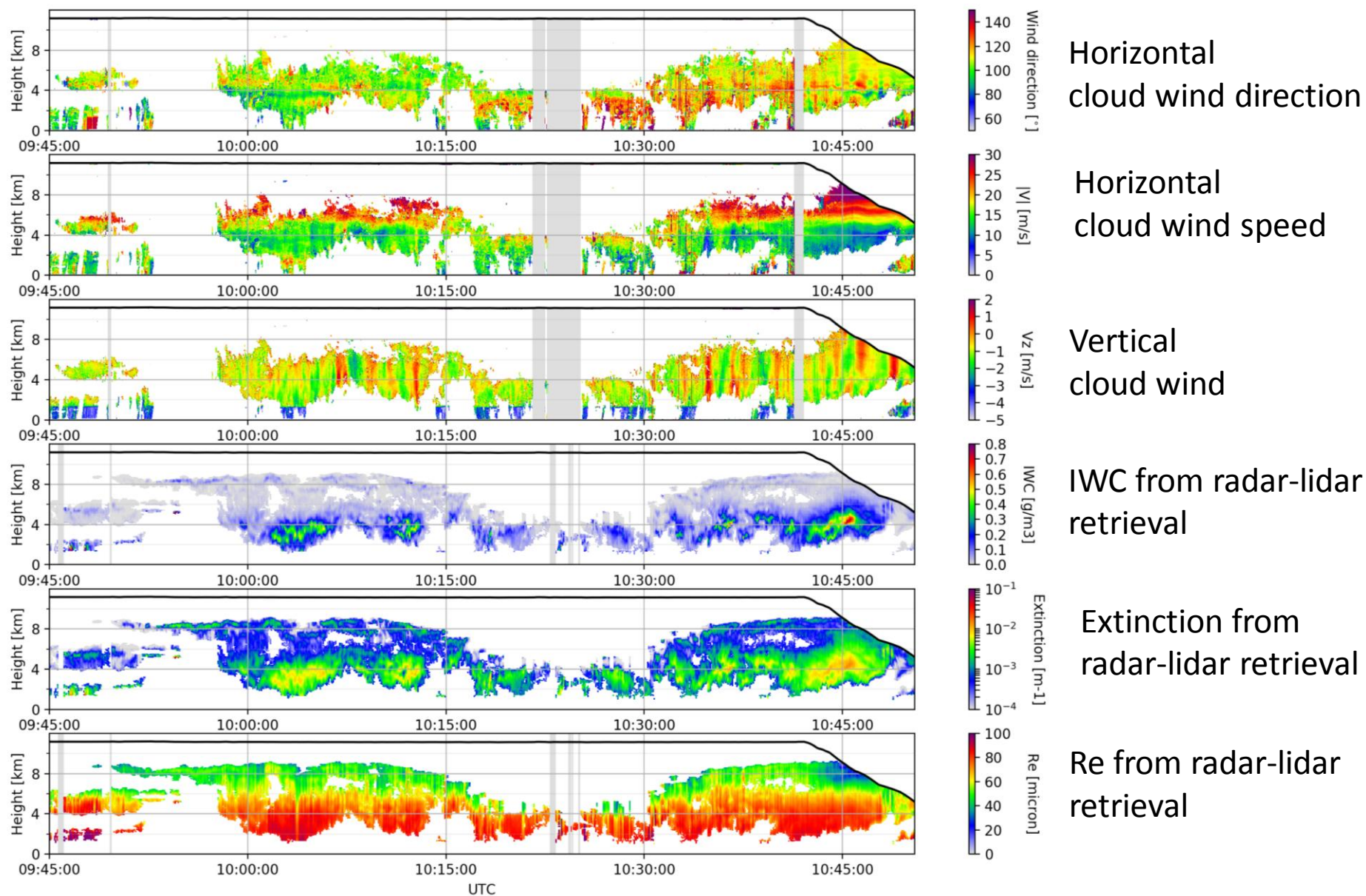
Combine radar
reflectivity and
Doppler velocity

W and Nt products
should be taken
with a grain
of salt...

Variables...

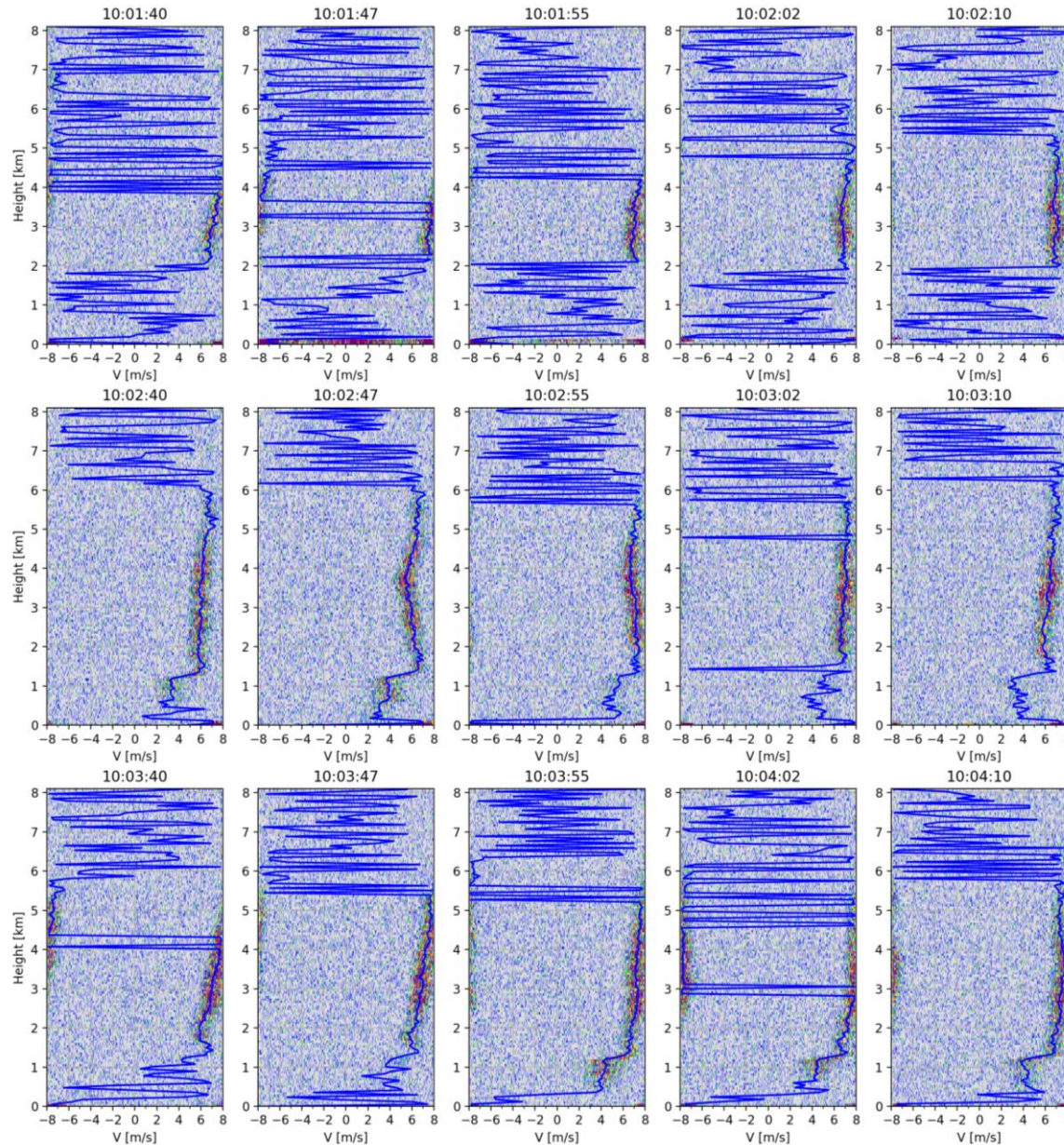
- Time: **time** (1D)
- Altitude of each radar retrieval : **height_2D** (2D)
- IWC : **iw_c_ret** (2D)
- Mean volume diameter : **Dm_ret** (2D)
- Vertical wind : **w_ret** (2D)
- Extinction : **extinction_ret** (2D)
- Effective radius: **re_ret** (2D)
- Total number concentration: **Nt_ret** (2D)

RALI retrievals



RADAR Spectral analysis

product



Spectral analysis
product available
as we store I and Q