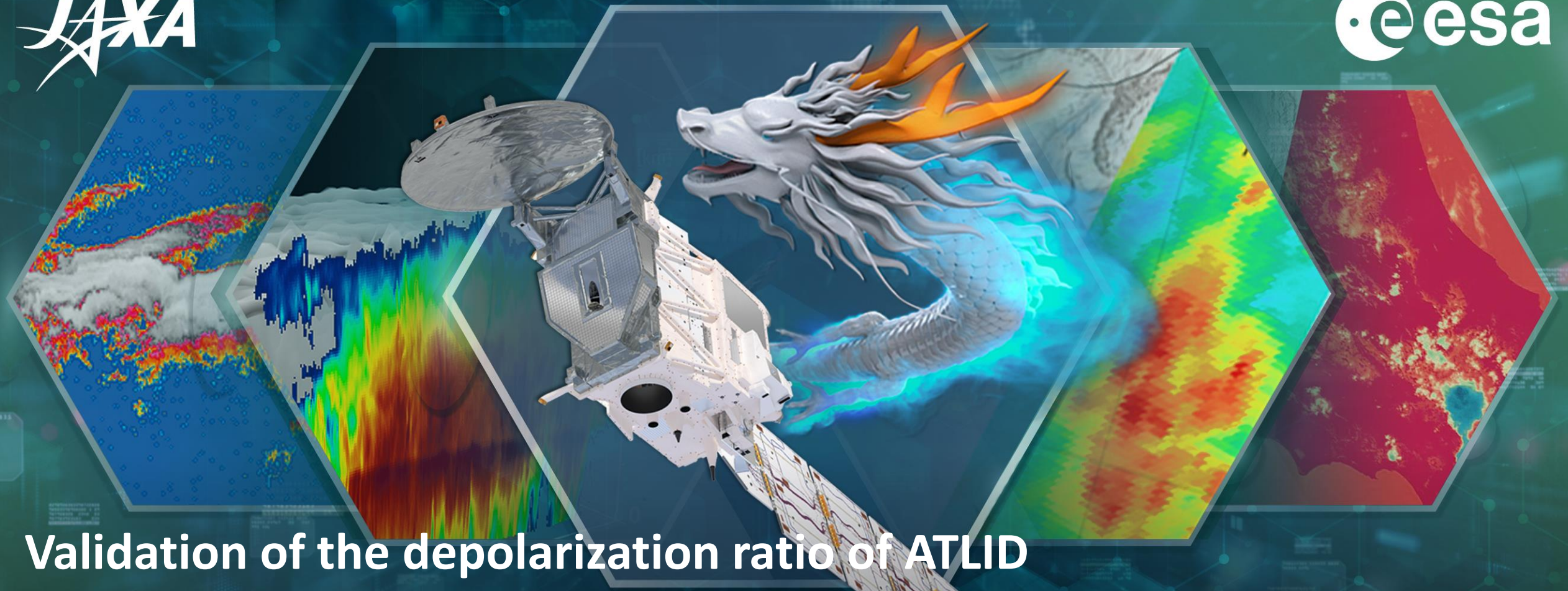


Validation of the depolarization ratio of ATLID

Moritz Haarig[1], David Donovan[2], Henriette Gebauer[1], Leonard König[1], Holger Baars[1], Jonathan Hair[3], Taylor Shingler[3], Richard Ferrare[3], Chris Hostetler[3], Silke Groß[4], Martin Wirth[4], Maria Tsichla[5], Kalliopi Artemis Voudouri[5], Eleni Marinou[5], Hossein Panahifar[6], Maria Poutli[6,7], Rodanthi Mamouri[6,7], Annabel Chantry[8], Fabien Marnas[8], Athena A. Floutsi[1], Julian Hofer[1], Ronny Engelmann[1], Ping Wang[2], Gerd-Jan van Zadelhoff[2], and Ulla Wandinger[1]

[1]TROPOS, Leipzig, Germany, [2]KNMI, Netherlands; [3]NASA Langley, USA; [4]DLR, Germany; [5]NOA, Greece; [6]ECoE, Cyprus; [7]CUT, Cyprus, [8]ESA ESTEC, Netherlands

2nd ESA-JAXA EarthCARE In-Orbit Validation Workshop

17 – 20 March 2025 | Frascati, Italy

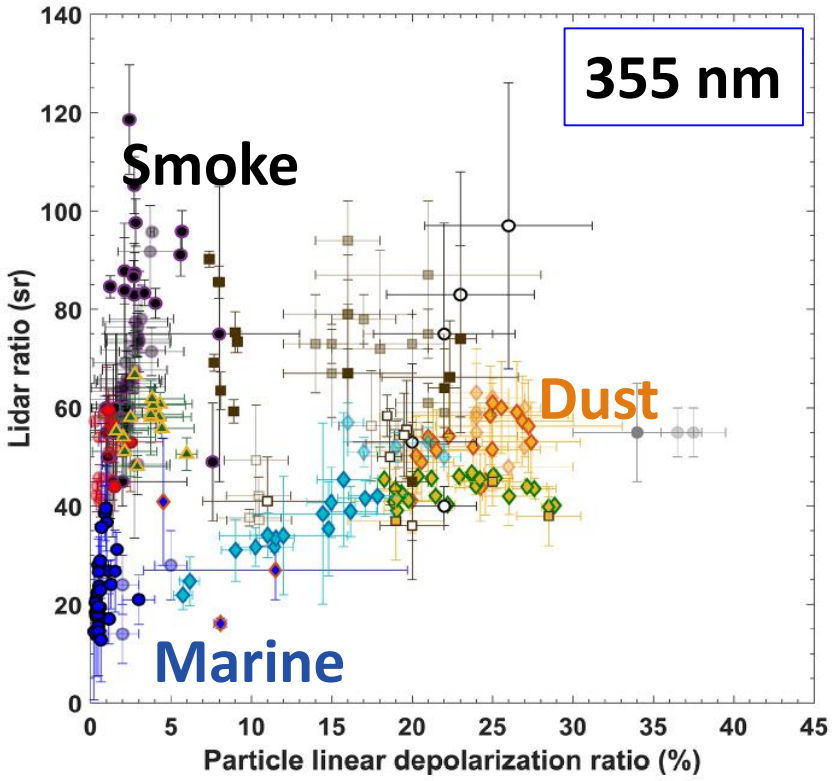
Why do we need an exact depolarization ratio?

Particle linear depolarization ratio

$$\delta = \frac{\mathrm{Mie}_{\mathrm{cross}}}{\mathrm{Mie}_{\mathrm{co}}}$$

Essential quantity in aerosol typing and separation of aerosol components

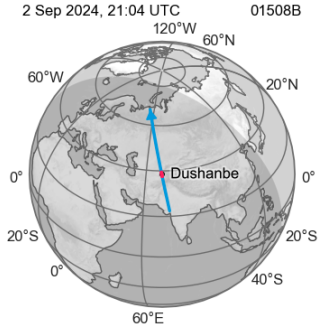
Already available from L1 data!

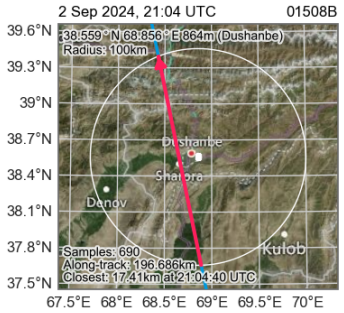


Floutsi et al., AMT 2023

Suborbital Data Collection

Example case: Polly^{XT} at Dushanbe, Tajikistan

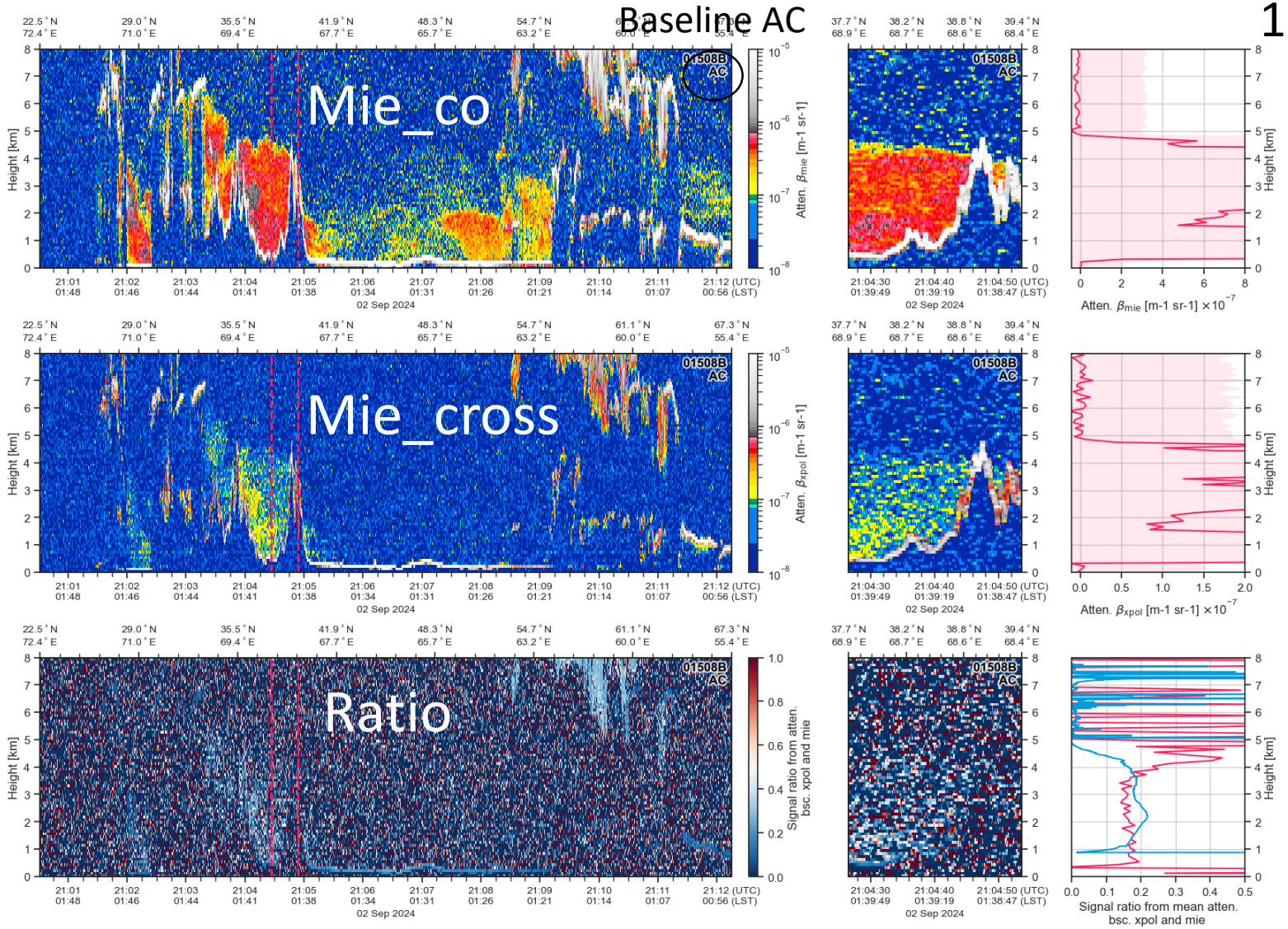




Dust layer in the mountains of Central Asia

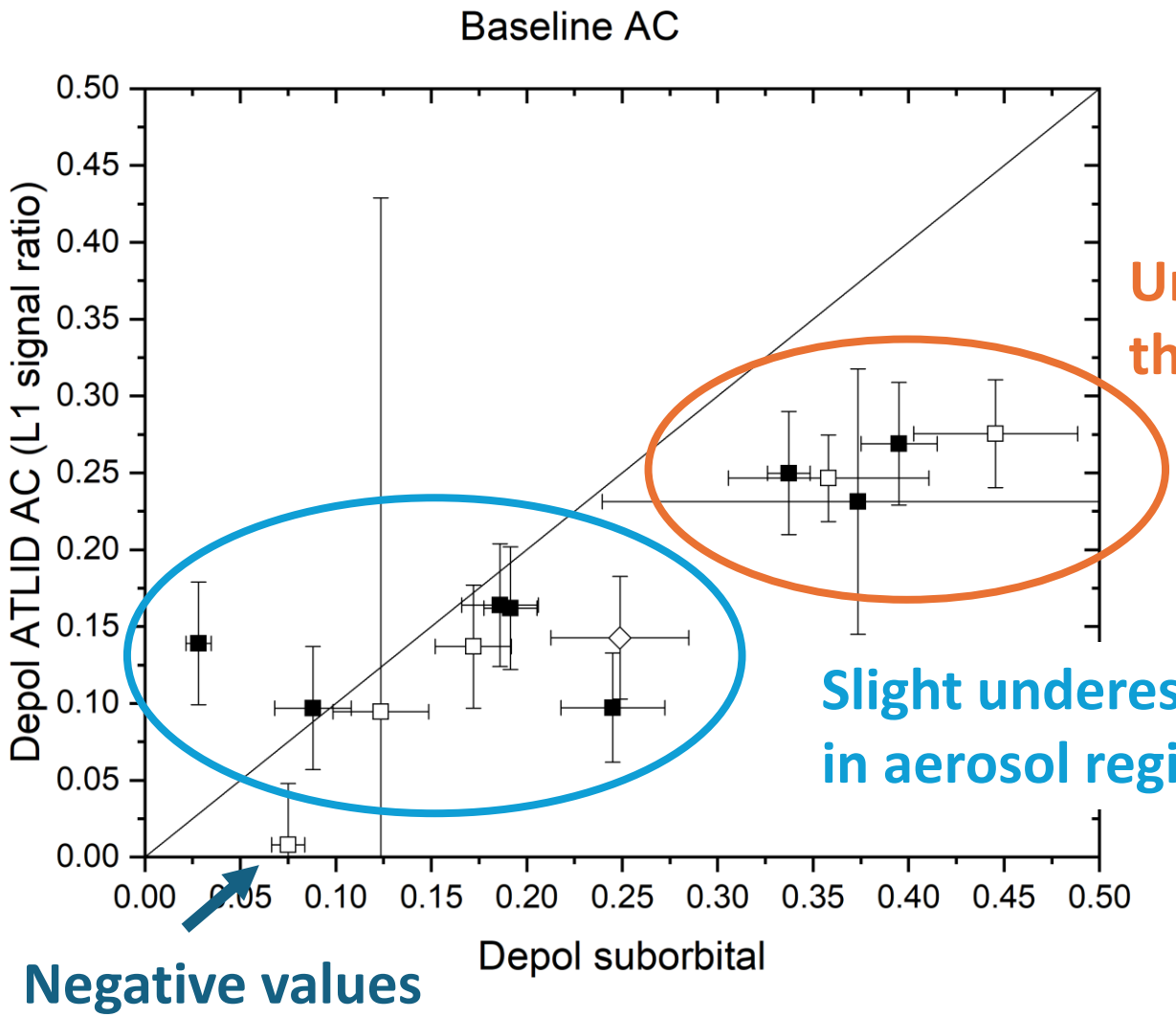
Baseline AC

1508B



100 km around the station

Statistical comparison with suborbital measurements



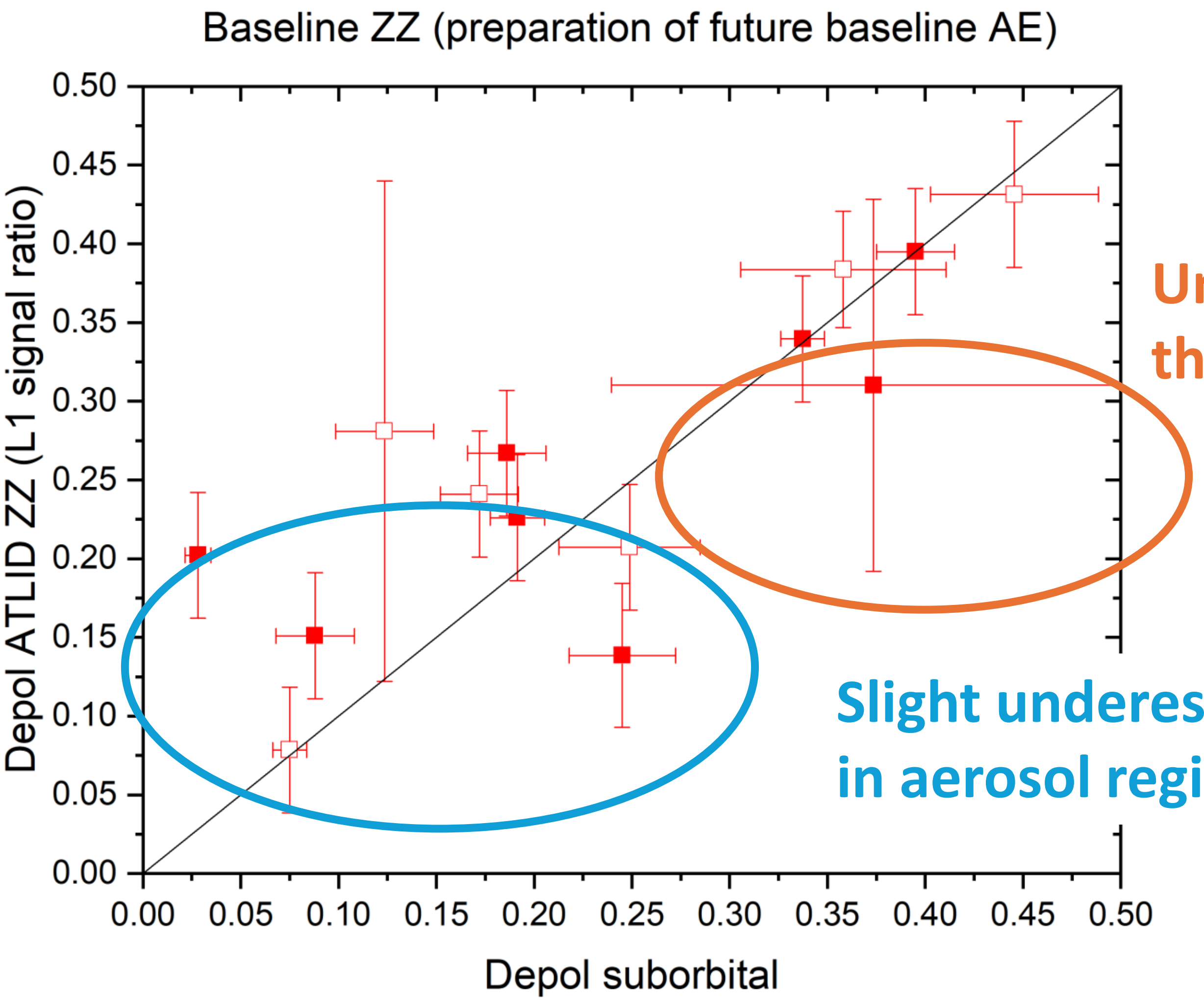
Improvements for baseline AD

- Daytime background subtraction of cross-polar channel (increased δ)

Improvements in preparation of baseline AE (L1 processor v 5.0)

- Channel transmissions and gain ratios in line with on-ground tests

Statistical comparison with suborbital measurements



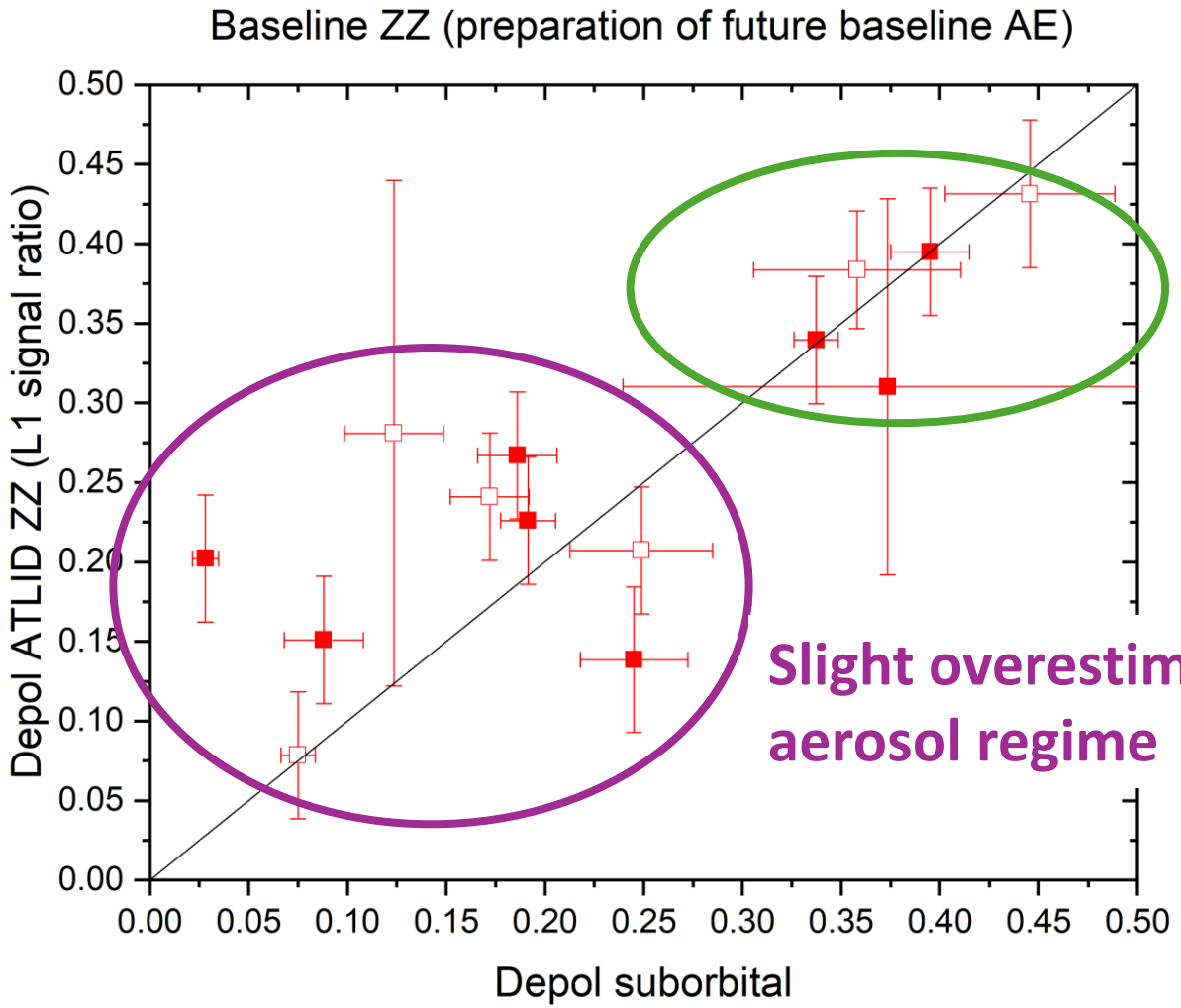
Improvements for baseline AD

- Daytime background subtraction of cross polar channel (increased δ)

Improvements in preparation of baseline AE (L1 processor v 5.0)

Ma6hehrepltoaessiriggsiofns
20 aordgaiinsoatioainelsirbey
gmw(itlaboelregrbaseditneszZ)

Statistical comparison with suborbital measurements



Good agreement in the cirrus regime

Slight overestimation in aerosol regime

Improvements in preparation of baseline AE (L1 processor v 5.0)

- Channel transmissions and gain ratios in line with on-ground tests

Manuel reprocessing of 20 comparison frames by gmv (labeled baseline ZZ)

Conclusion

- Depolarization ratio already provided as L1 signal ratio

- Baseline AC:
  - Daytime depolarization ratio too low (offset bug) → fixed in baseline AD
  - Depolarization in cirrus too low → fixed in baseline AE

- However, depolarization ratio in aerosol regime (<30%) seems to be overestimated in baseline AE → needed to be checked

- Thanks to all data contributors from
  NASA, DLR, NOA, ECoE, CUT, KNMI & TROPOS and gmv for reprocessing