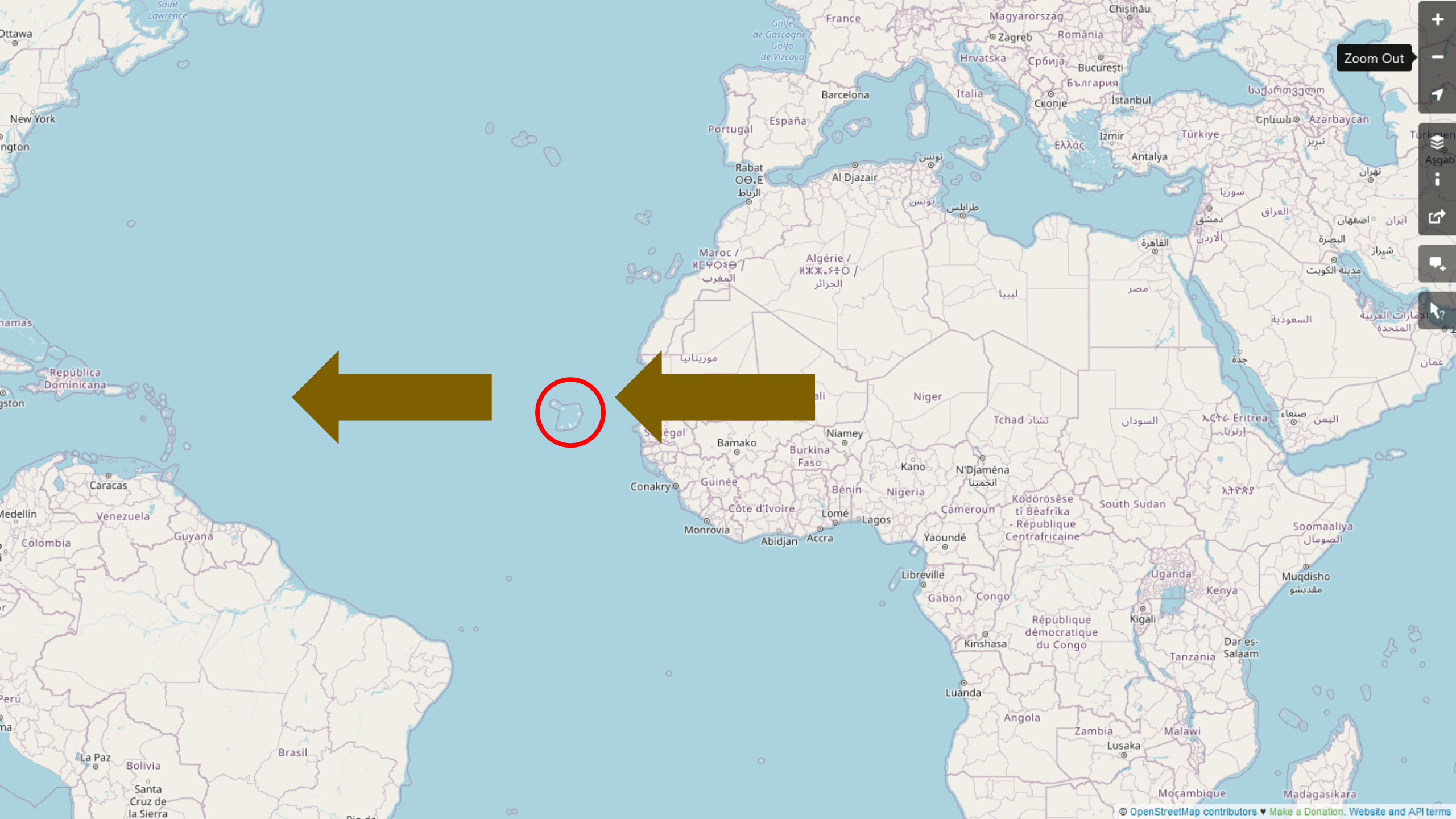
ESA-JAXA Pre-Launch EarthCARE Science and Validation Workshop

13 – 17 November 2023 | ESA-ESRIN, Frascati (Rome), Italy

In-situ airborne measurements during Aeolus Cal/Val JATAC campaigns – relevance for EarthCARE aerosol products

J. Yus-Díez, M. Bervida, L. Drinovec, U. Jagodič, B. Žibert, M. Lenarčič, E. Marinou, P. Paschou, N. Siomos, D. Kouklaki, H. Baars, R. Engelmann, A. Skupin, C. Zenk, T. Fehr, Griša Močnik


Zoom Out
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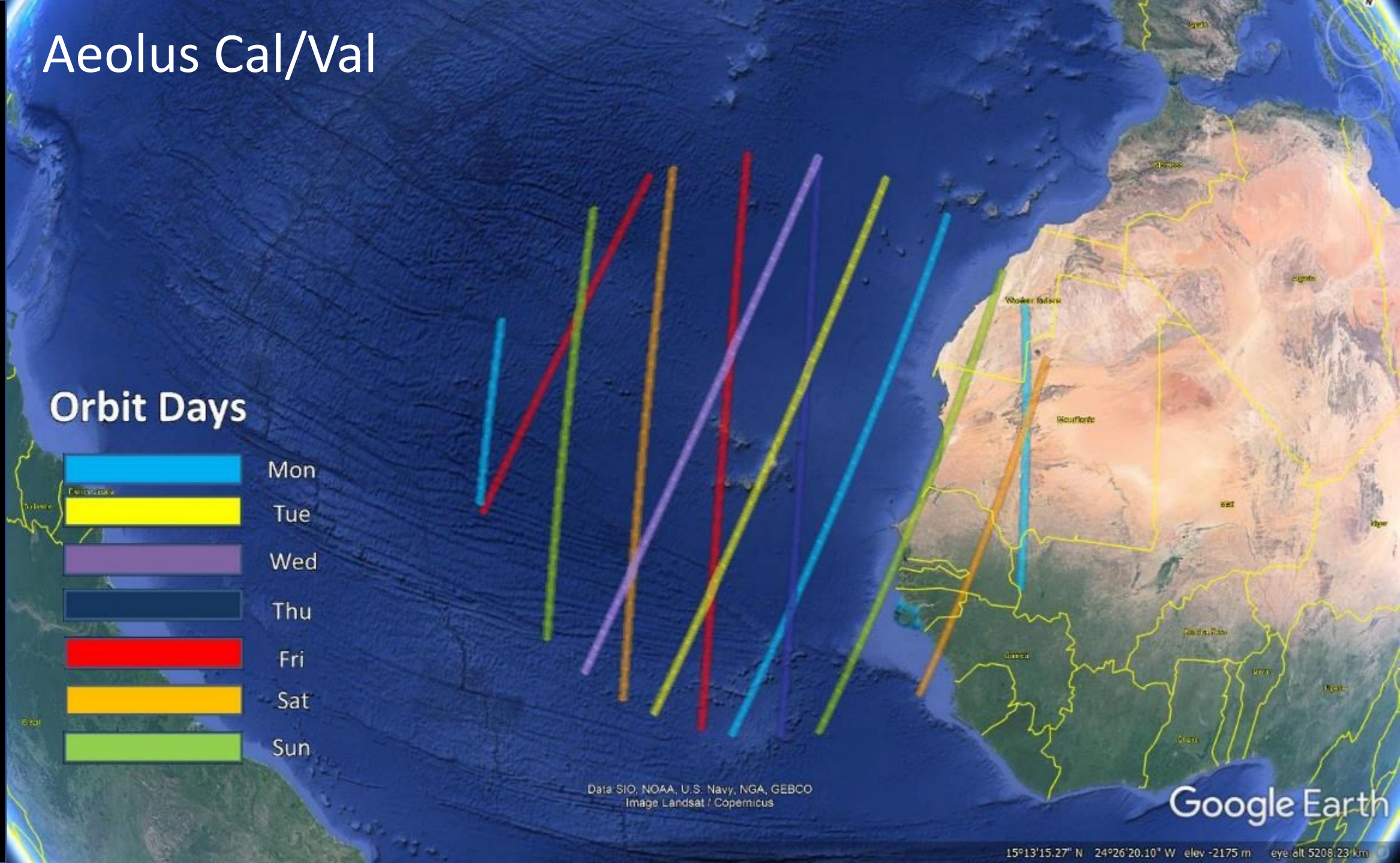
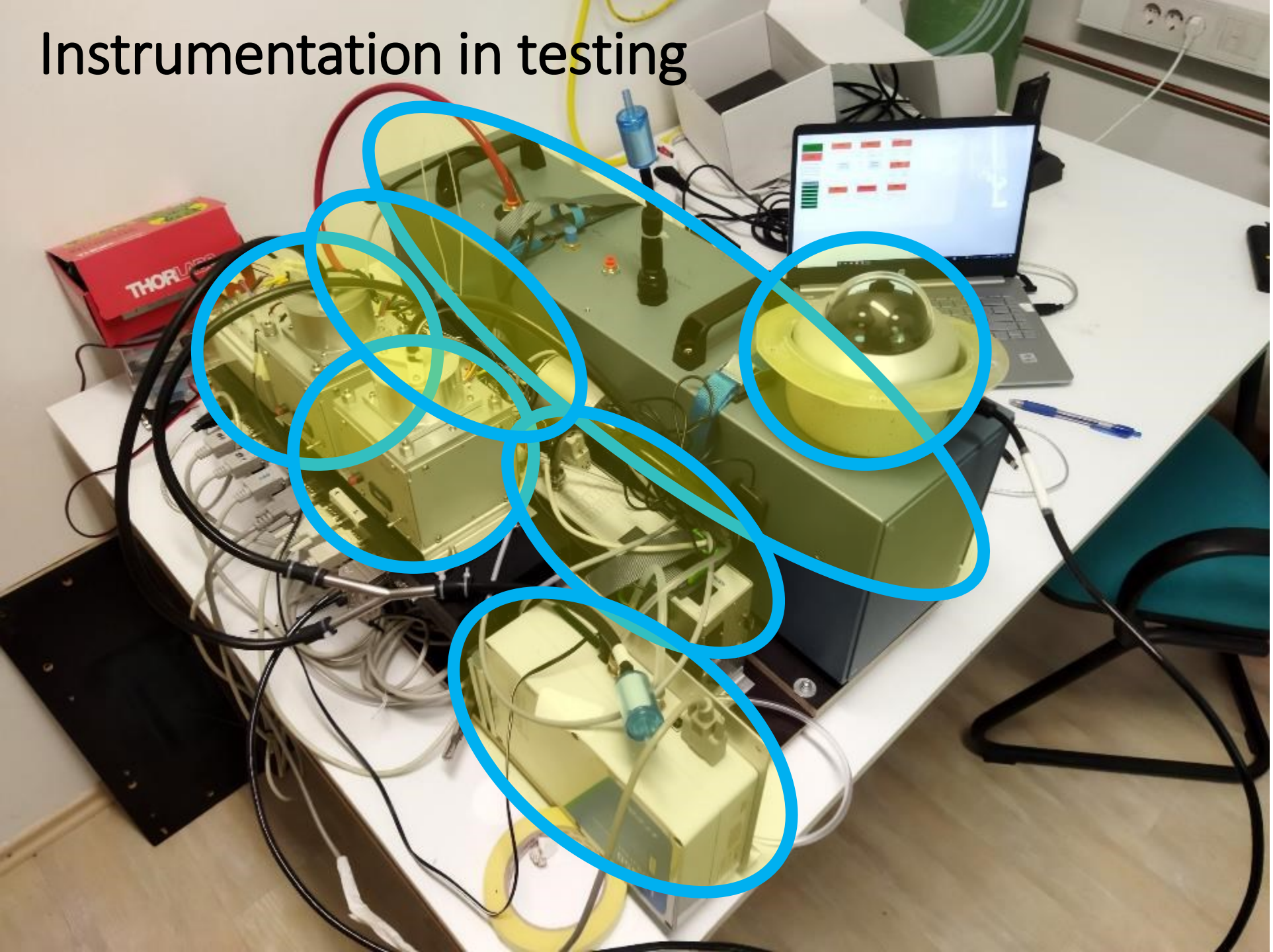
Aeolus Cal/Val



Instrumentation in testing



Absorption coeff.:

- fine
- coarse enhanced

Scattering coeff.:

- total

Size distribution:

- total
- coarse enhanced

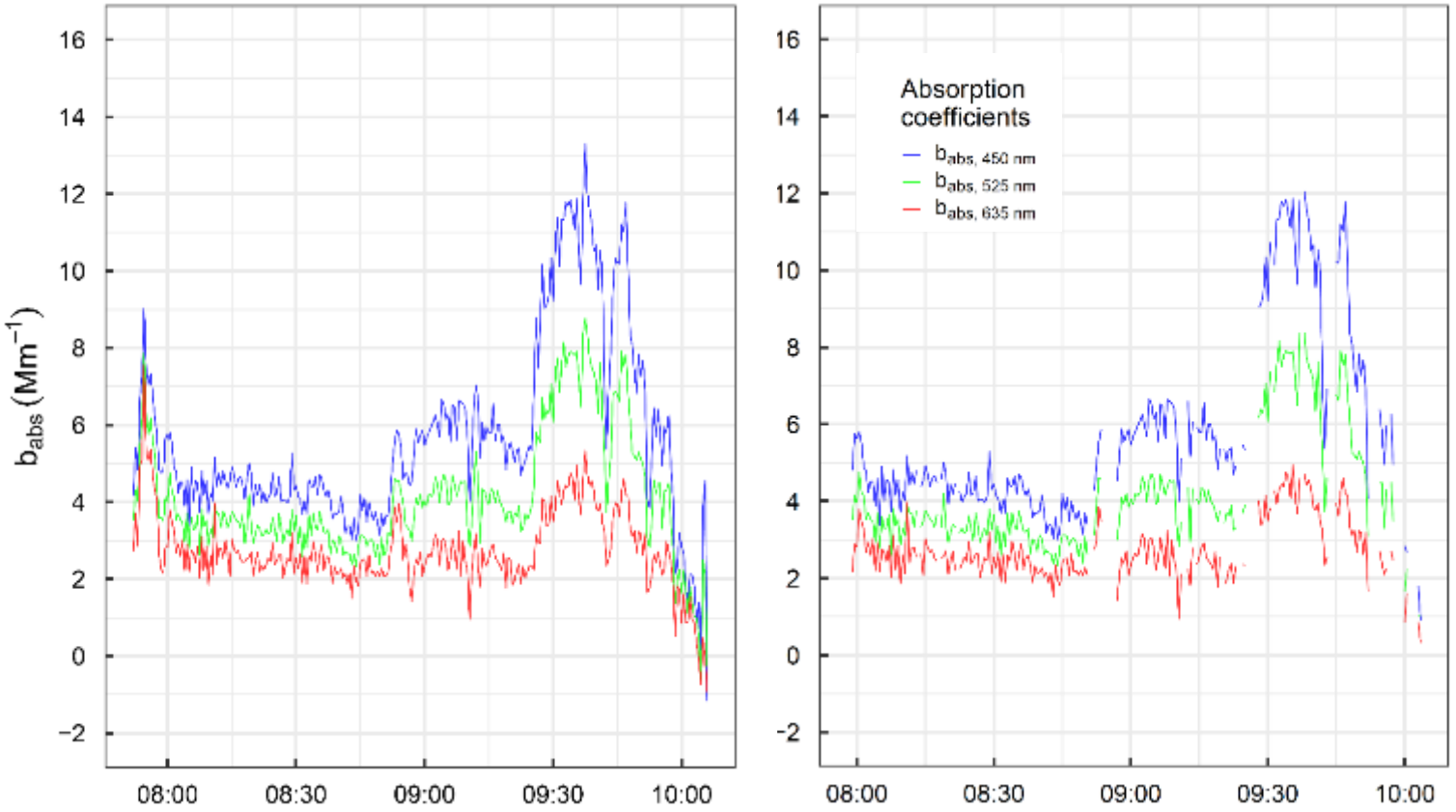
Solar irradiance

CO2 sensor, RH

Quality control – calibration: abs, scatt

raw data

postprocessed data

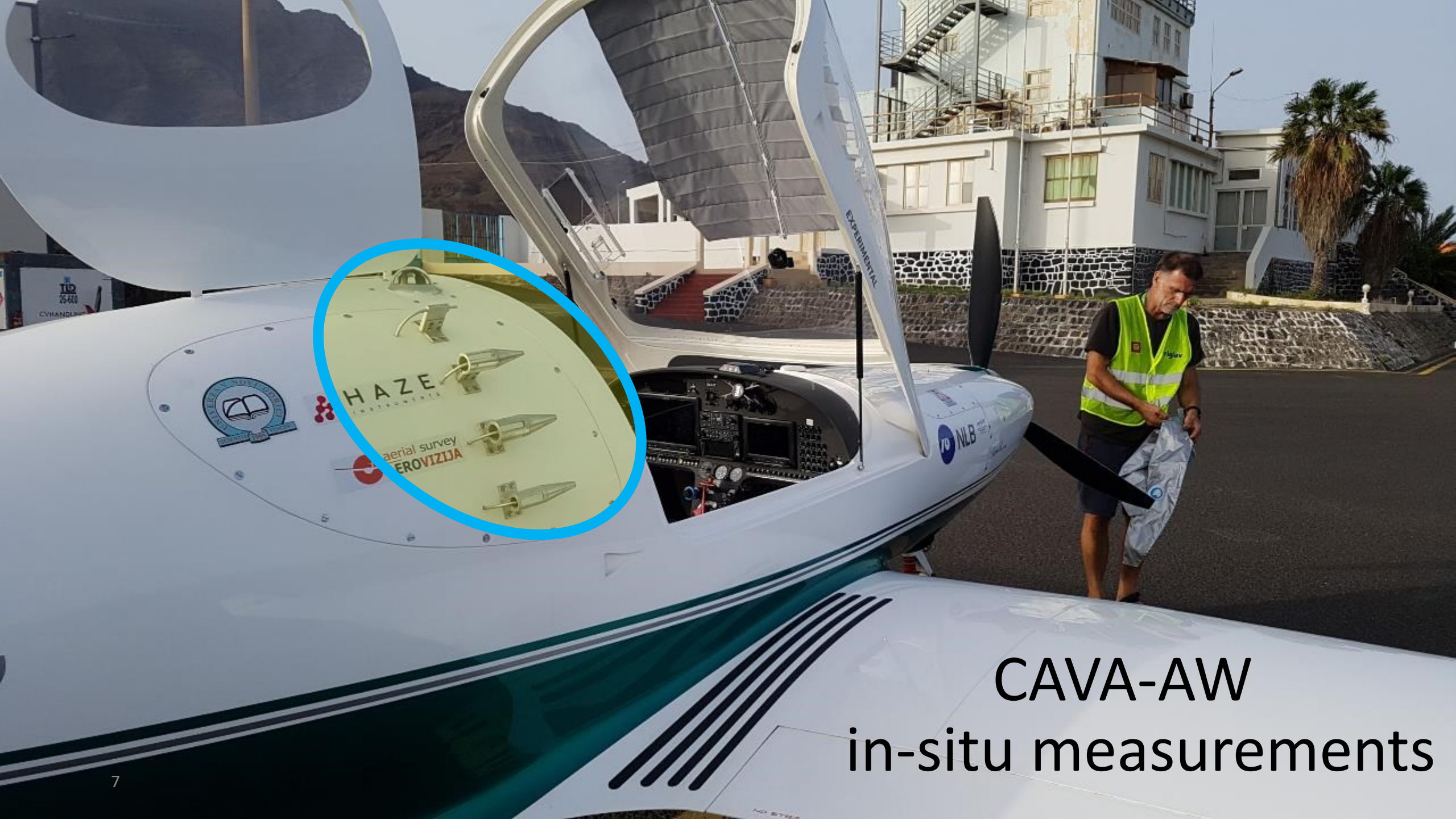


aerosol absorption coefficient
8 Sept 2021

A dual-wavelength photothermal aerosol absorption monitor: design, calibration and performance

Luka Drinovec[1,2,3], Uroš Jagodič[1,2], Luka Pirker[2,4], Miha Škarabot[2], Mario Kurtjak[5], Kristijan Vidović[6], Luca Ferrero[7], Bradley Visser[8], Jannis Röhrbein[8], Ernest Weingartner[8], Daniel M. Kalbermatter[9], Konstantina Vasilatou[9], Tobias Bühlmann[9], Celine Pascale[9], Thomas Müller[10], Alfred Wiedensohler[10], and Griša Močnik[1,2,3]

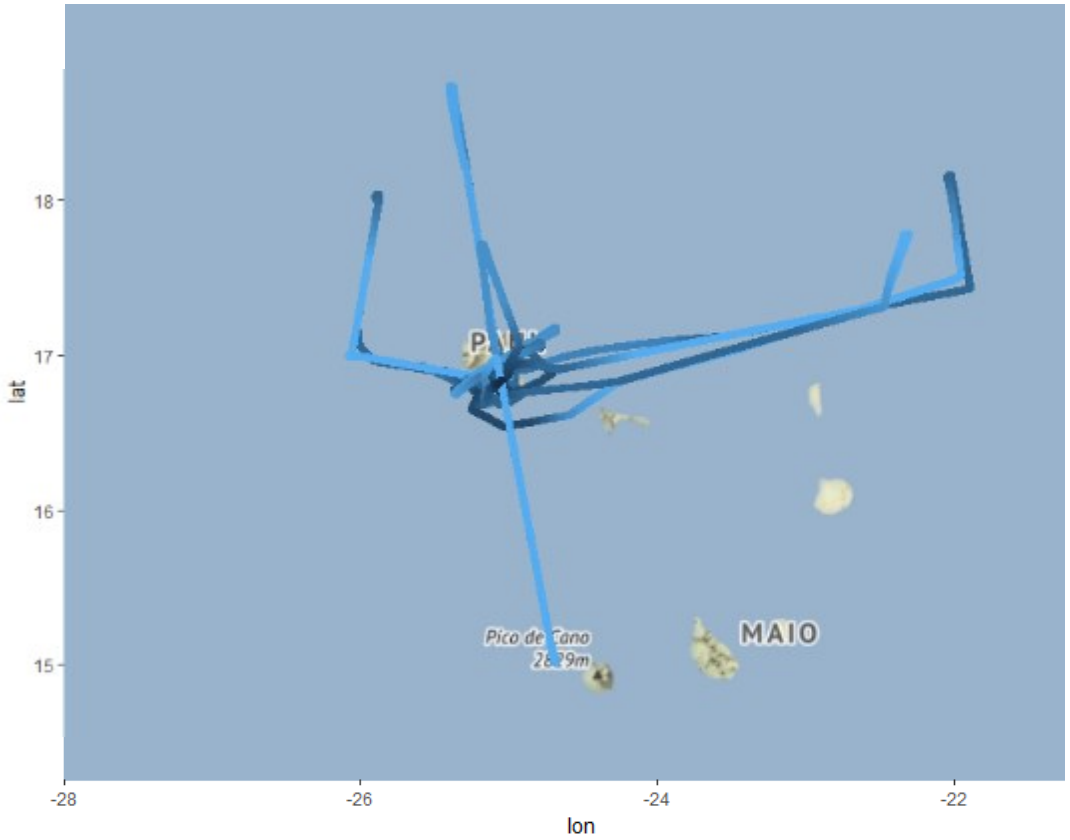
traceably calibrated with reference PTI



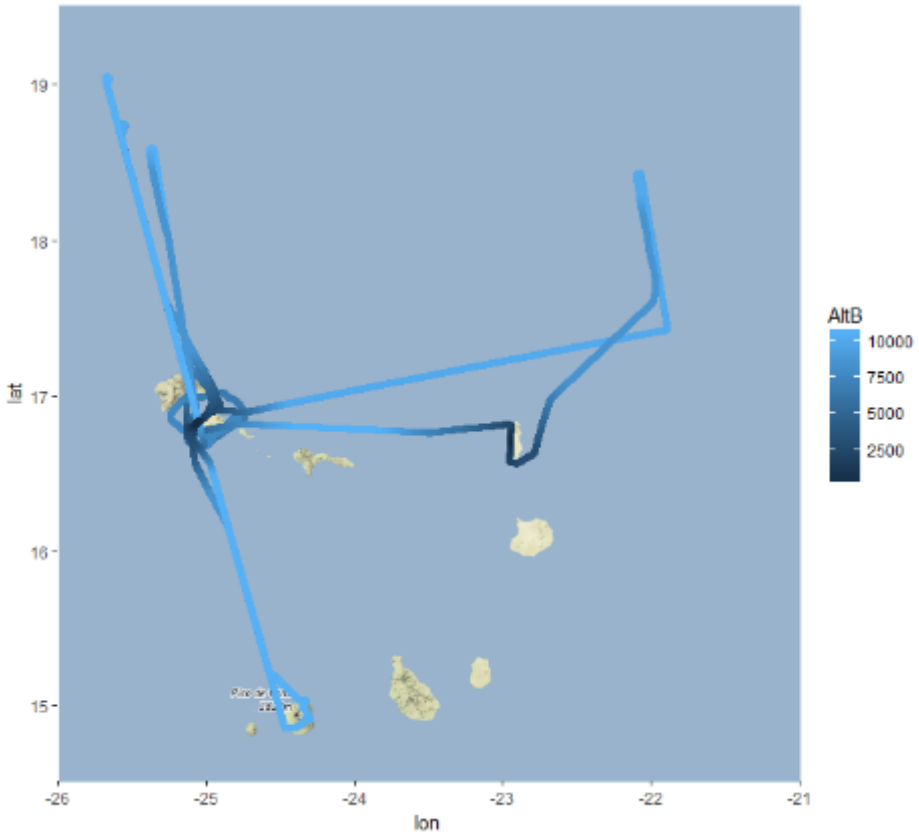
CAVA-AW
in-situ measurements

Campaign overview

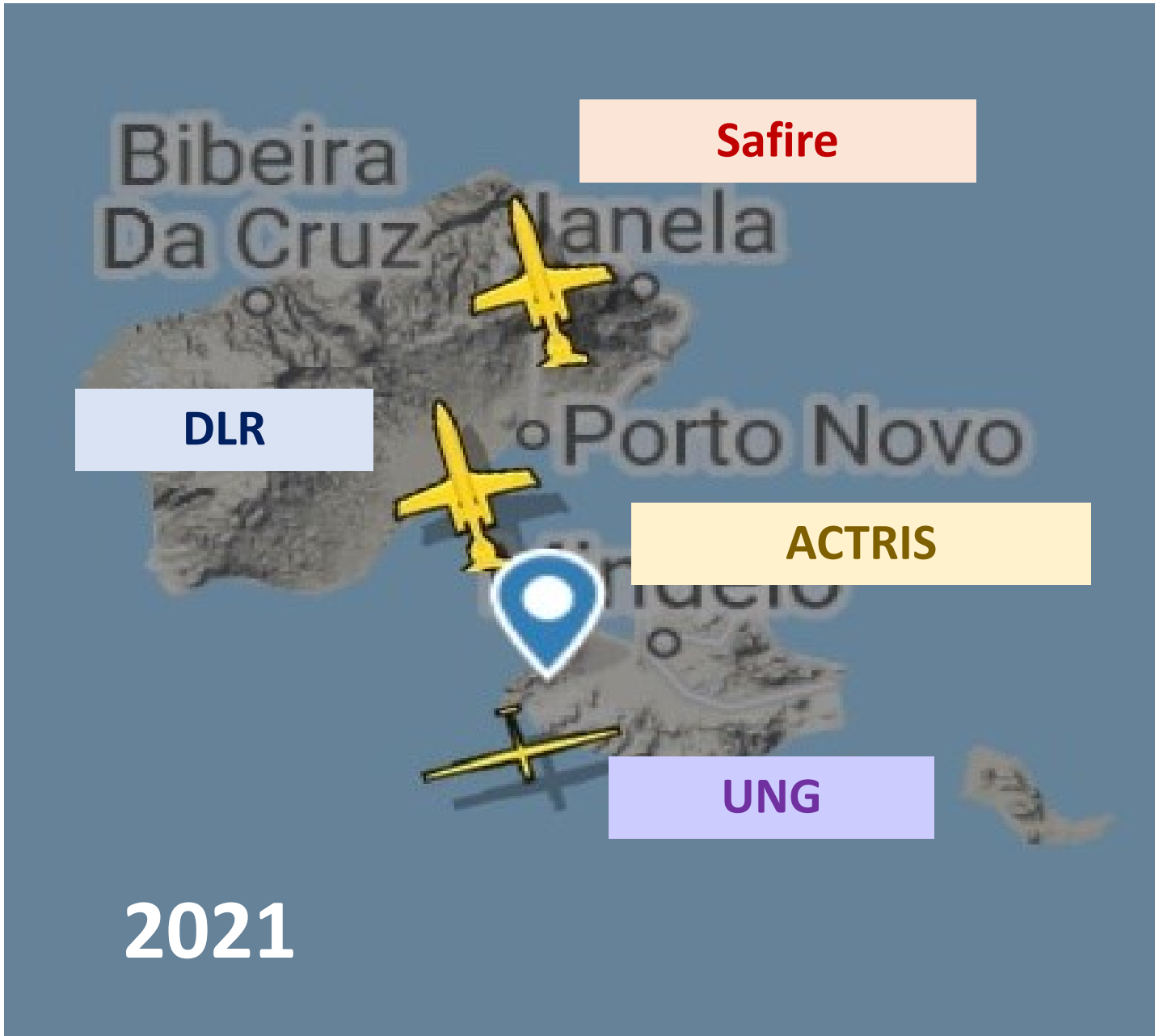
2021 – 18 flights

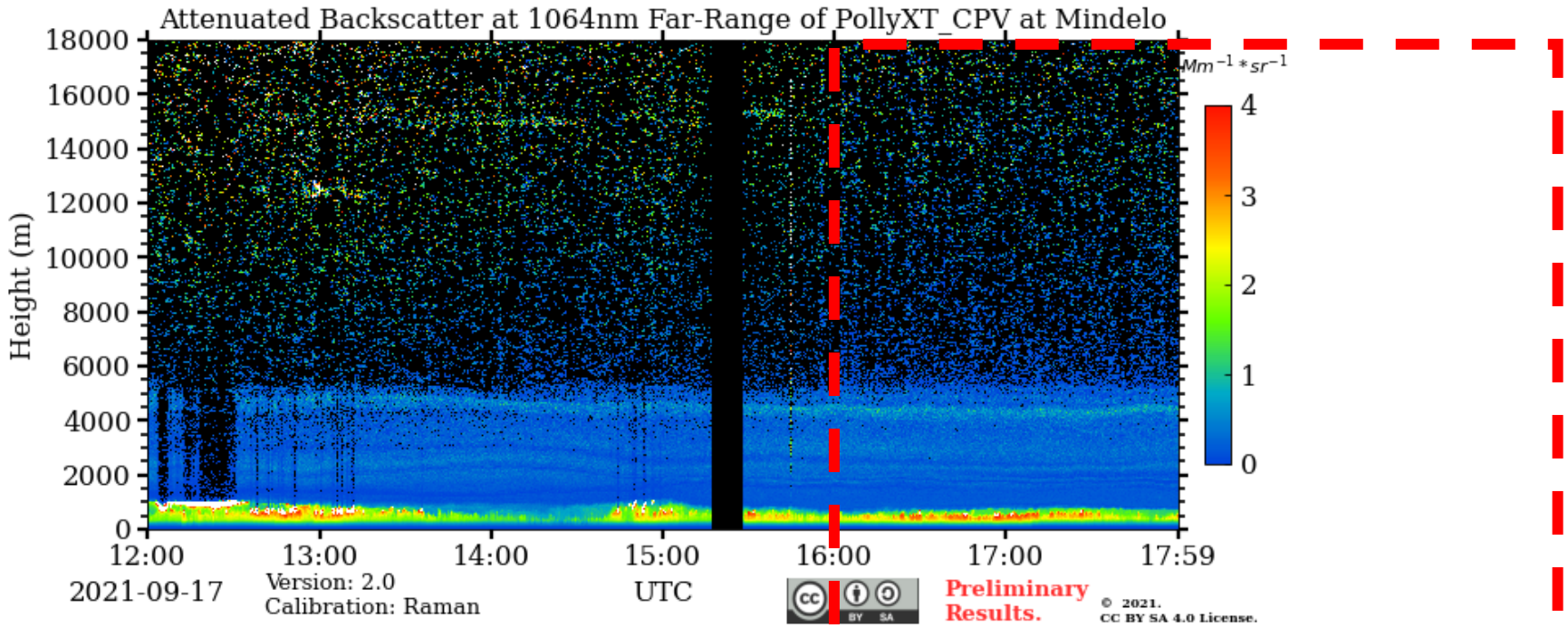


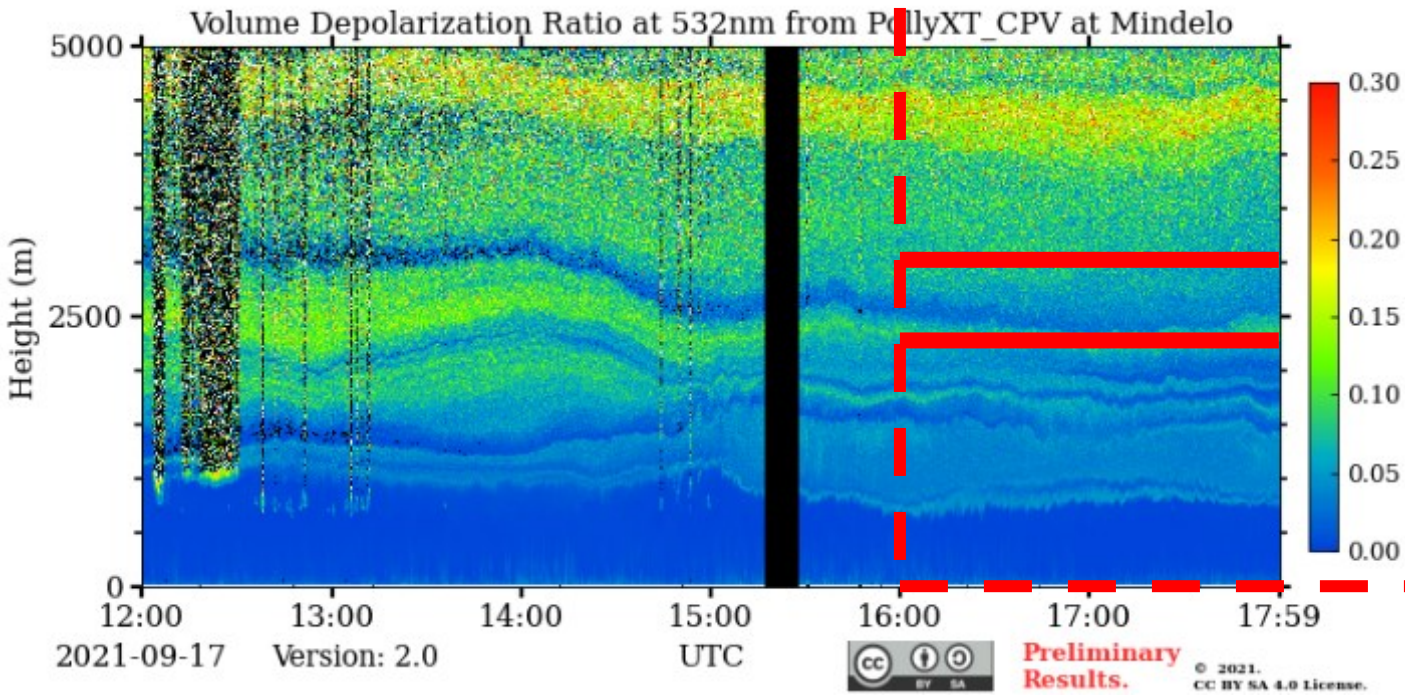
2022 – 9 flights



Coordination with DLR, SAPHIRE, NASA DC-8







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TROPOS
Leibniz Institute for Tropospheric Research


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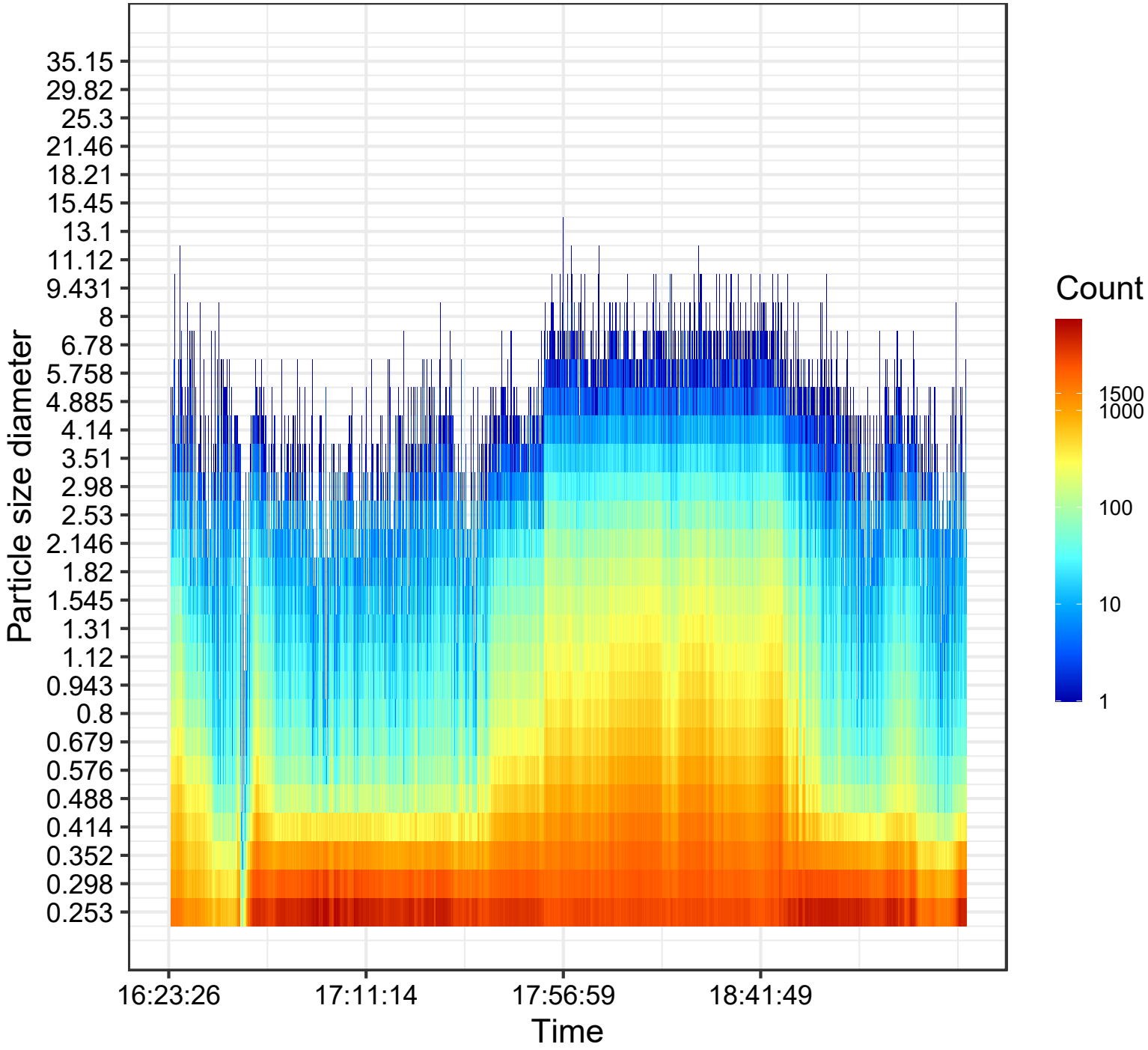
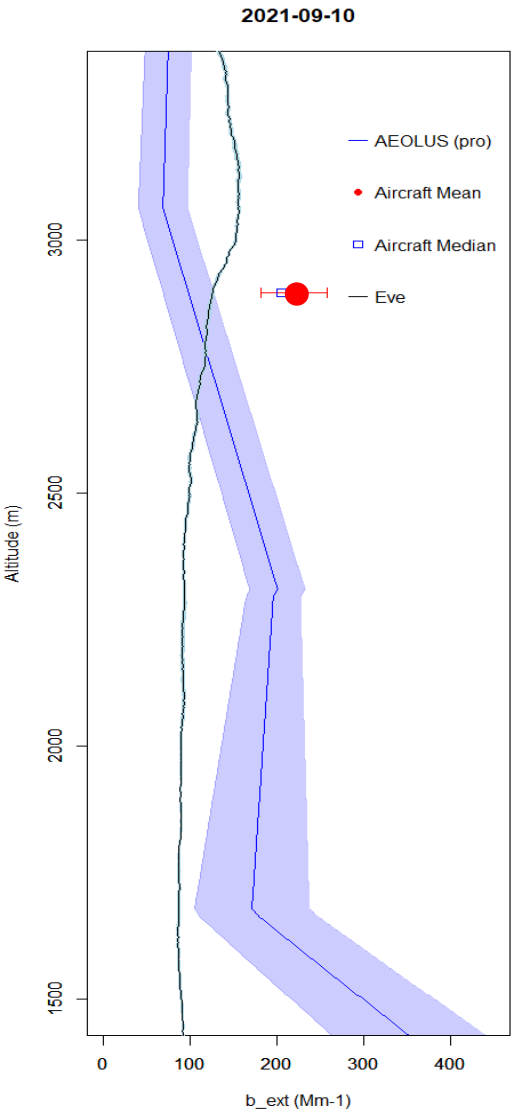
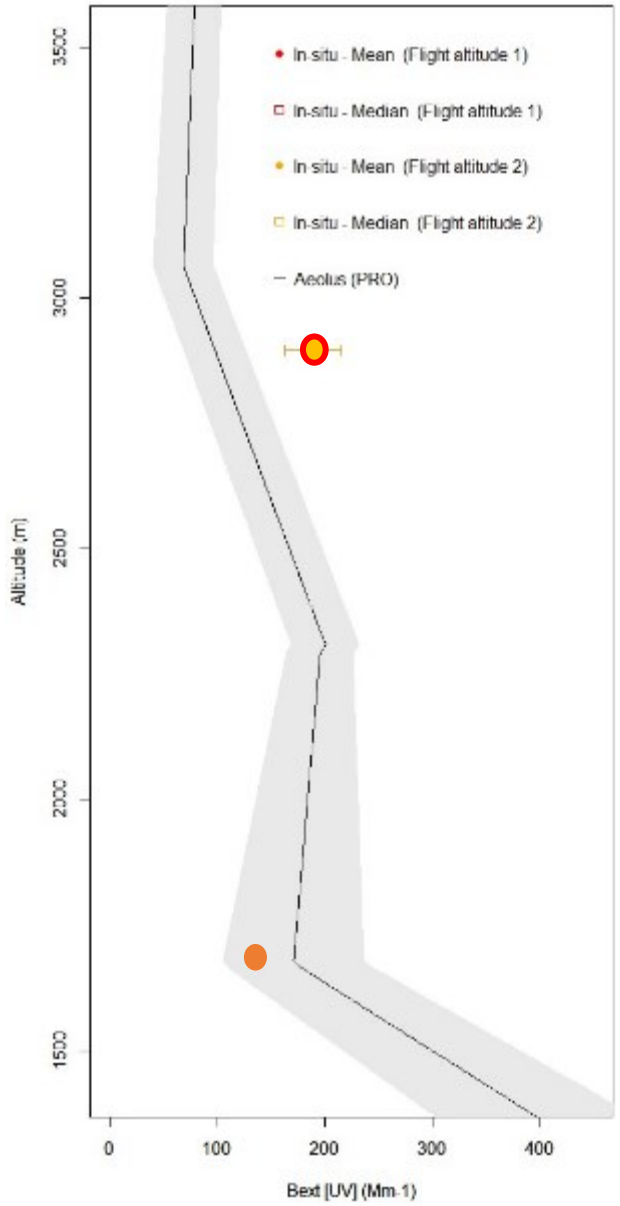

Particle size diameter
35.15
29.82
25.3
21.46
18.21
15.45
13.1
11.12
9.431
8
6.78
5.758
4.885
4.14
3.51
2.98
2.53
2.146
1.82
1.545
1.31
1.12
0.943
0.8
0.679
0.576
0.488
0.414
0.352
0.298
0.253
16:23:26
17:11:14
17:56:59
18:41:49
Time
Count
1500
1000
100
10
1

17 Sep 2021

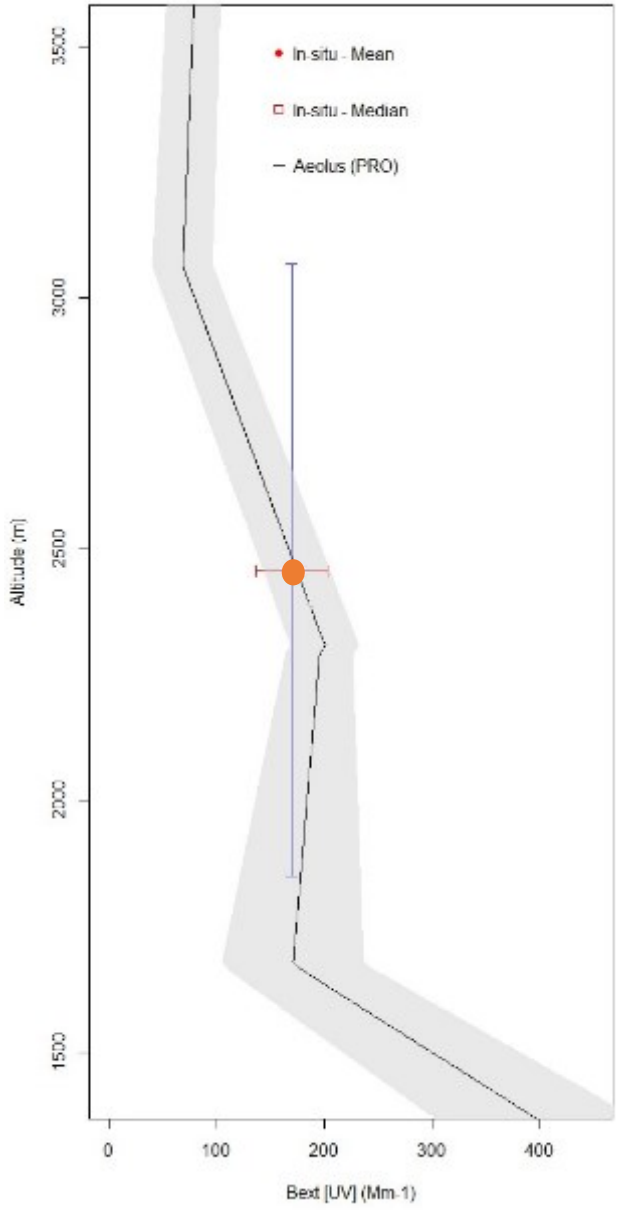
Aircraft data:
Filtered, spatially and temporally limited



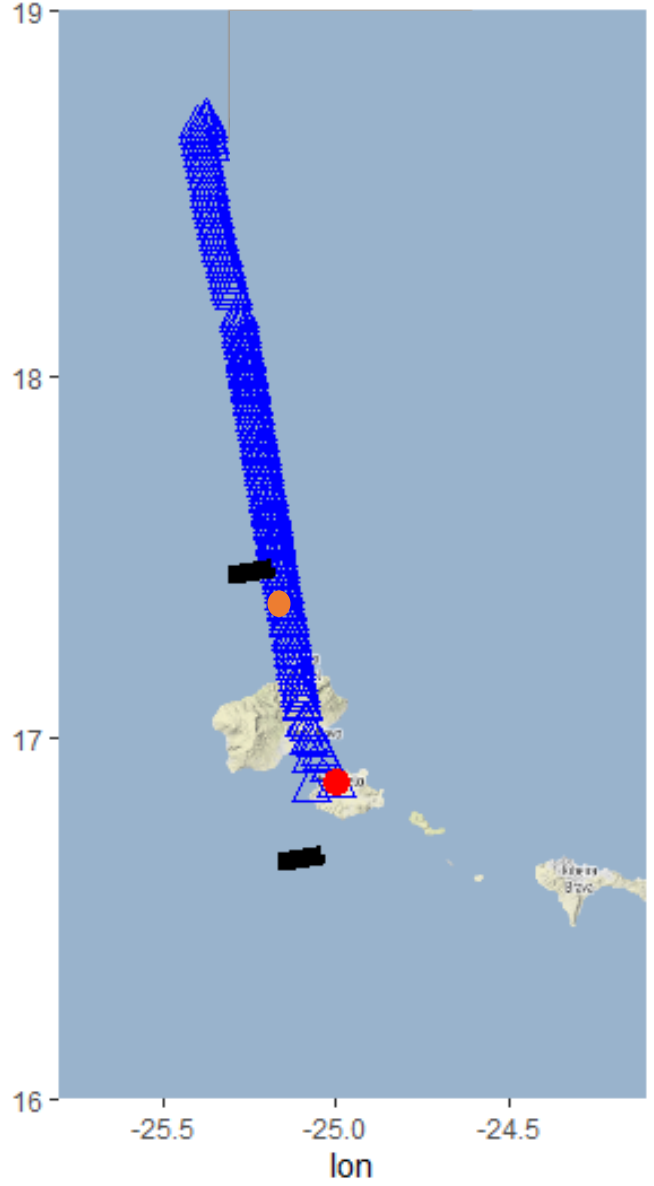
Aircraft data:
Filtered and averaged for 2 distinct constant altitudes



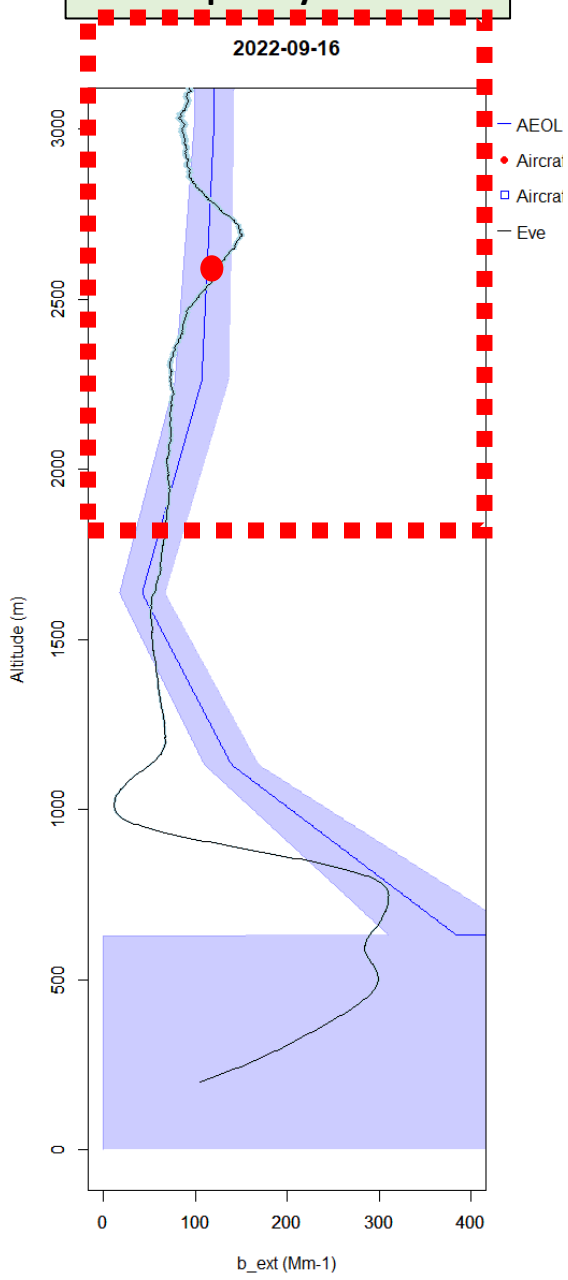
Aircraft data:
Filtered and averaged



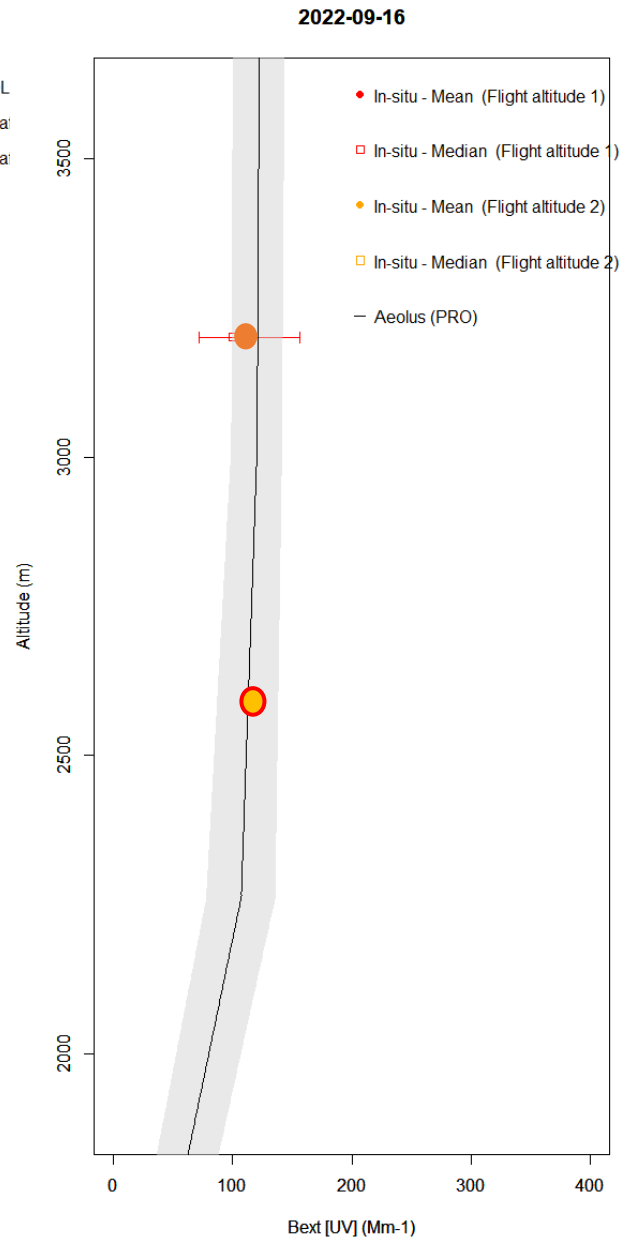
10 Sep 2021



Aircraft data:
Filtered, spatially and temporally limited

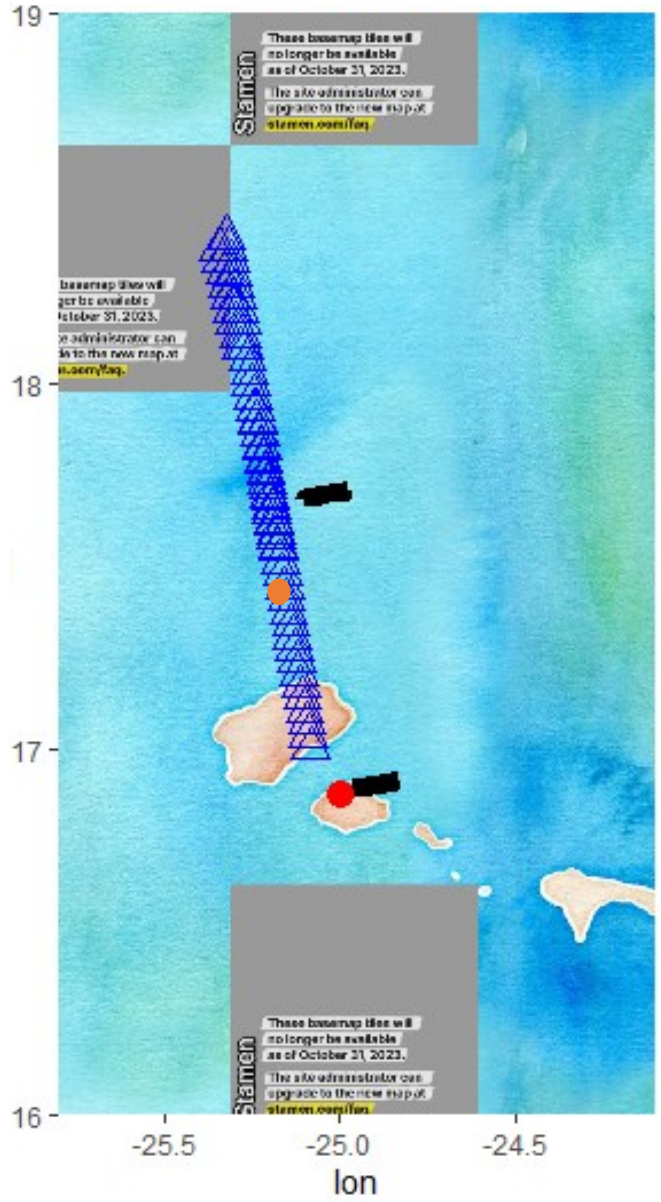


Aircraft data:
Filtered and averaged for 2 distinct constant altitudes



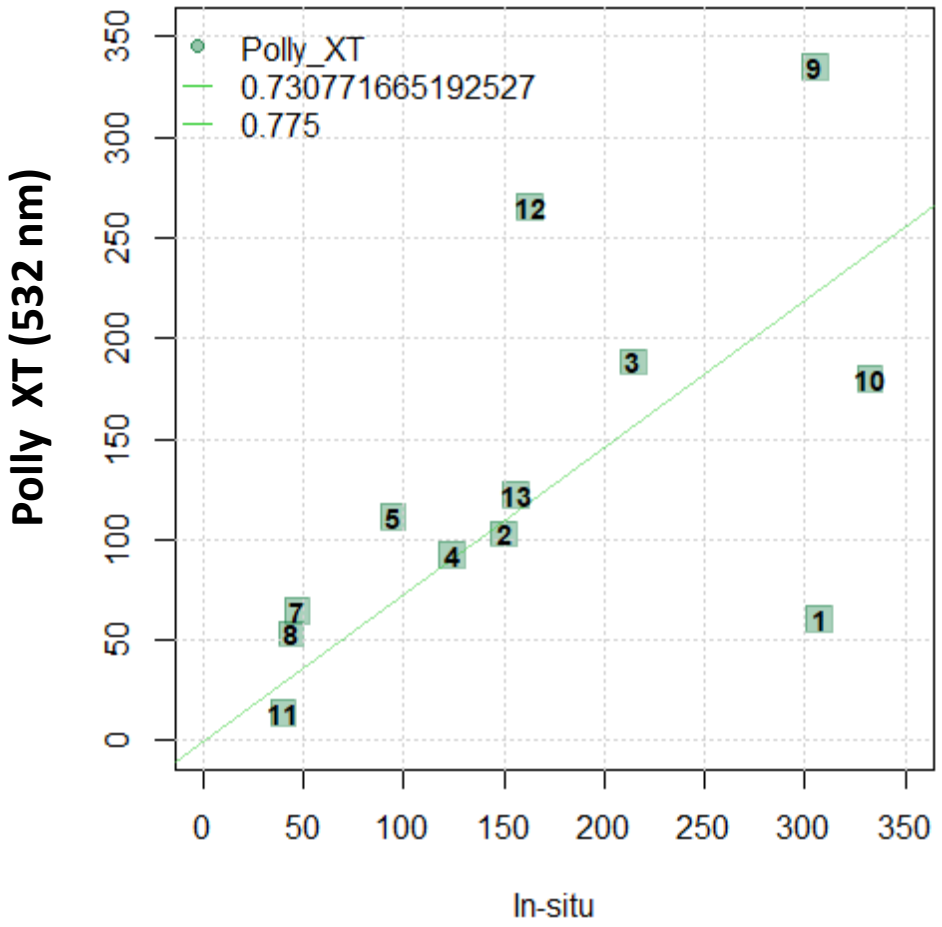
Aircraft data:
Filtered and averaged

16 Sep 2022

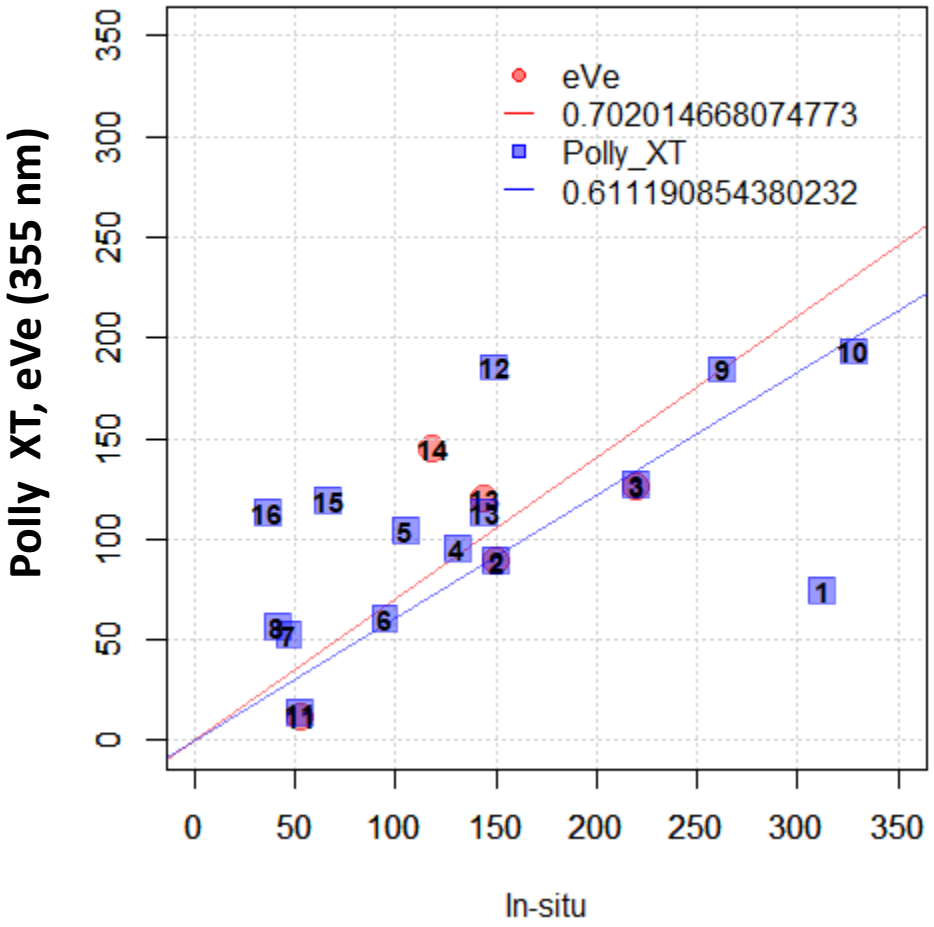


Comparison:

532 nm

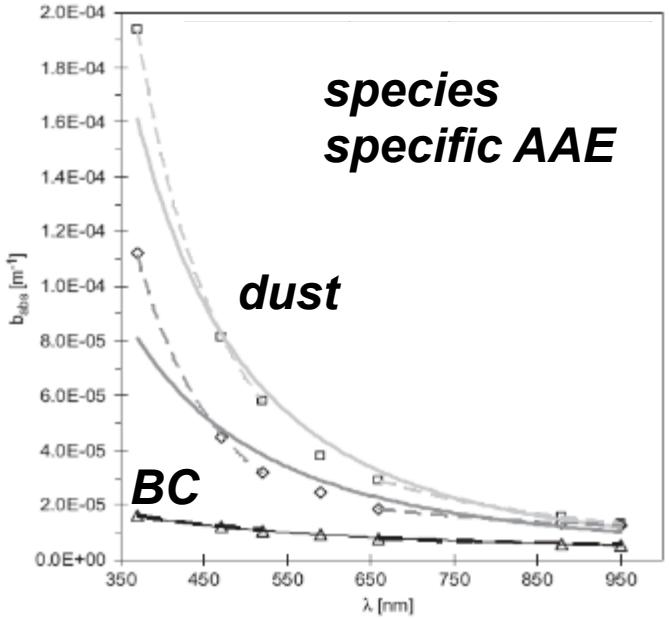


355 nm



some 450 → 355 nm extrapolation issues remain

Methodology – Dust & BC Absorption



VI inlet
&
isokinetic inlet

+

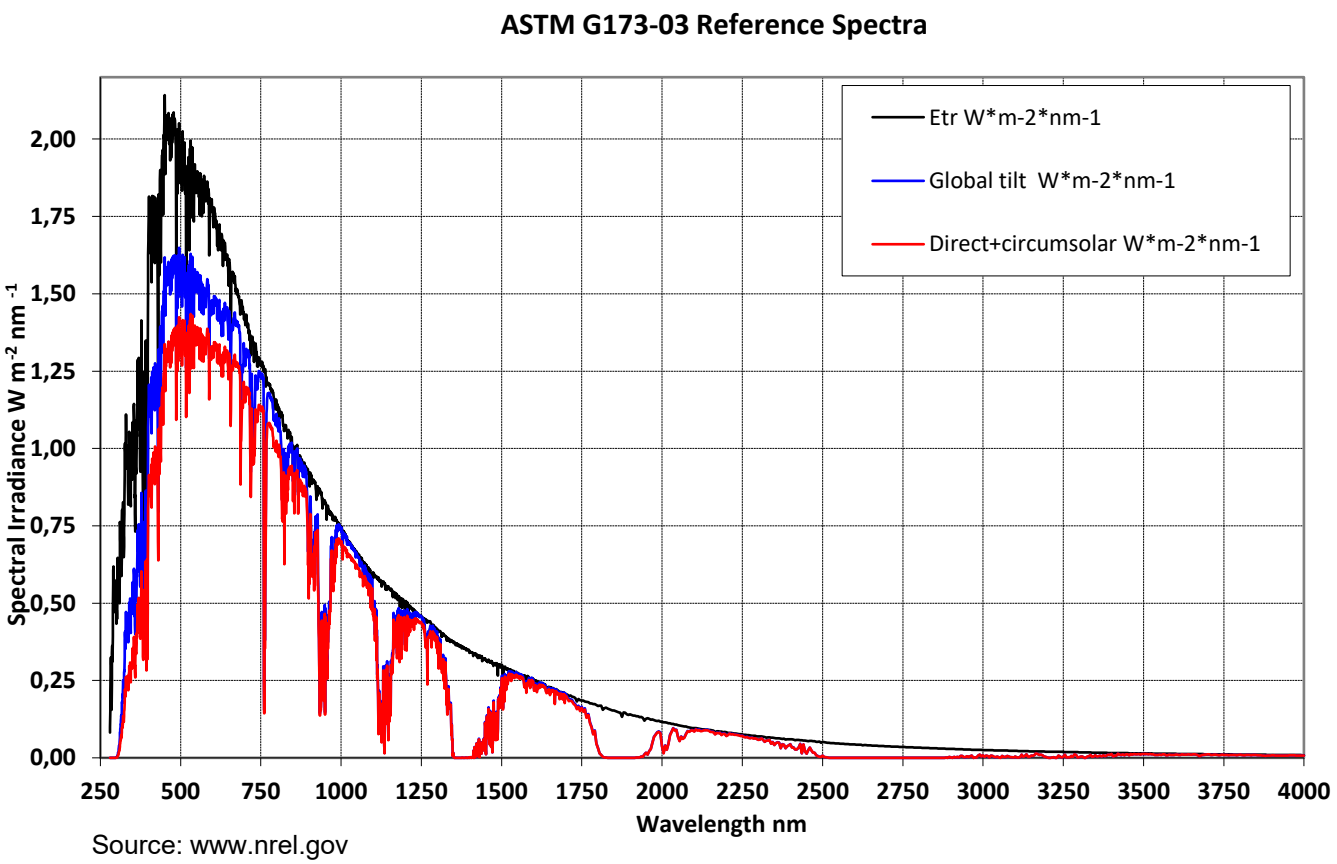
wavelength dependence

$$\rightarrow \begin{cases} b_{abs,\,\boldsymbol{dust}} \\ b_{abs,\,\boldsymbol{BC}} \end{cases}$$

Heating Rate

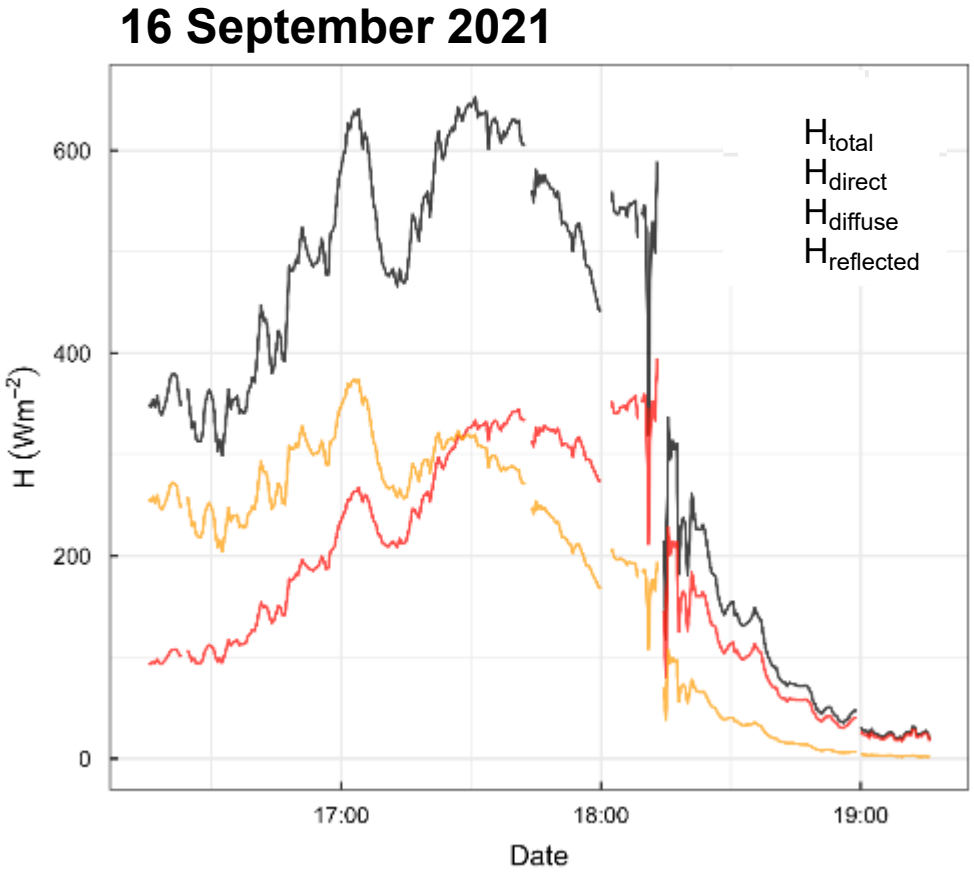
$$\mathrm{HR} = \mathrm{HR}_{\mathrm{direct}} + \mathrm{HR}_{\mathrm{diffuse}} + \mathrm{HR}_{\mathrm{reflected}}$$

$$\mathrm{HR} = \frac{1}{\rho C_p} \sum_{n=1}^{3} \int_{\theta} \int_{\lambda} \frac{F_{n(\lambda,\theta)}}{\mu} b_{\mathrm{abs}(\lambda)} \, \mathrm{d}\lambda \, \mathrm{d}\theta$$



Source: www.nrel.gov

*



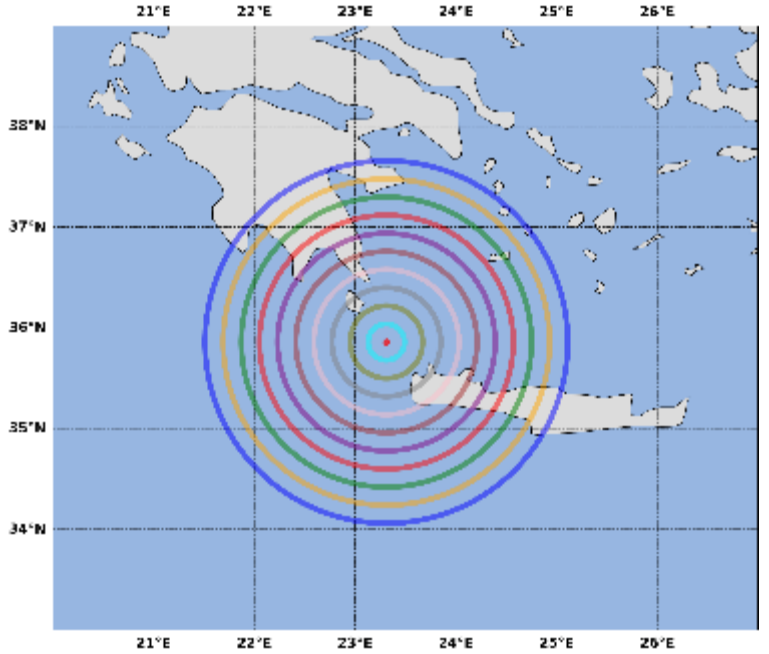
Conclusions

grisa.mocnik@ung.si

- very well **3D-resolved** measurements
- **(in)homogeneous** situations
- solid **QA/QC**
- **no** clear evidence of **cloud-related issues**
- **heating rate dust, BC** – similar importance, dust may be bigger!
- **EarthCARE:** absorption @ 370 nm, scattering possible?

- **Thx**: ESA, ARRS/ARIS, MSC SMASH

Additional payload (radiation, aerosol) planned for **ACROSS Mediterranean campaign** 2025.



Thank you!

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SMASH

machine learning for science and humanities **postdoctoral program**

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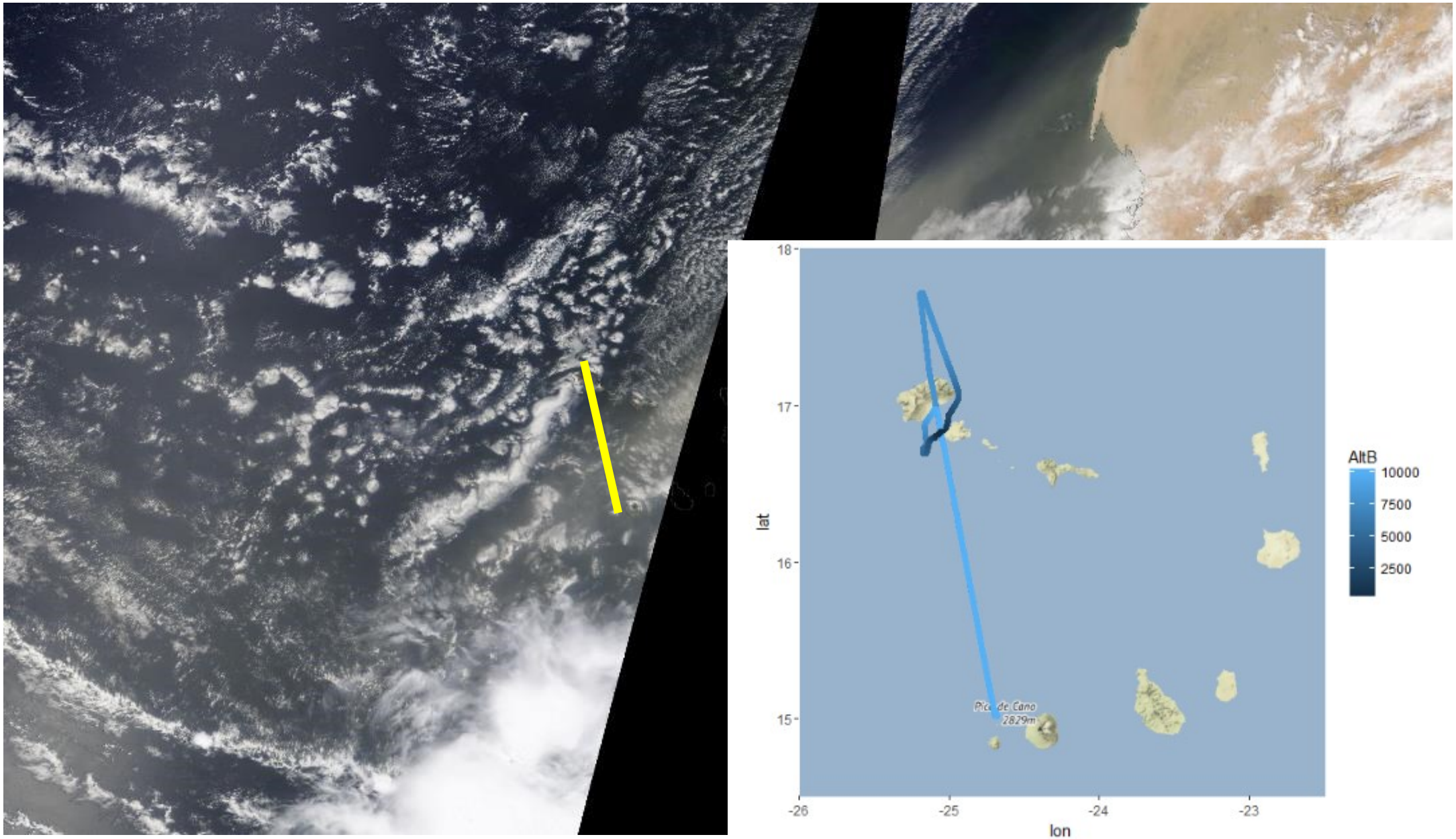
The role of clouds

MODIS True Color - Aqua
Corrected Reflectance



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