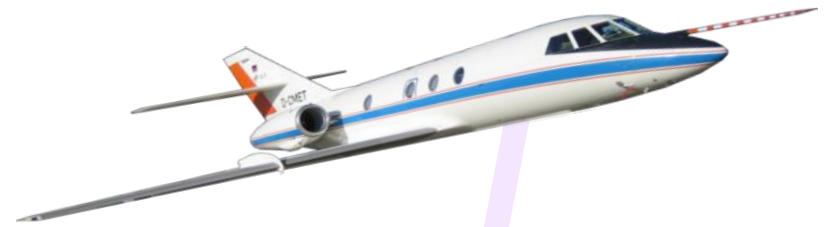


DLR's Doppler wind lidar

Investigating gravity waves within the
DEEPWAVE campaign

Benjamin Witschas
Stephan Rahm (PI),
Fernando Chouza Keil,
Rudolf Simmet, Martin
Wirth, et al.



Knowledge for Tomorrow



Content

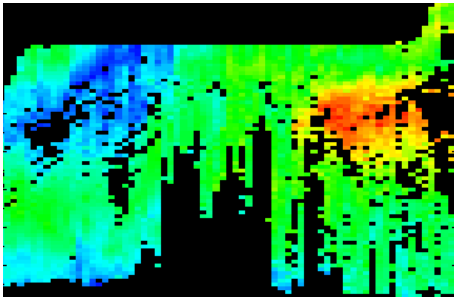


Introduction

- The 2 μ wind lidar
- Specs and operation principle

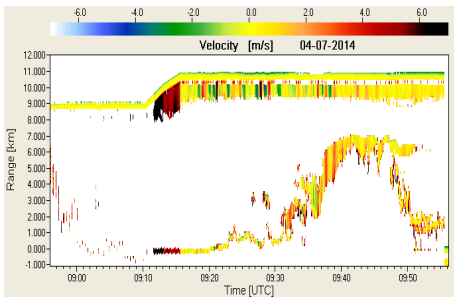
Operation principle of the 2 μ wind Lidar

- Fix LOS (Nadir looking) incl. example
- Scanning mode incl. example



First measurements within DEEPWAVE

- Quicklooks (4. July 2014, 2nd flight)
- Processed data



The 2 μ Wind Lidar

Instrument description

Transceiver specifications

- Wavelength 2.022 μm
- repetition rate 500 Hz
- pulse energy 1.5 mJ
- pulse length 0.5 μs (150 m)

Resolution:

- Vertical 100 m
- Horizontal (scan) ~6 km
- Horizontal (Nadir) ~0.2 km (1 s)

Accuracy

- Better than 1 m/s

Off-axis telescope:

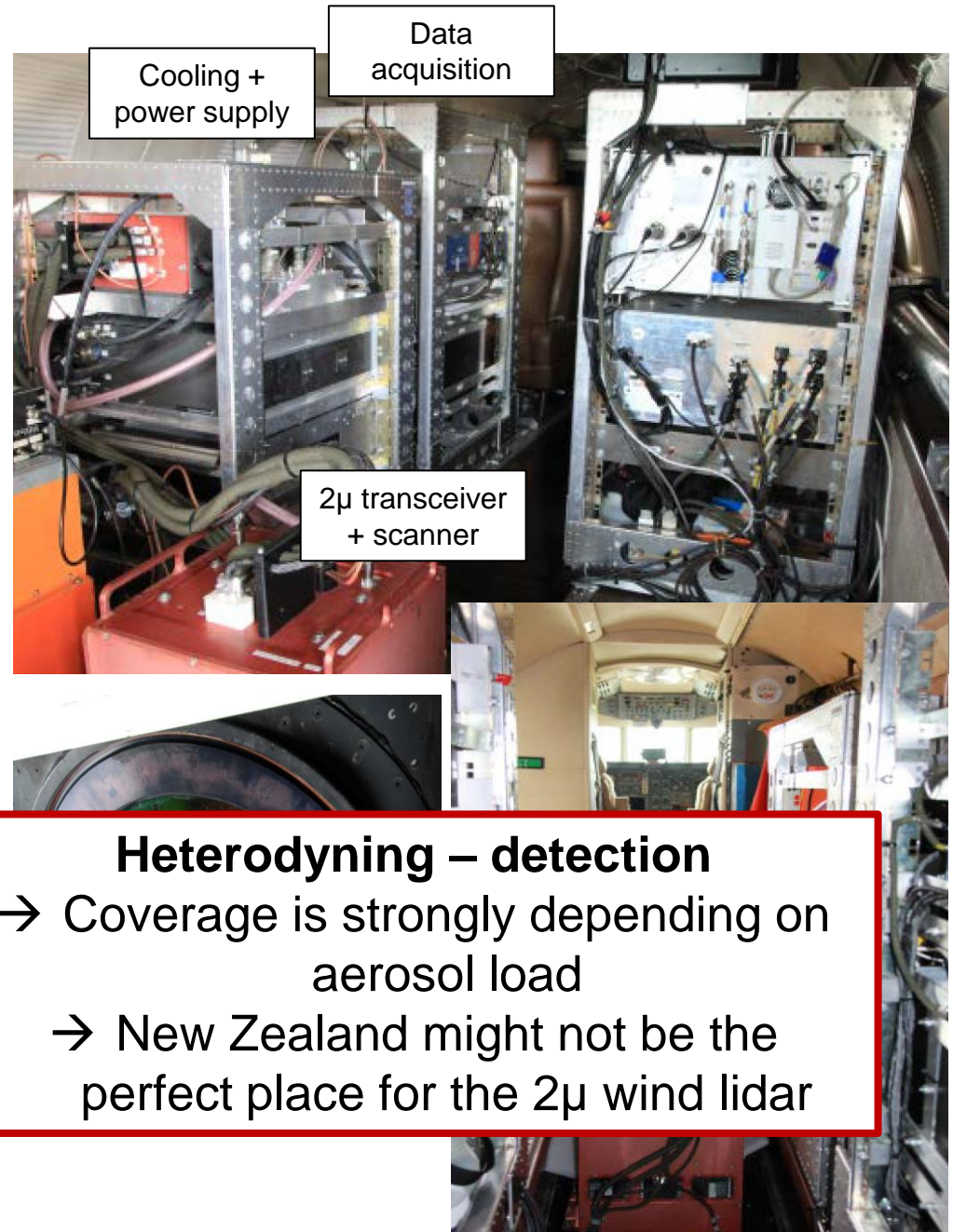
- Aperture 10 cm

Double Wedge Scanner:

- Elevation sector +/- 30 $^\circ$
- Scan speed variable

Sign convention

- “+” = towards the Lidar
- “-” = away from the Lidar



Heterodyning – detection
→ Coverage is strongly depending on aerosol load
→ New Zealand might not be the perfect place for the 2 μ wind lidar

Content

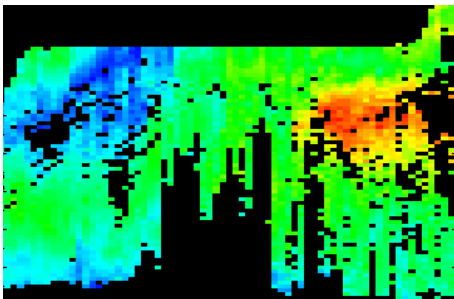


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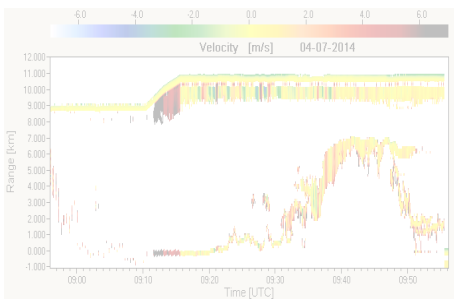
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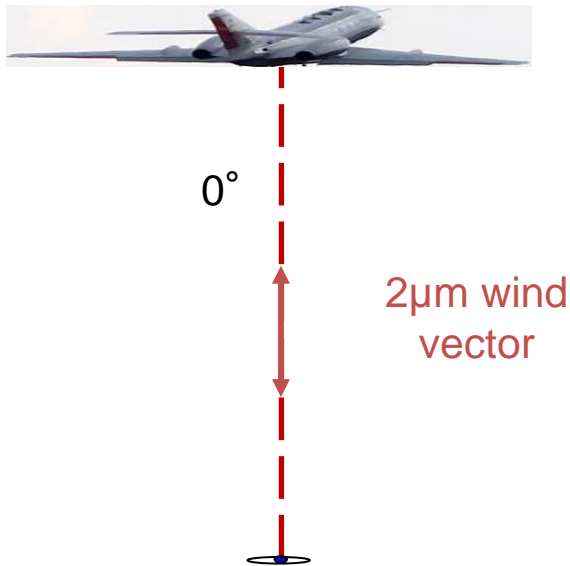


The 2 μ Wind Lidar

Operation principles within DEEPWAVE

Fixed LOS-mode (Nadir)

- LOS-wind vector with a horizontal resolution of ~ 0.2 km (1 s).
- Vertical resolution ~ 100 m

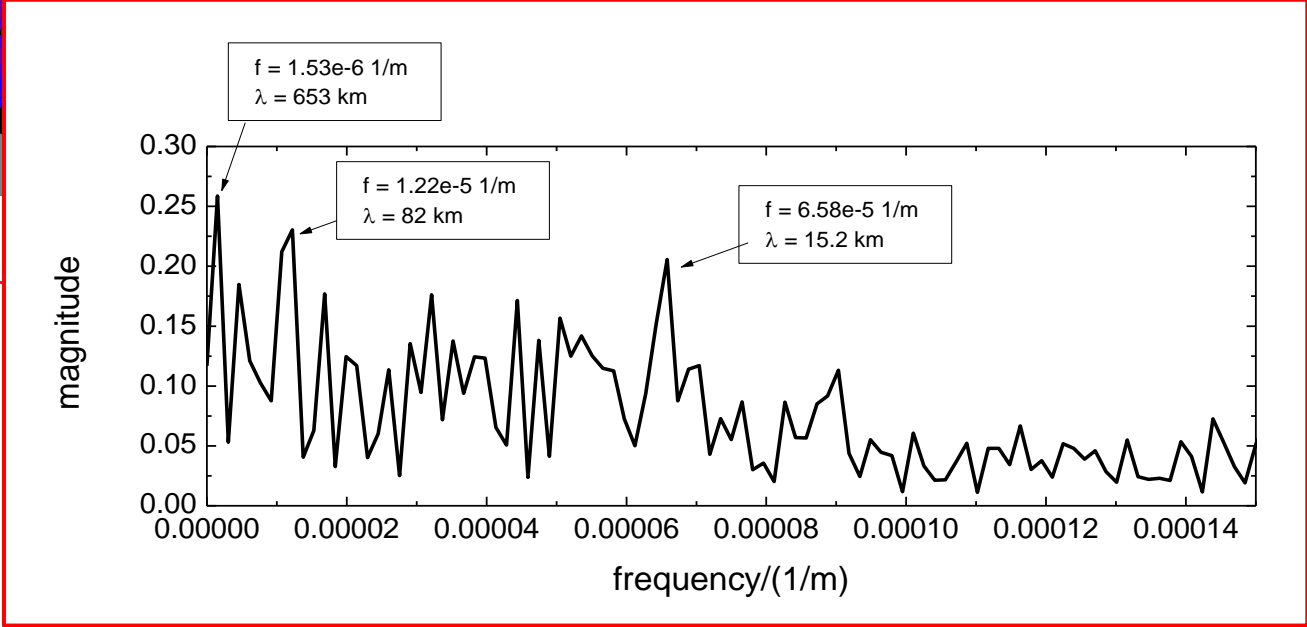
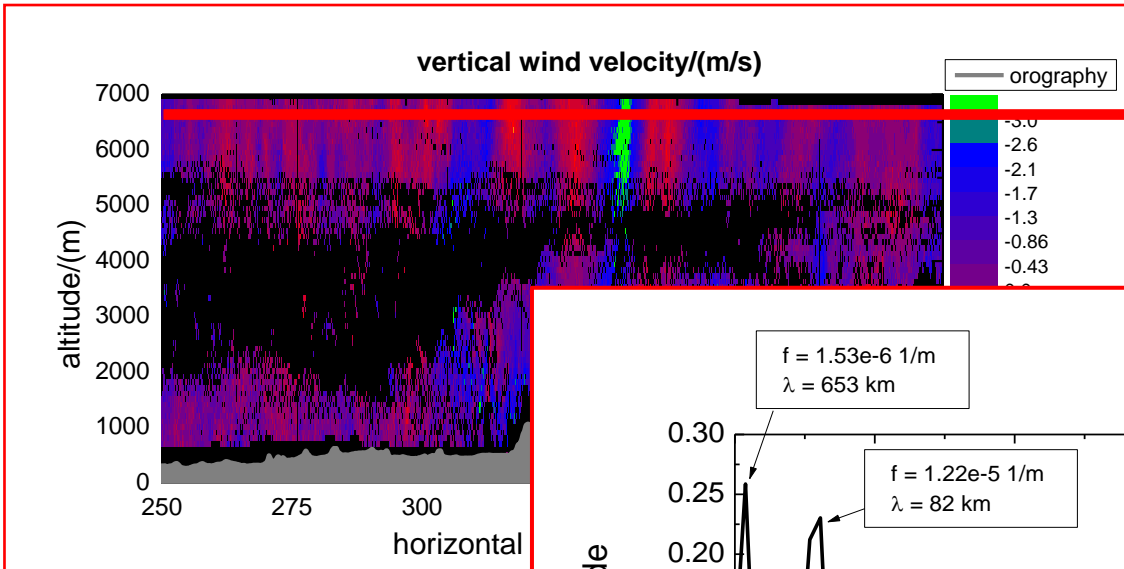
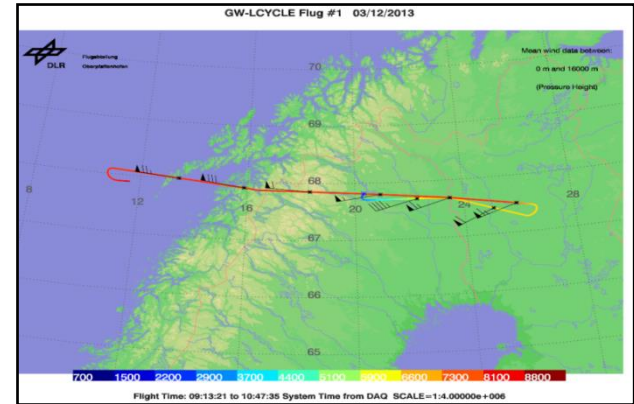


- Correct measured LOS wind by the aircraft velocity depending on the respective aircraft position (pitch, roll, yaw angles).
- Verifying that the pointing stays in nadir-direction during the flight (control loop)
→ Ground reference (zero wind) helps to improve the overall accuracy (~ 0.2 m/s).

The 2 μ Wind Lidar

Operation principles

Example from GW-LCYCLE

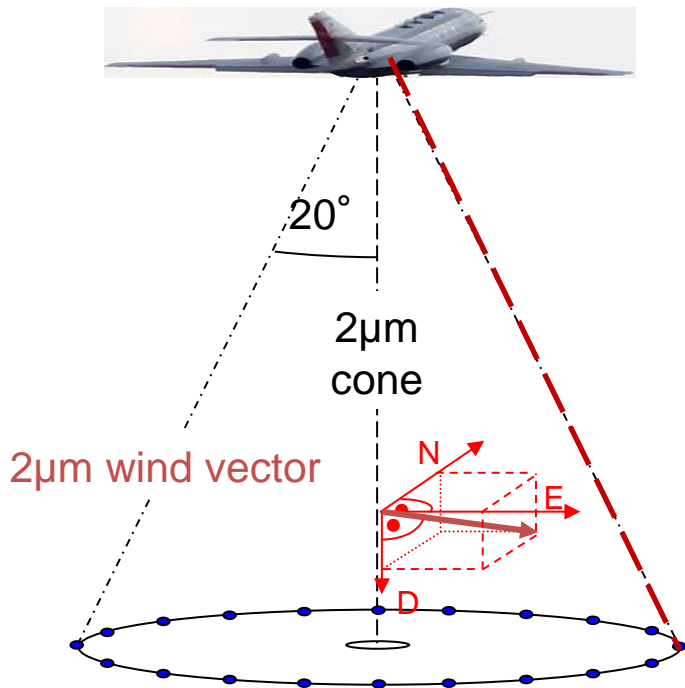


The 2 μ Wind Lidar

Operation principles within DEEPWAVE

Scanning mode

- 3D wind vector with a horizontal resolution of ~ 6.7 km (32 s).
- Vertical resolution ~ 100 m

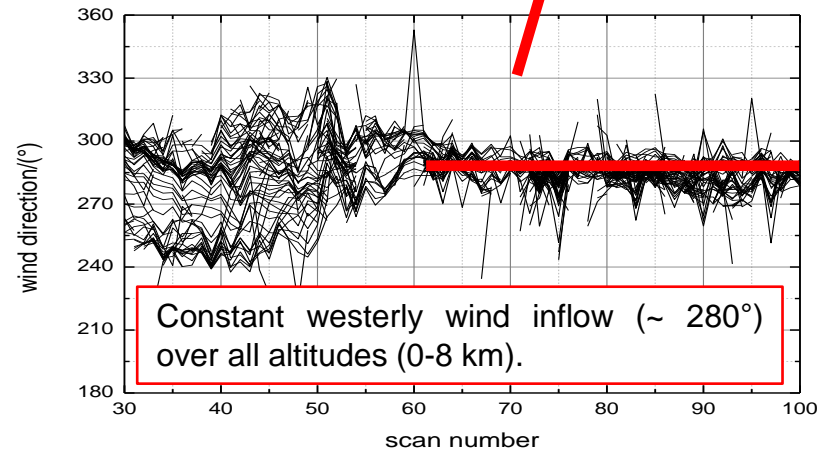
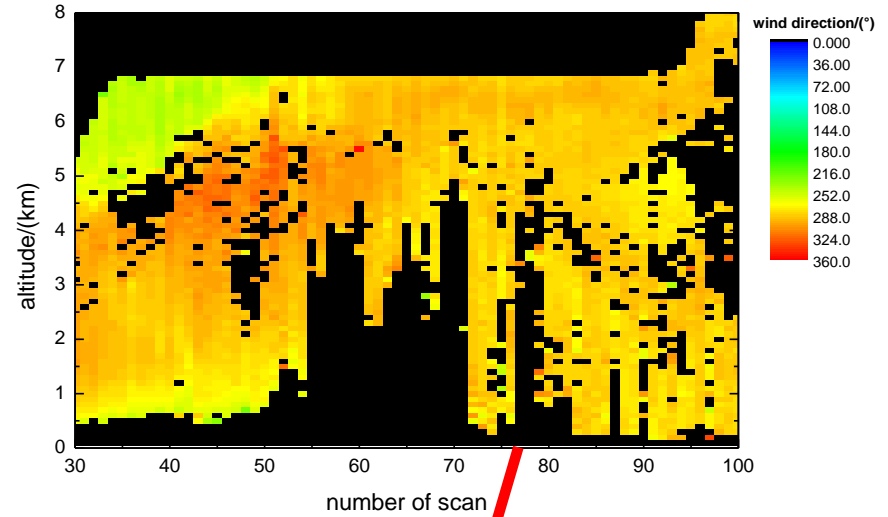
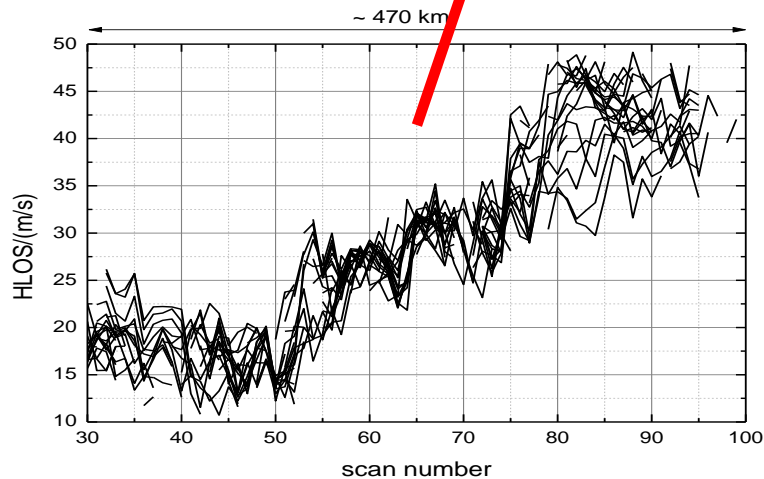
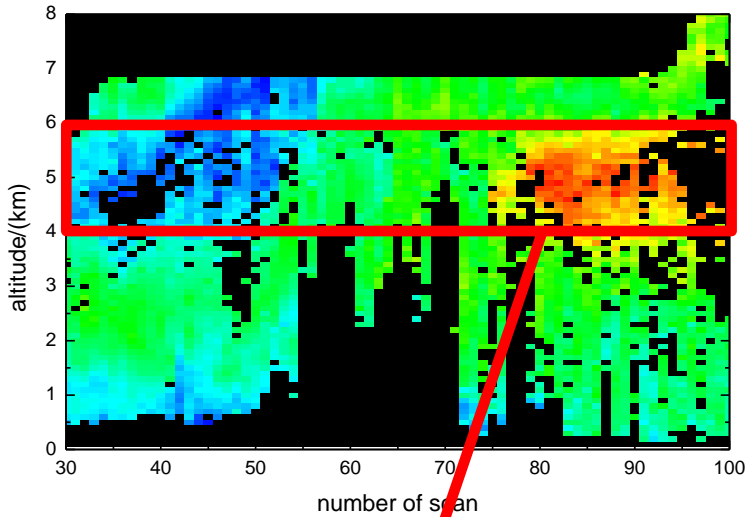
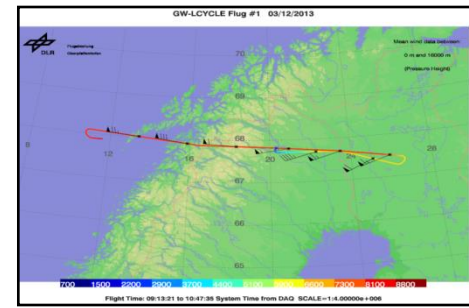


- Measured LOS wind has to be carefully corrected by the aircraft velocity depending on the respective aircraft position (pitch, roll, yaw angles).
→ Ground reference (zero wind) helps to improve the overall accuracy.

The 2 μ Wind Lidar

Operation principles

Example from GW-LCYCLE



Content

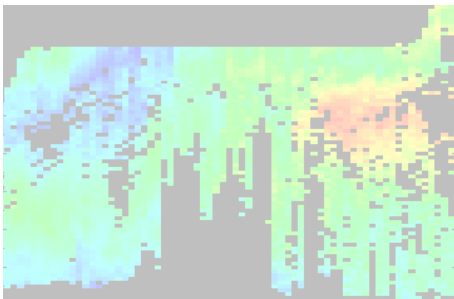


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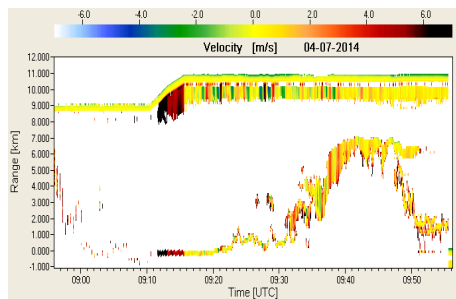
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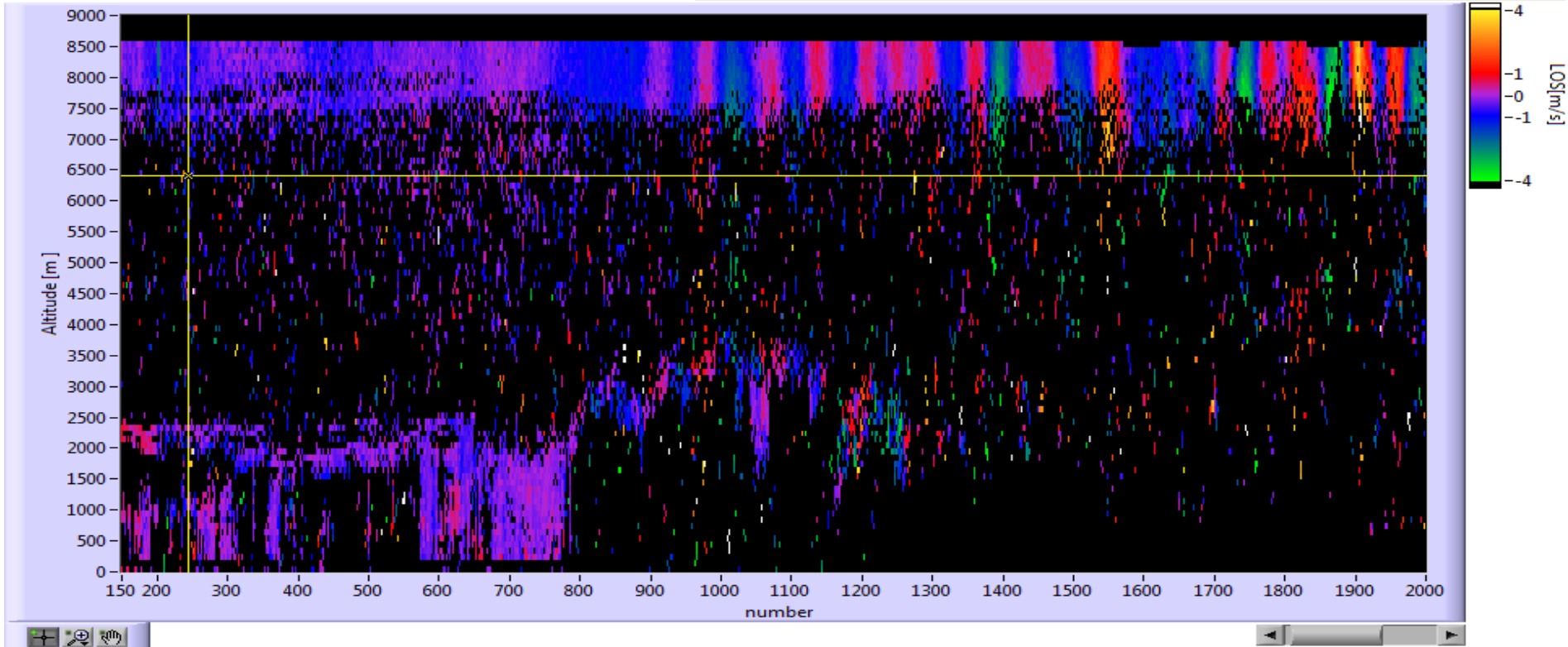
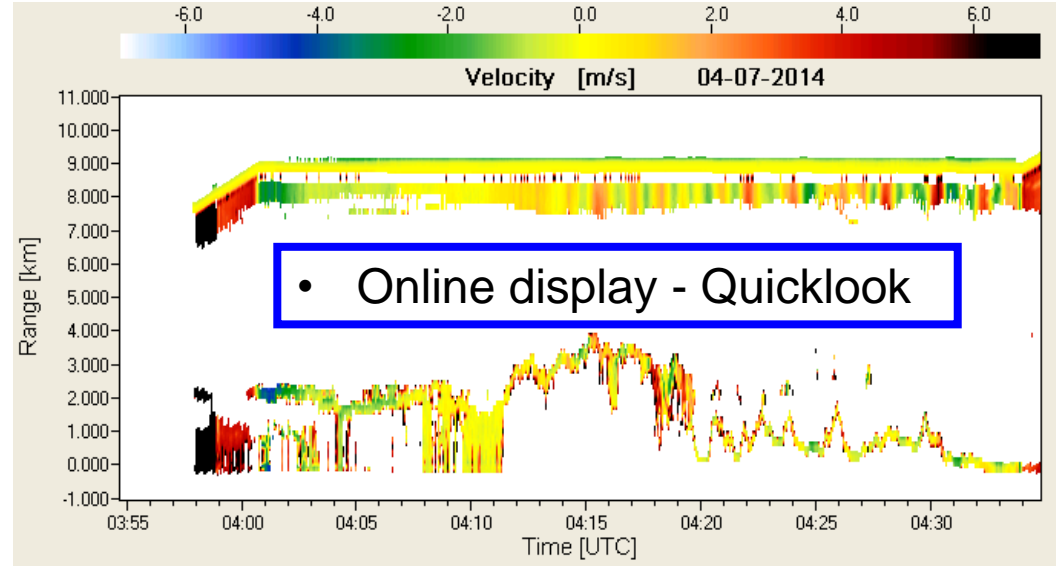
- Quicklooks (4. July 2014, 2nd flight)
- Processed data



The 2 μ Wind Lidar

First results (4. July 2014)
1st flight
Pre-Processed

West \rightarrow East, FL 300

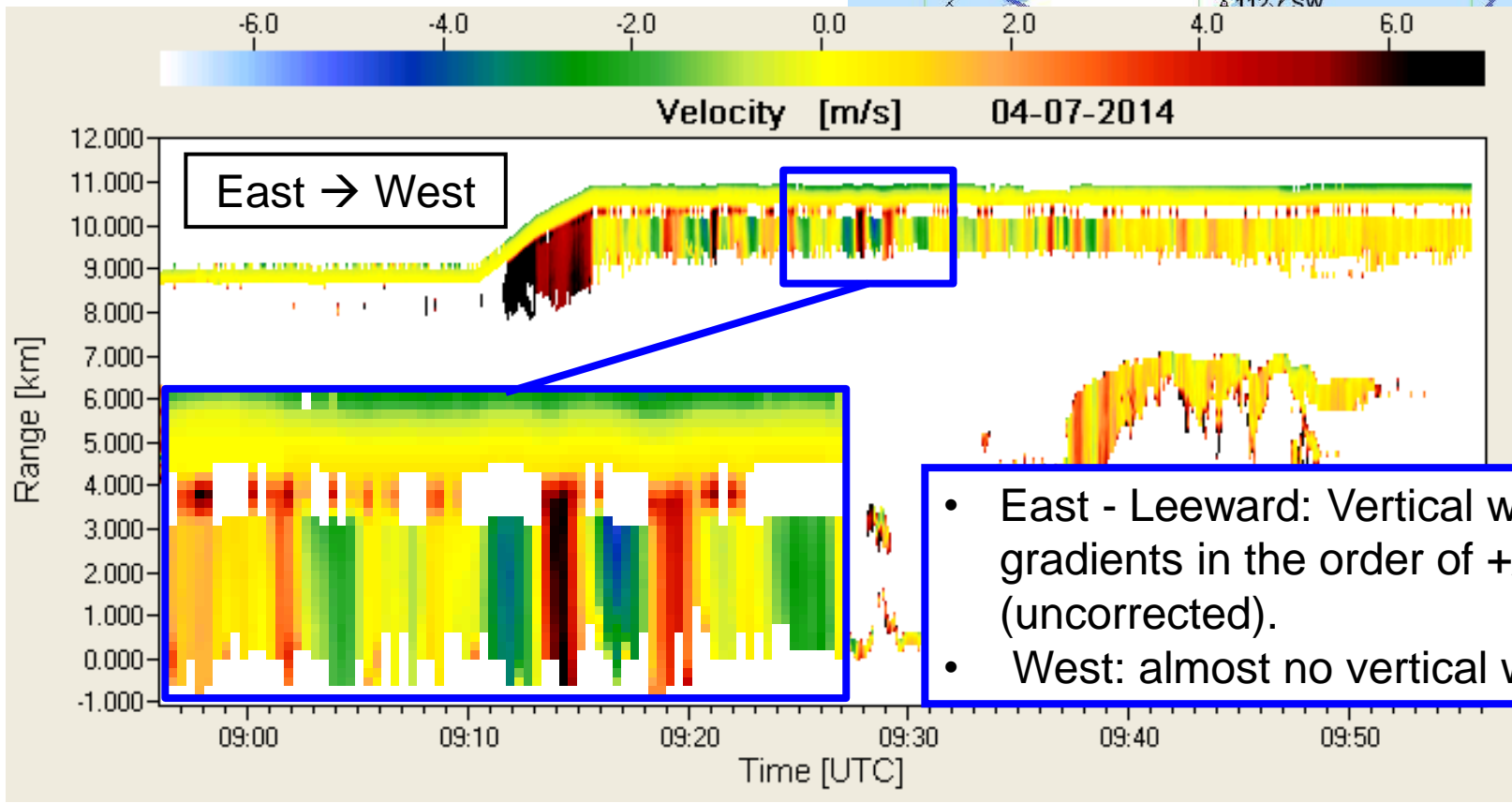
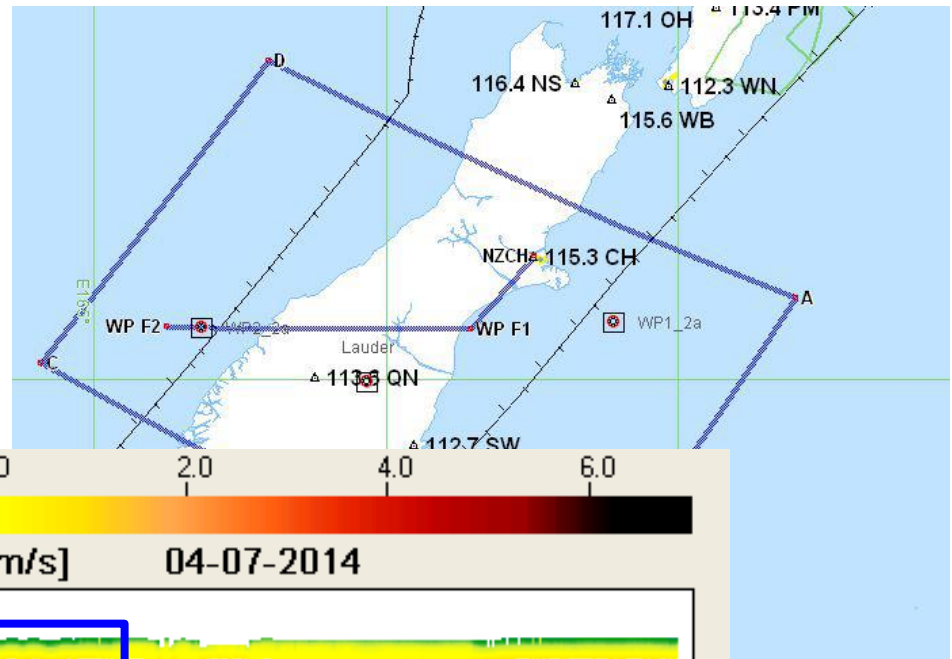


The 2 μ Wind Lidar

First results (4. July 2014)

2nd flight

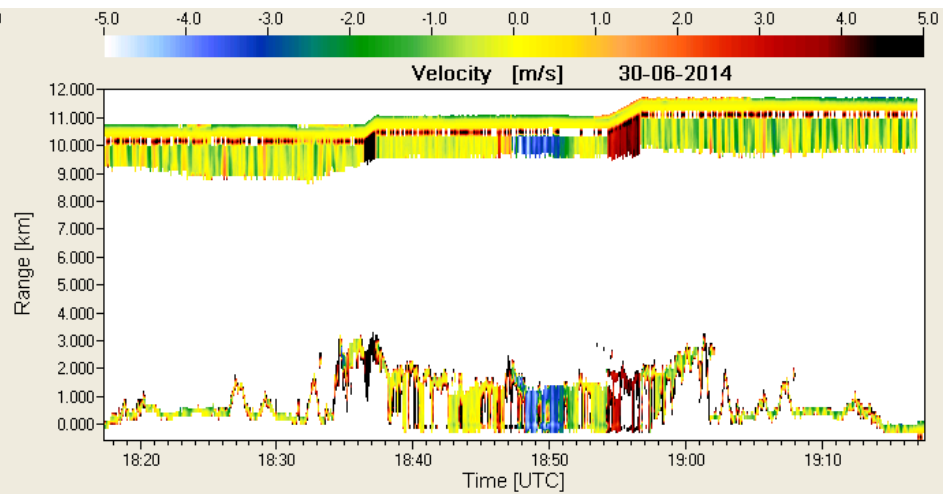
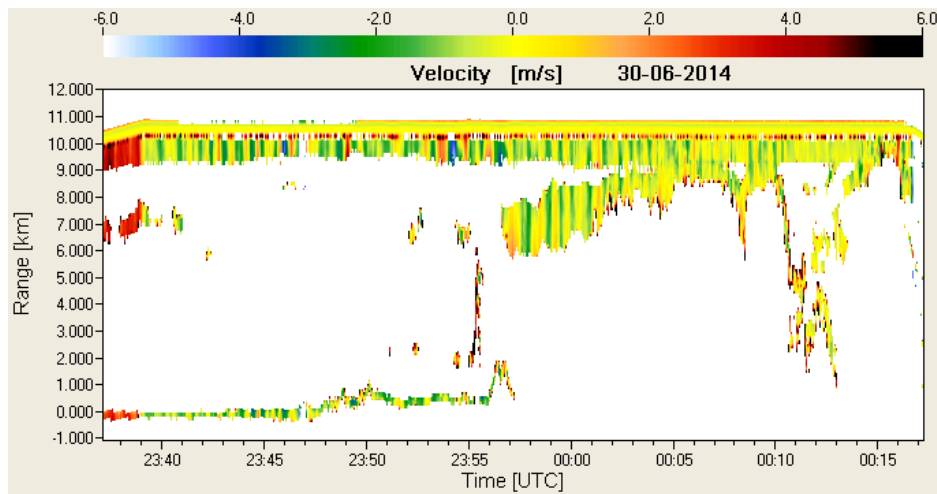
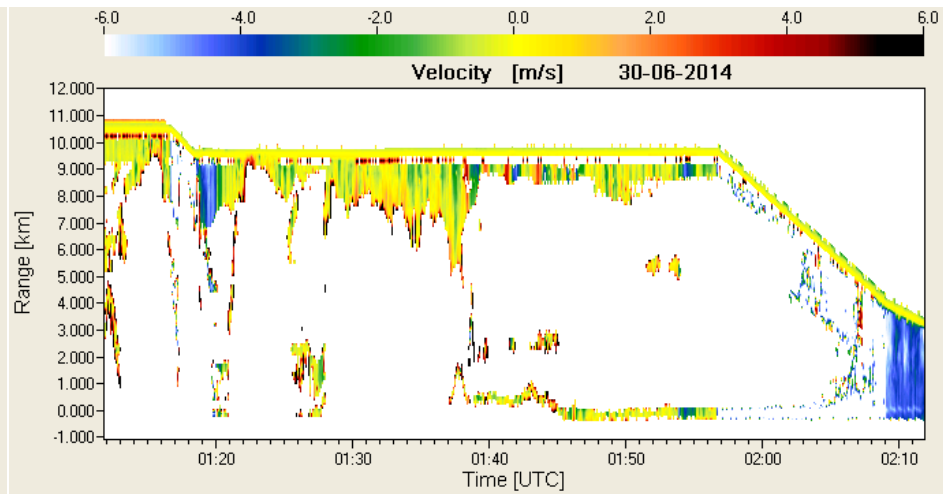
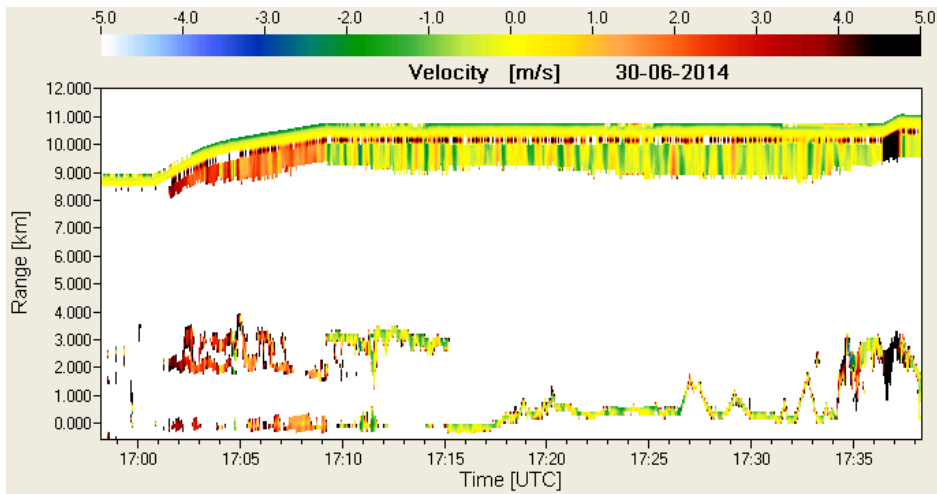
Preliminary (quicklook)



- East - Leeward: Vertical wind gradients in the order of +/- 6 m/s (uncorrected).
- West: almost no vertical wind



The 2 μ Wind Lidar Quicklooks



A high-angle, forward-looking view from an aircraft cockpit or wing. The left side of the frame shows the metallic surface of the wing and a portion of the fuselage. Below the wing, a vast expanse of blue ocean is visible, with a layer of white clouds just below the aircraft's altitude. The sky above is a clear, deep blue. The text "Thank you" is superimposed in the center of the image.

Thank you