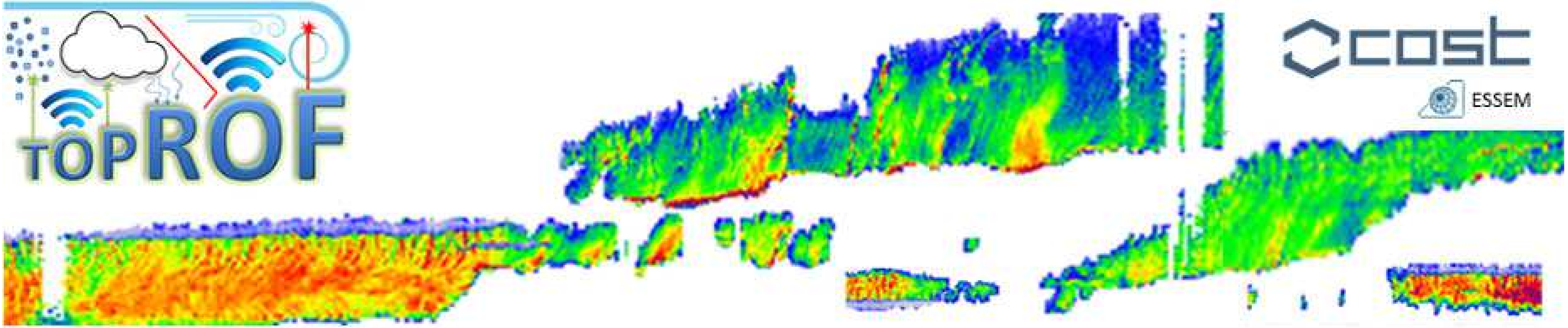


Updates on ALC calibration

Maxime Hervo

To-PROF and E-PROFILE teams

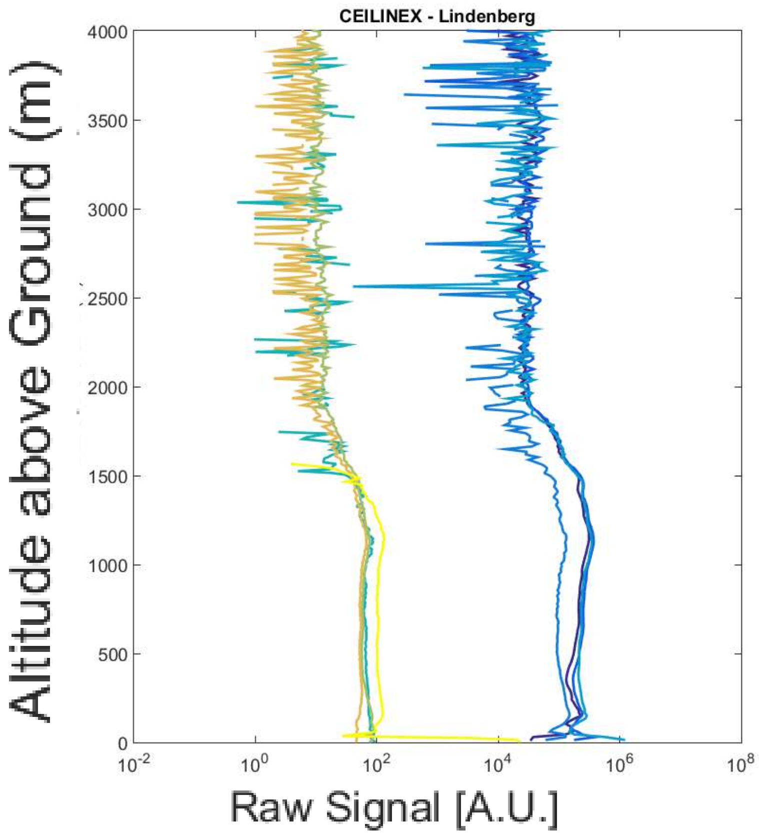
Atmospheric Calibration:

From raw signal to Attenuated Backscatter $\beta_{att} = \frac{Pr^2}{\boldsymbol{C_L}}$

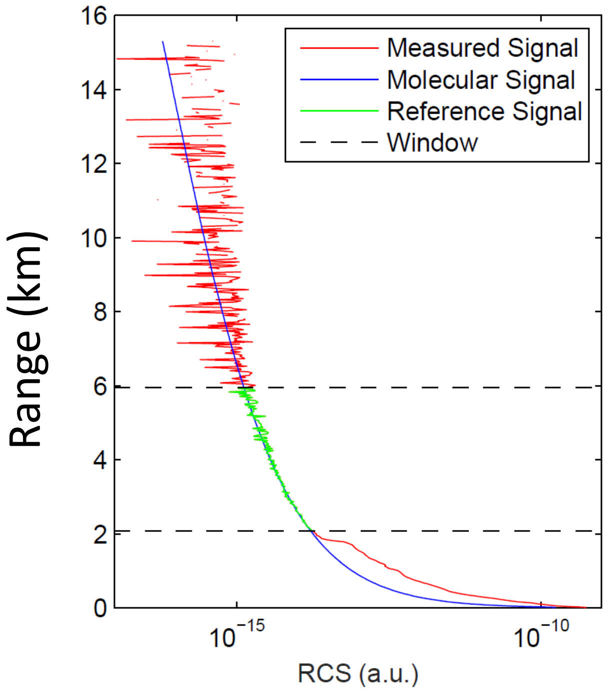
Atmospheric Calibration Using:

- **molecular** signal for instruments measuring at 1064nm
- **cloud** signal for instruments at 910nm

- No additional instrument
- No on site intervention
- Applicable to all instruments



3 orders of magnitude



Molecular calibration

[Wiegner and Geiß, 2012]

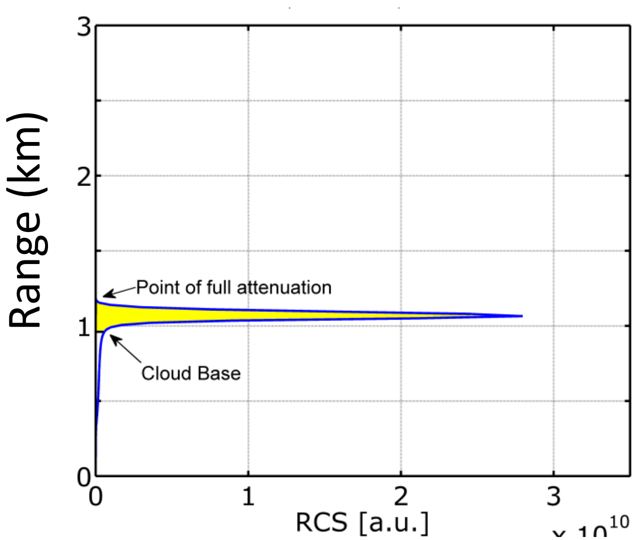
$$C_L = \frac{P(r)r^2}{\beta_{mol}(r)} e^{2\int_0^r \alpha(r')dr'}$$

P: Signal (range background and overlap corrected).
β: backscatter coefficient,
α extinction coefficient.
C_L: Lidar Constant,
r: range.

During night

Min 3 h average

Using T form ECMWF



Liquid cloud calibration

[O'Connor et al., 2004]

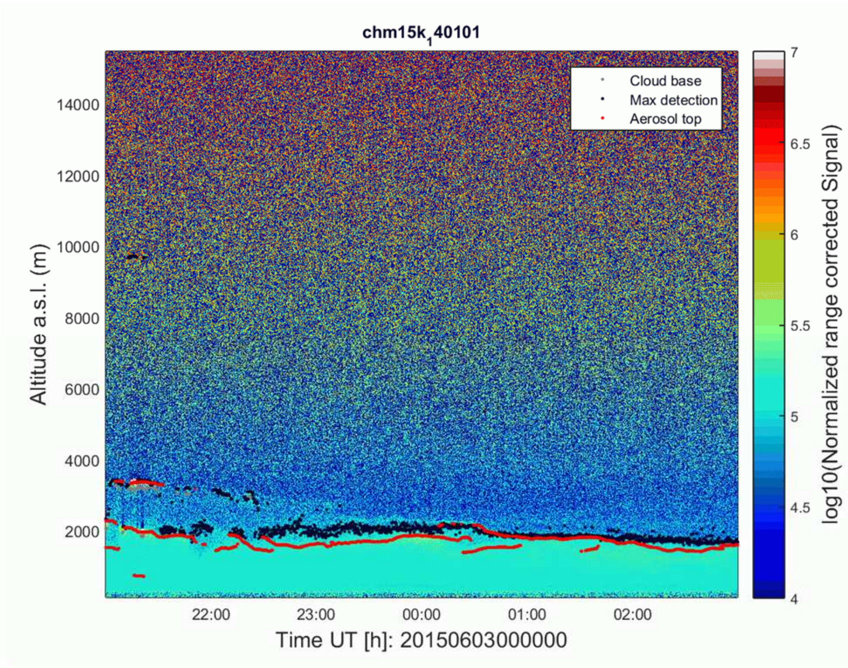
$$C_L = \frac{1}{B * 2\eta S}$$

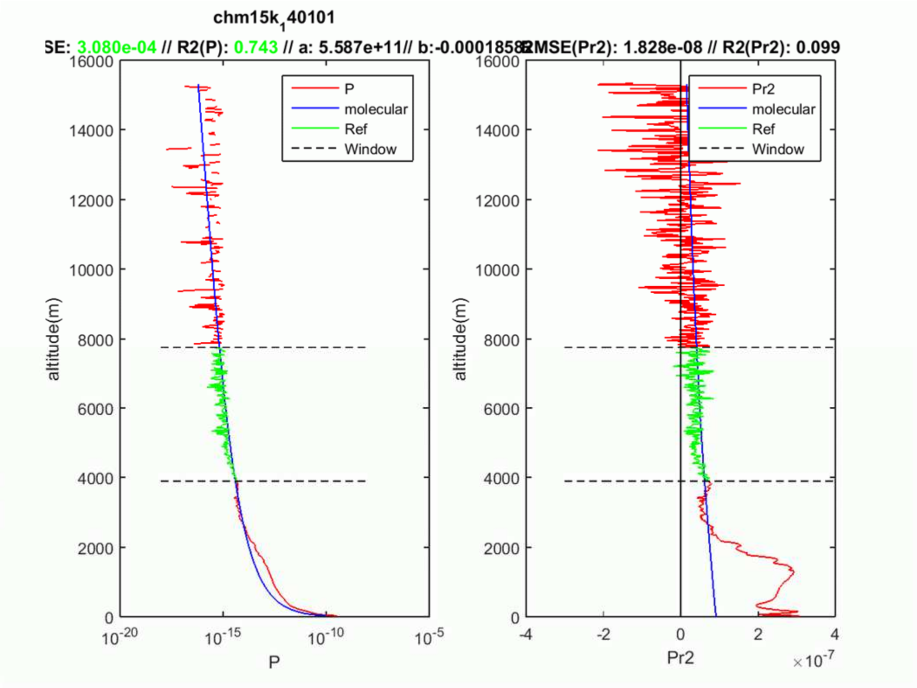
C_L the lidar calibration constant,
B the integral of the signal (yellow area),
η correction factor for multiple scattering
S the liquid cloud lidar ratio (18.8 ±0.8 sr)

Transmission corrected

Using T form ECMWF

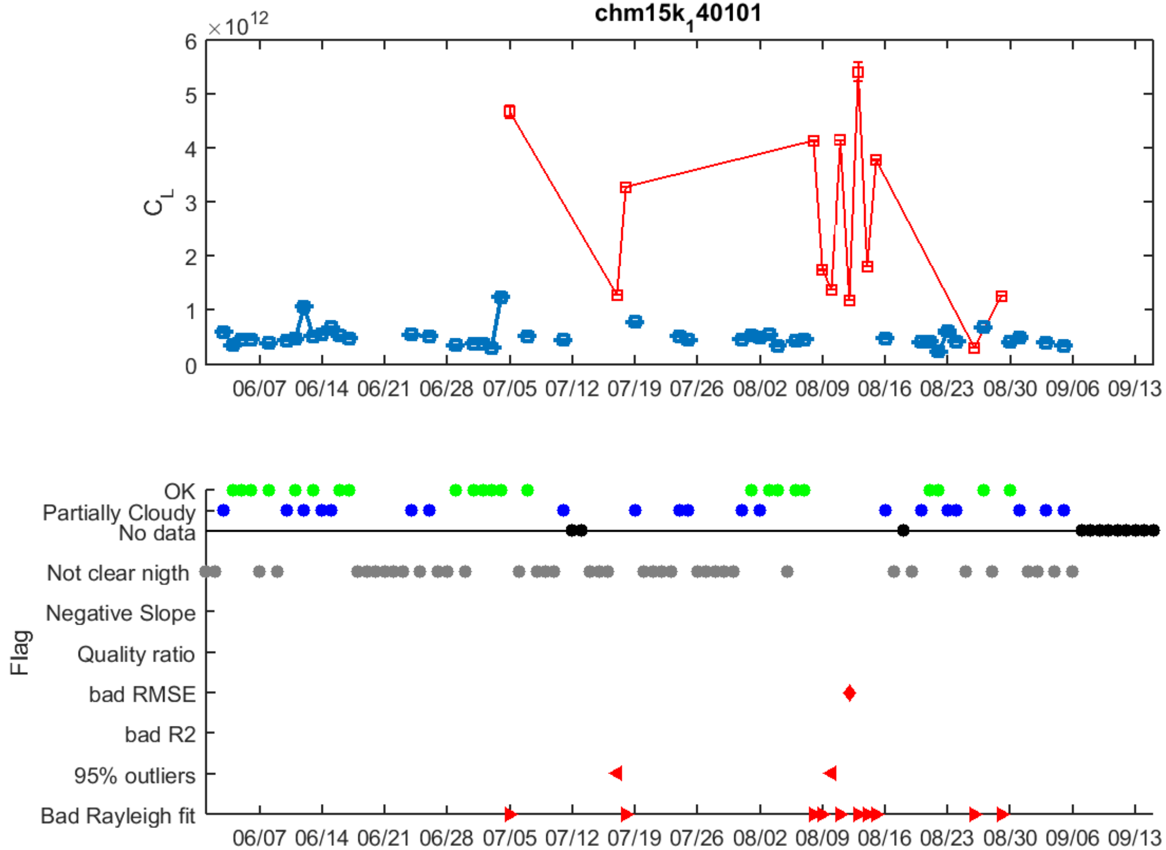
Molecular Calibration overview





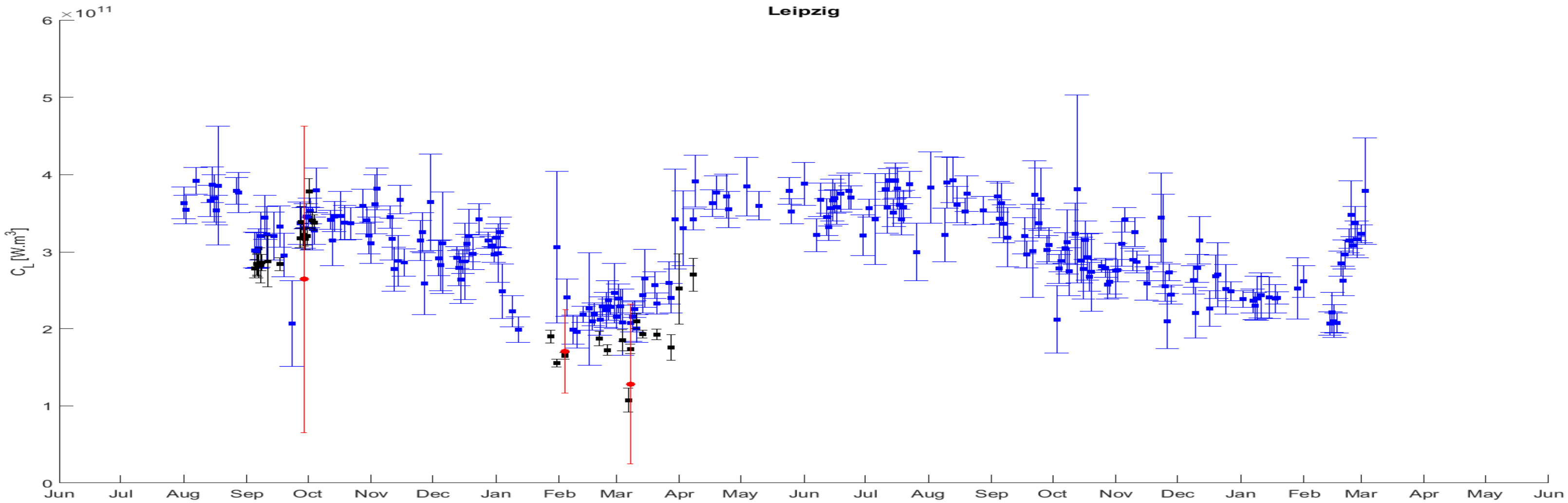
- Select profiles from 21:00 to 03:00,
- Remove clouds, Calculate CL if more than 50% of profiles without cloud detection
- Detect molecular layer
- Calculate ratio between molecular and raw profile (fit y= a x + b)
- Corrected by transmission below molecular zone

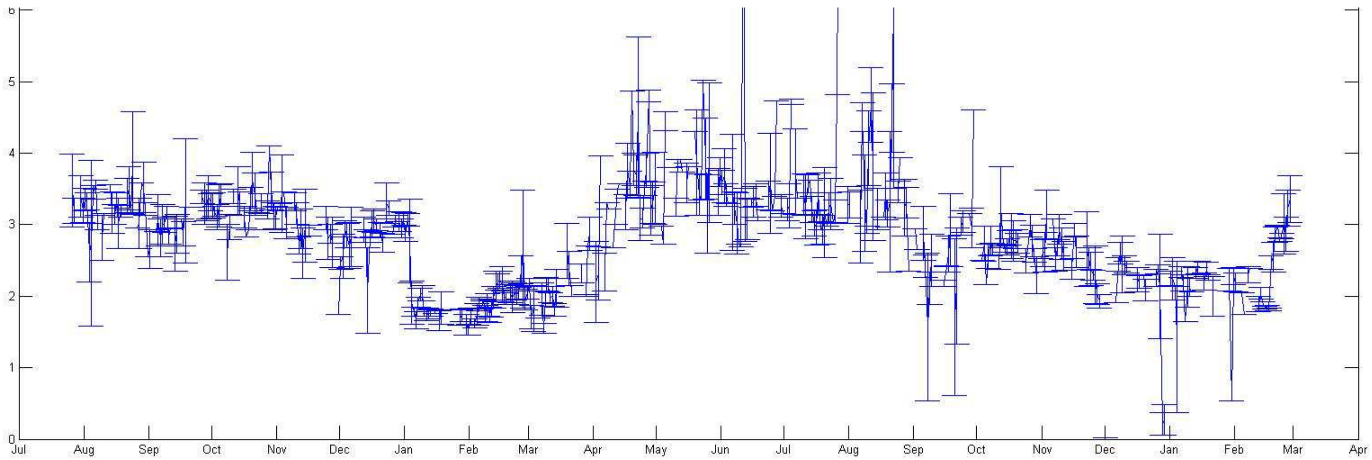
Molecular Calibration time series: quality check



Most of the outliers are removed when *b* value of Rayleigh fit is high

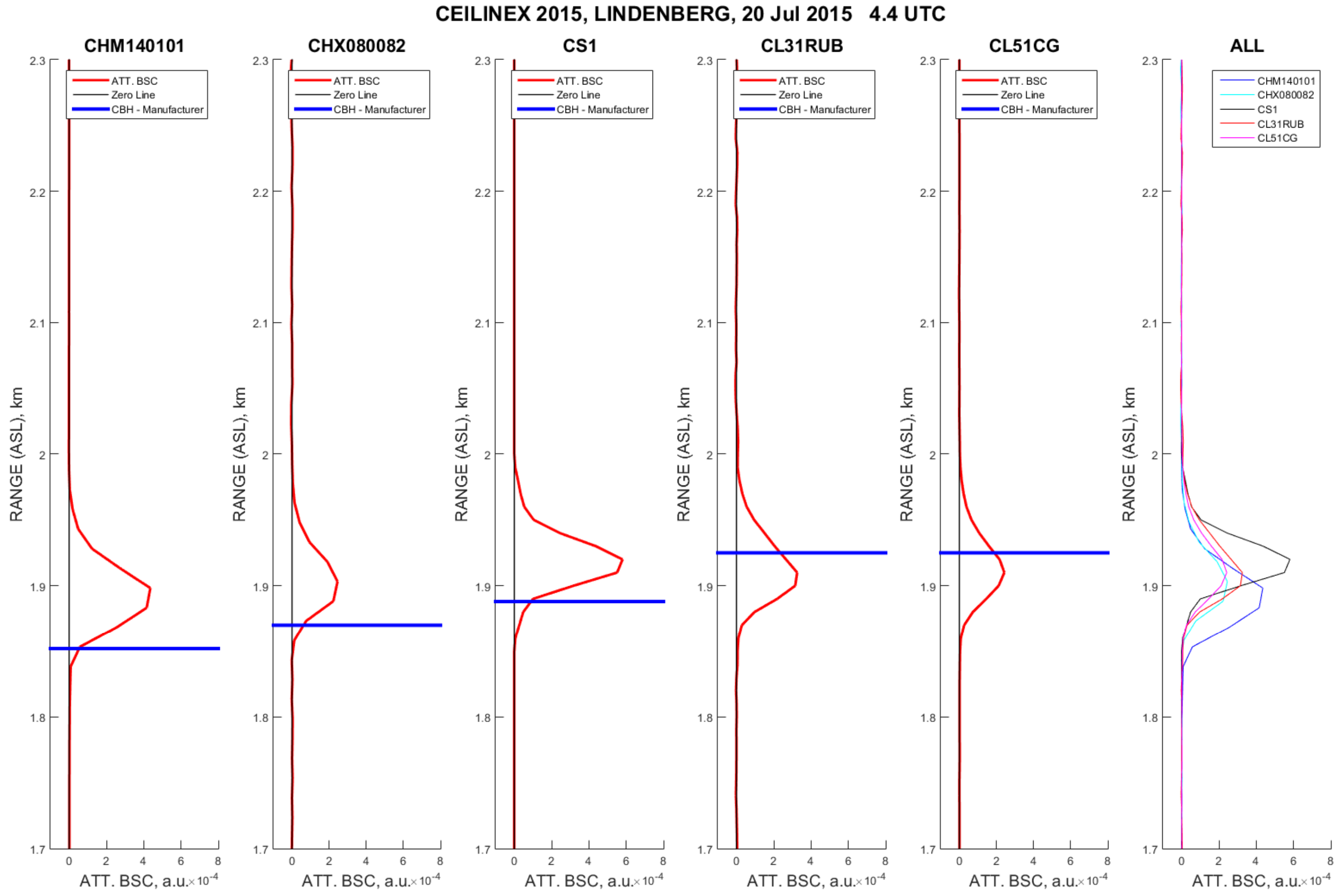
Meteoswiss+ DWD + Granada similar results for Leipzig





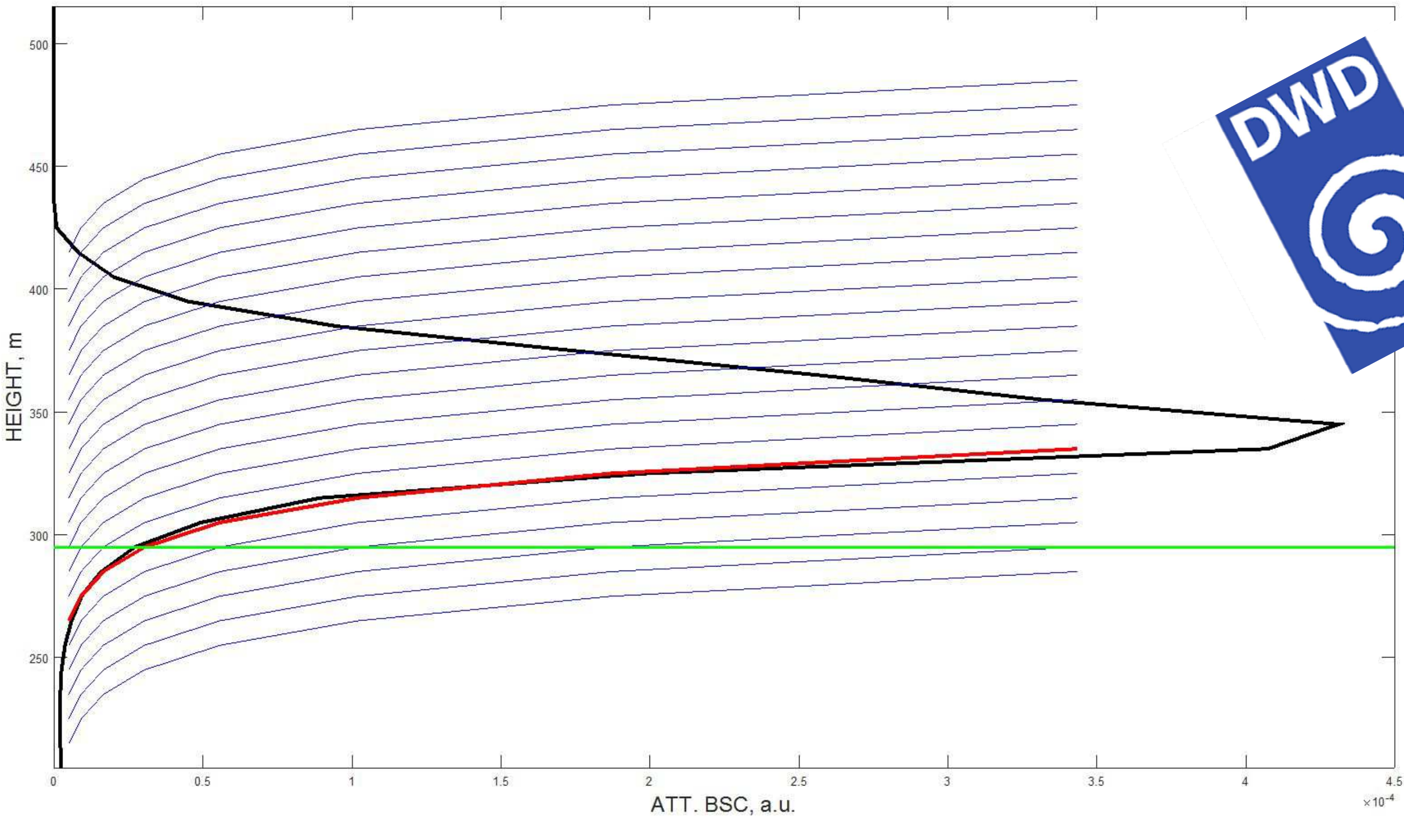
Thanks to Alberto, Frank and Ina

Cloud base height variability



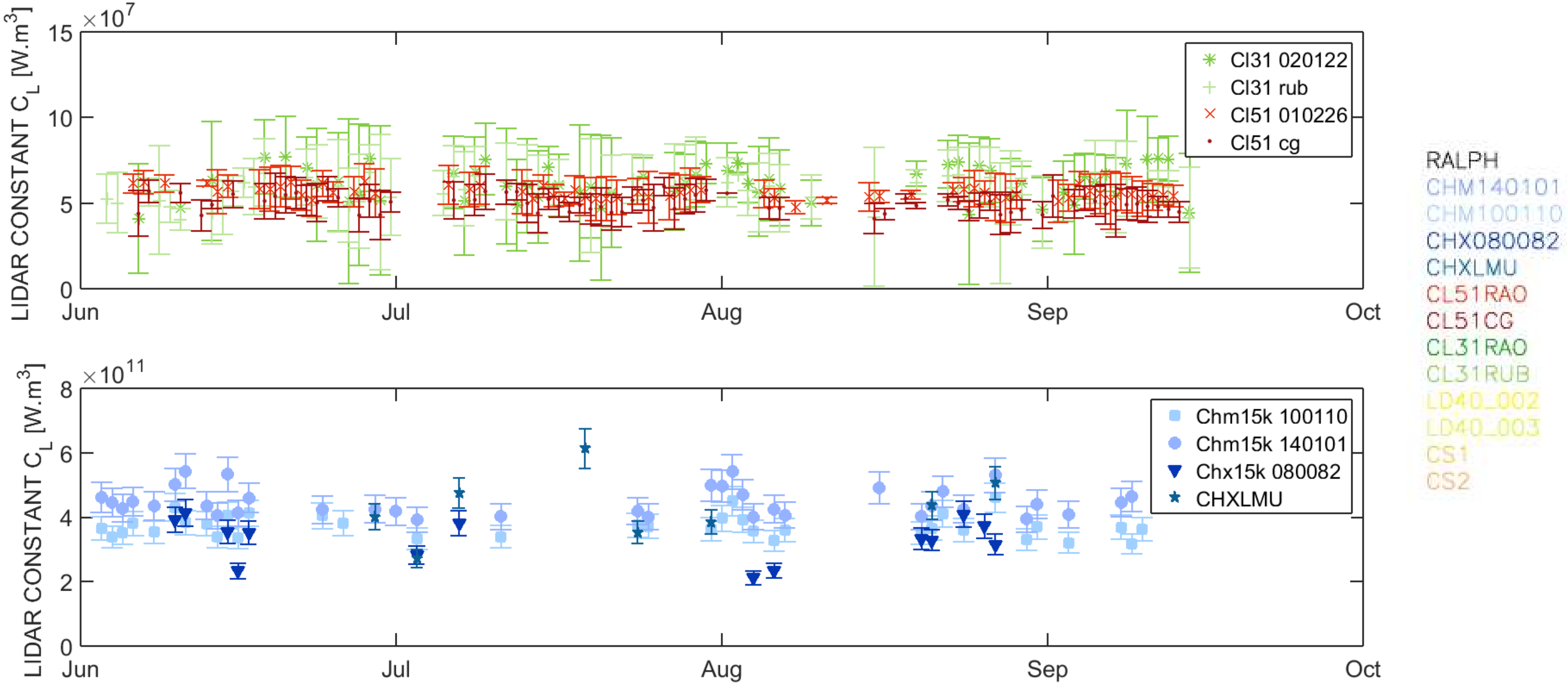
<u>CBH differs according to each manufacturer</u>

Solution for cloud calibration



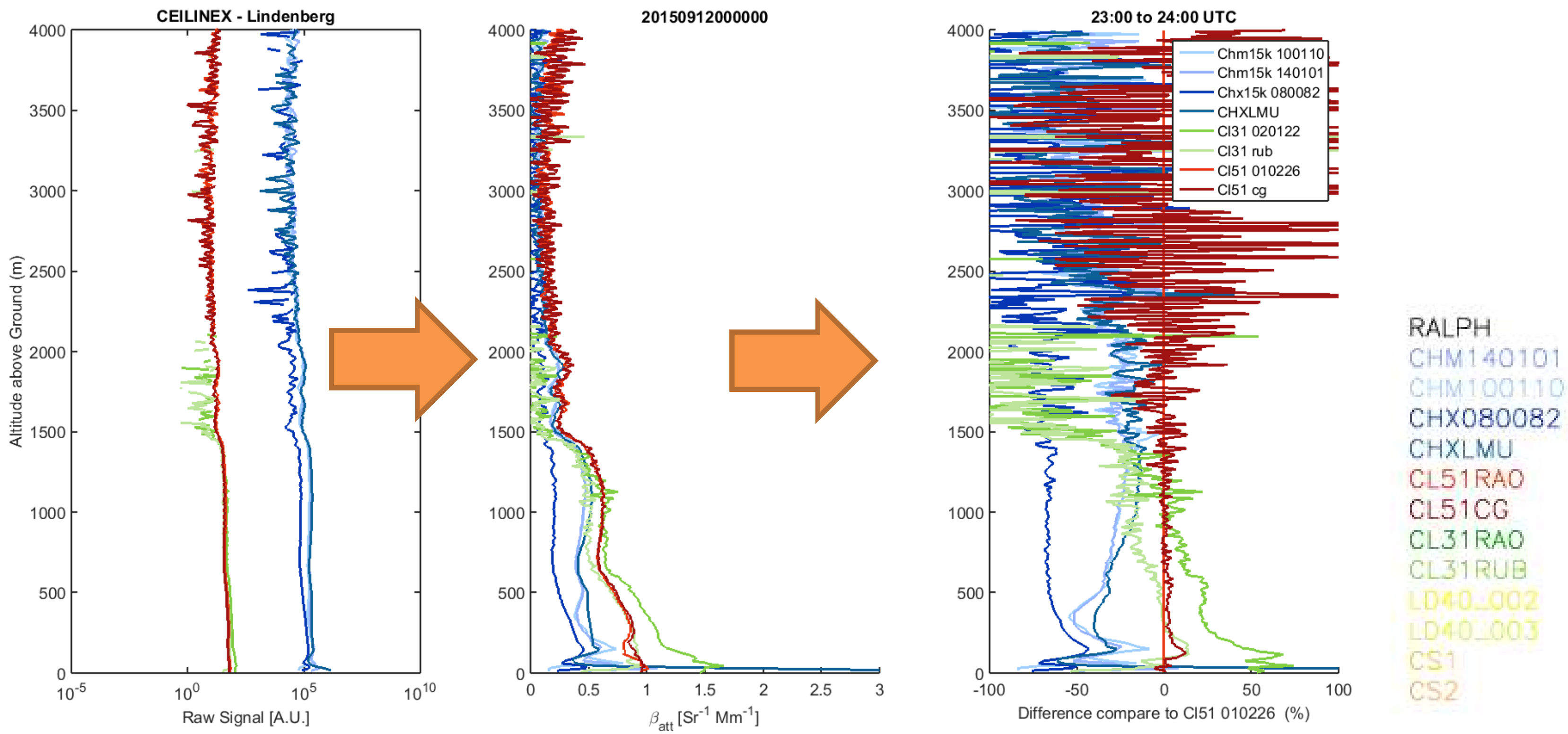
<u>New Cloud base detection by DWD</u>

Time series



Variability (STD/mean): CHM15K: ~10%
CHX : ~25%
CL31: ~10%
CL51: ~15%

Profiles



From 3 orders of magnitude to 50% difference
Two groups of data: Lufft vs Vaisala (1064nm vs 905nm).
CHX08 too low: Molecular partly influence by noise level?
Assumption: color ratio (532/1064) in Europe 2.43 (Gross 2013)

How to improve ??

Conclusions

- Molecular and Cloud calibration tested for more than 3 months

- Less than 50% differences .

=> How to improve it?

- Compare with Ralph measurements
- Investigate cloud calibration for CS135.