ESA-JAXA Pre-Launch EarthCARE Science and Validation Workshop

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

EVID36 (AO70173): AVE-ECARE: validation and evaluation of the EarthCARE aerosol products.

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Objectives

The proposed work is aimed at the validation and evaluation of EarthCARE products with the main focus on the aerosols.

Validation of aerosol products will be performed to

(i) identify the level of confidence

(ii) identify (provide to users) products limitations

(iii) advice product providers on directions for product further development

Products

- **ATLID aerosol parameters (KNMI)**

Extinction, backscatter, and depolarisation for aerosol regions, **aerosol layer information, aerosol type**

- **ATLID aerosol layer descriptors (TROPOS)**

Aerosol layer top/base height, optical thickness, extinction, backscatter, depolarisation

- **MSI aerosol optical thickness (FU Berlin)**

Aerosol optical thickness at 670 nm (land and ocean) and at 865 nm (ocean only)

- **ATLID/MSI aerosol column descriptor (Tropos)**

Aerosol optical thickness at 355 and 670 nm (land and ocean) and at 865 nm (ocean only), corresponding Angstrom exponents, aerosol type

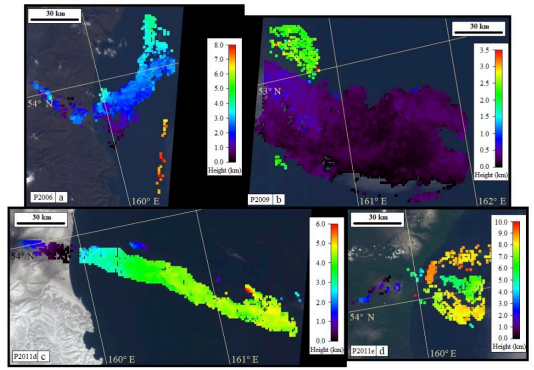
- **ATLID/CPR/MSI composite product (Environment Canada)**

Cloud water/ice content, cloud particle size, **aerosol optical depth at 355 nm, aerosol type**

Reference products

AERONET ground based observations and other similar aerosol products retrieved from satellites (e.g., MODIS for column AOD, Calipso*, Icesat-2, MISR, Tropomi, PACE and for aerosol vertical profile (ALH)).

https://aeronet.gsfc.nasa.gov/



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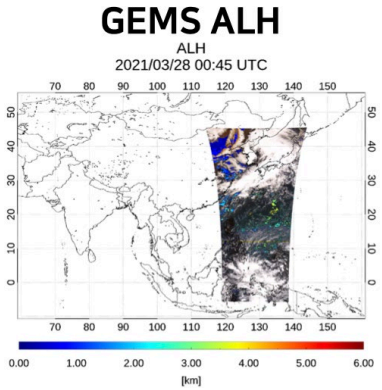


- *Calipso is not in operation since 01.08.2023
- ALH from GEO satellites (Sentinel-4, GEMS, TEMPO)
- High Spectral Resolution Lidar (HSRL-2)

https://www.unescap.org/sites/default/d8files/event-documents/Day3-GEMS_SLee_1.pdf

Validation protocol

For column AOD

- ESA/Copernicus LAW project (validation of Sy_2_AOD product) – has not been finalized
- ESA OPT_MPC project – further development

Methods (1)

Data collection and matchup

- AERONET data in time window ±30 min around satellite overpass
- satellite data in XXX km radius around AERONET stations will be collected and utilized

Methods (2)

Validation approaches

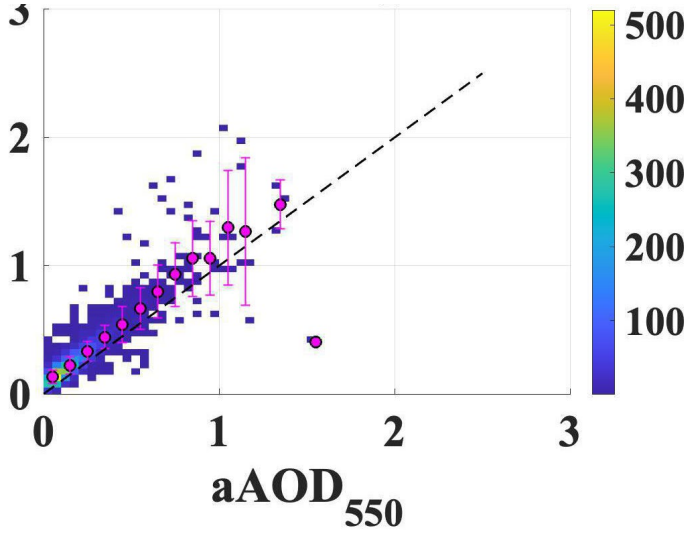
- Statistical analysis
- Temporal and spatial distribution
- Analysis of factors possibly influencing product quality

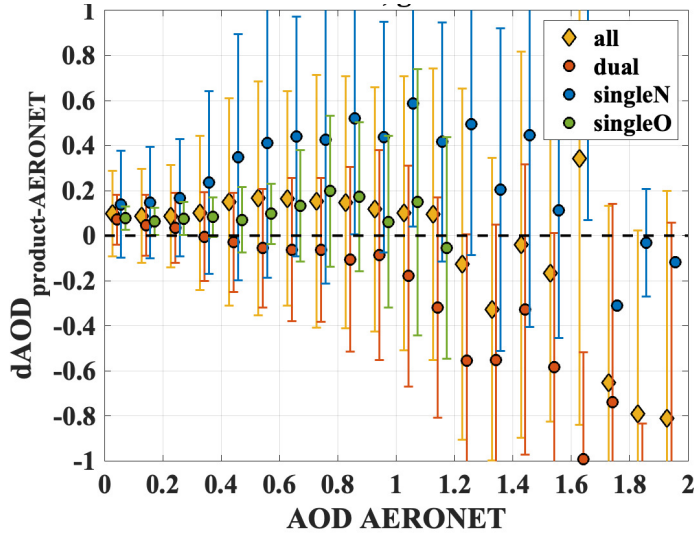
Important to know

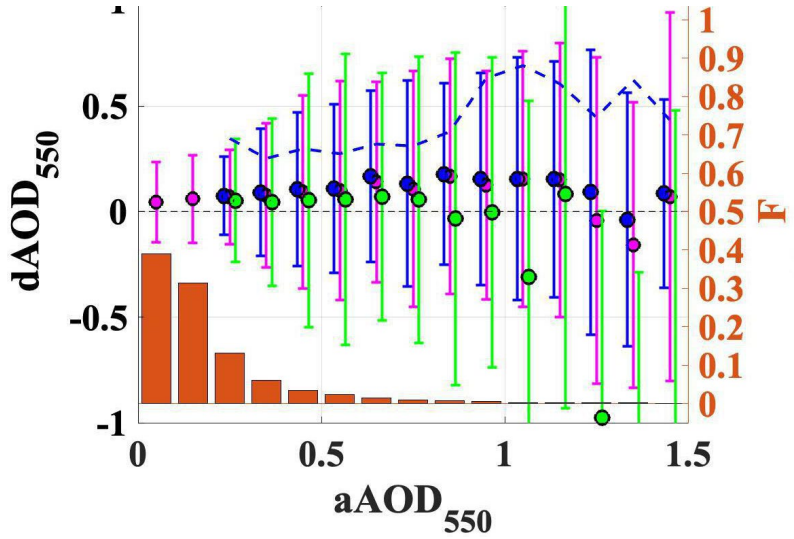
- Instrument specifications
- Retrieval approaches/assumptions

Examples for visualization of validation results (1)

Statistical analysis



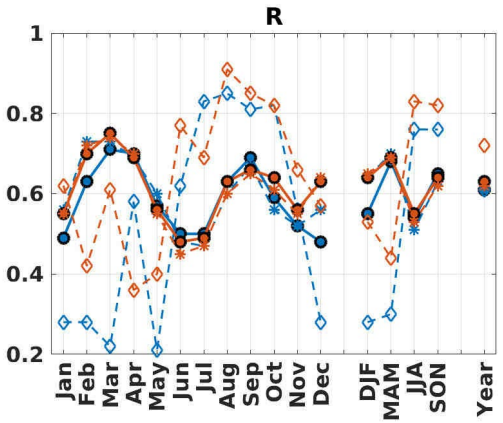


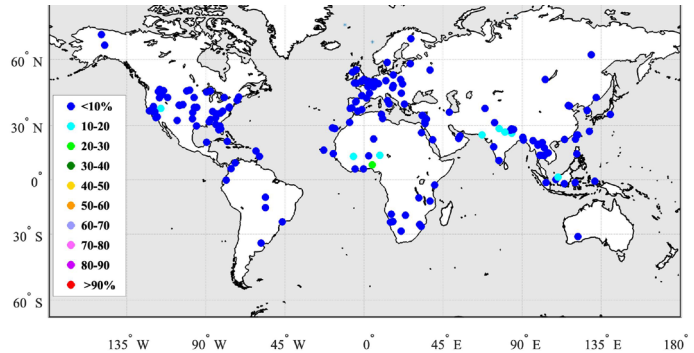


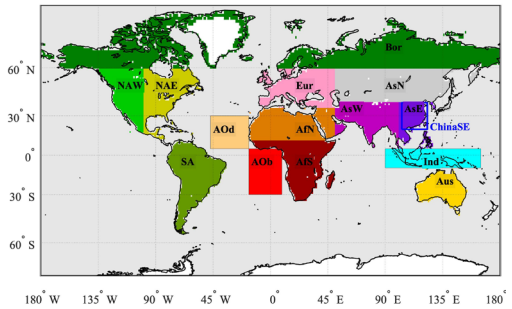
Sogacheva et al., 2022
https://doi.org/10.5194/amt-15-5289-2022

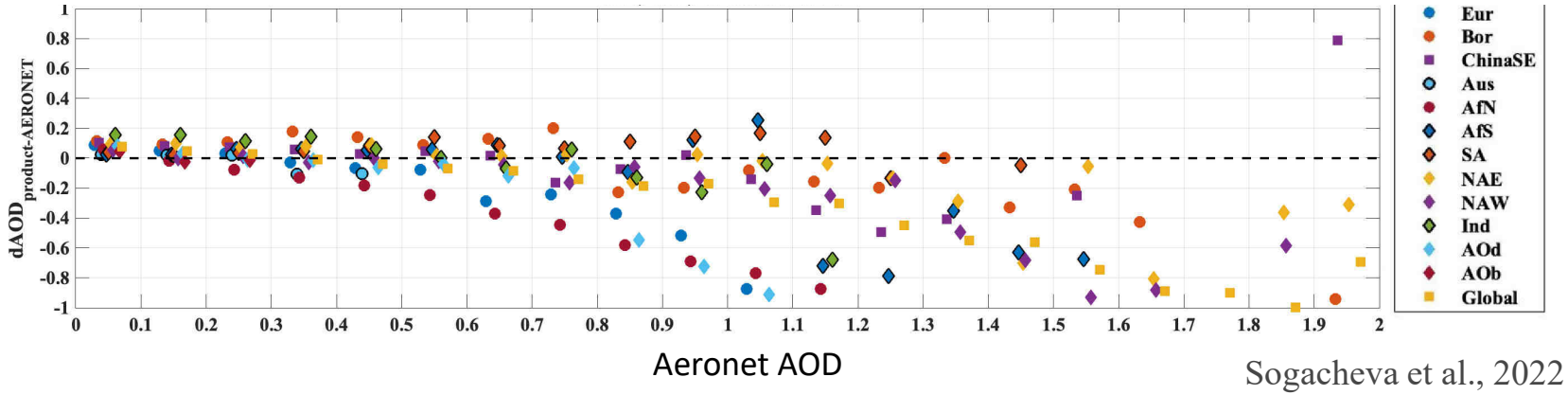
Examples for visualization of validation results (2)

Temporal and spatial distribution









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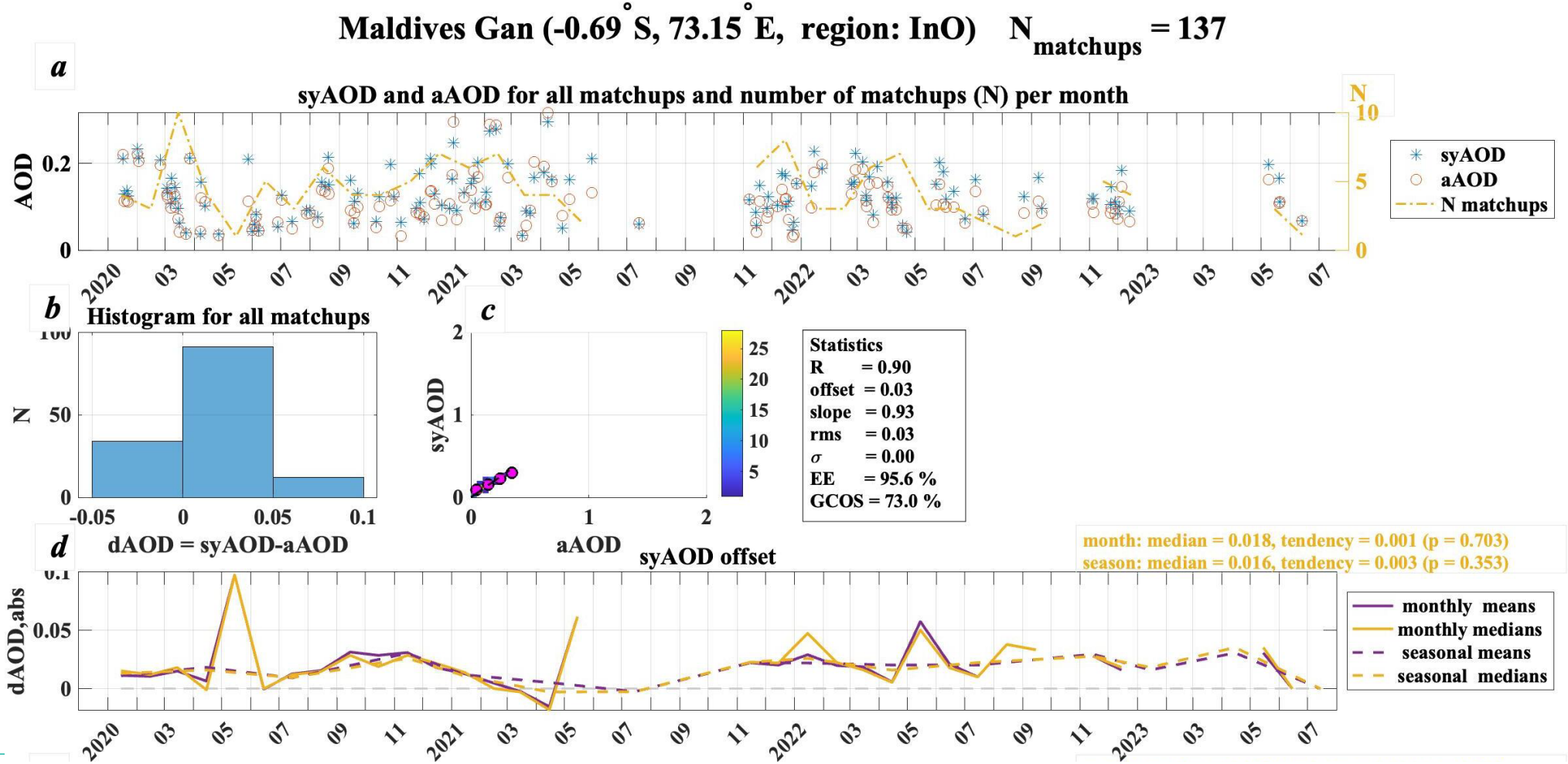
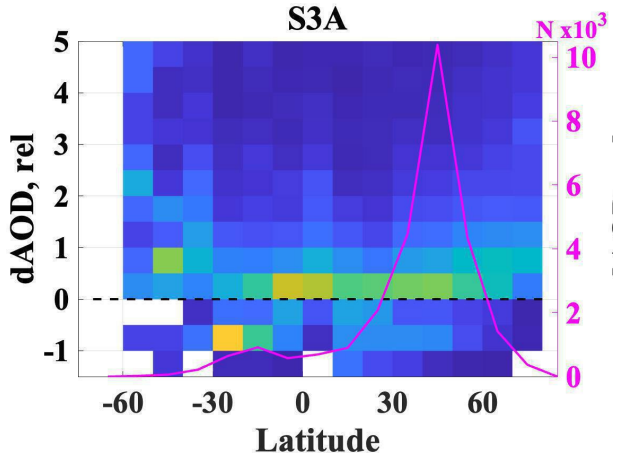
Examples for visualization of validation results (3)

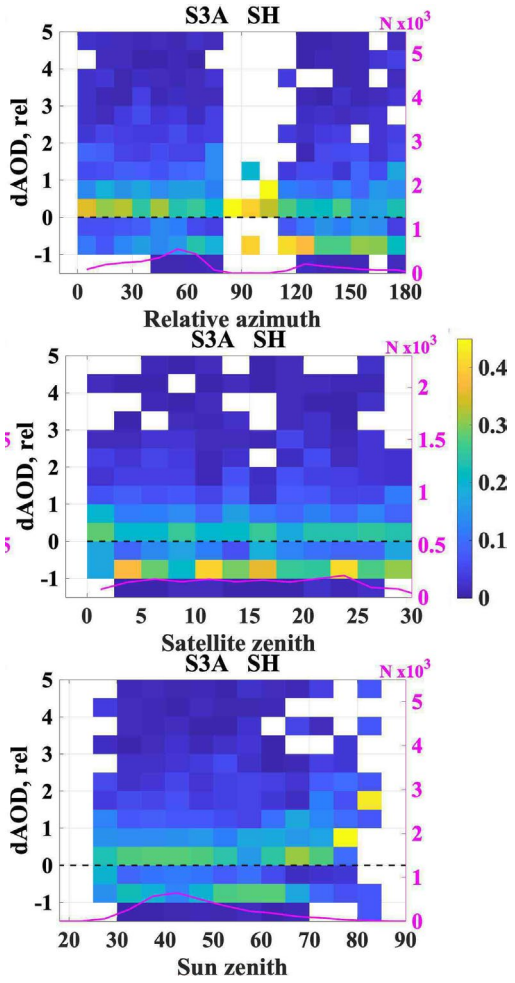
Per station analysis

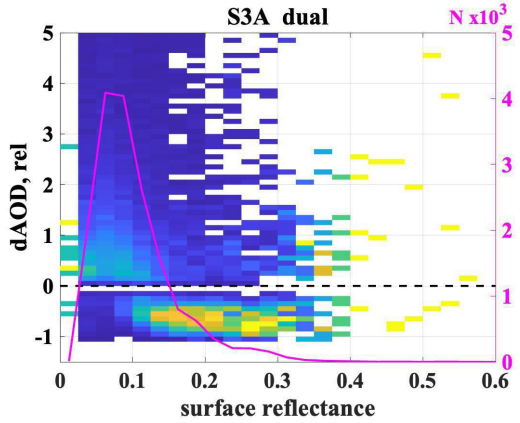


Examples for visualization of validation results (4)

Impact of, e.g., geometry/ aerosol types/ surface reflectance







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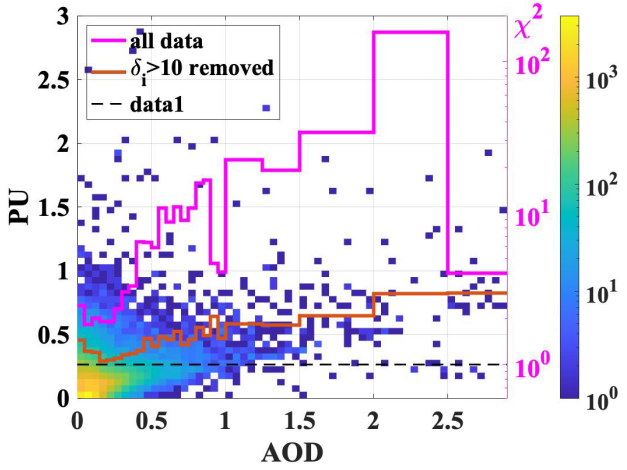
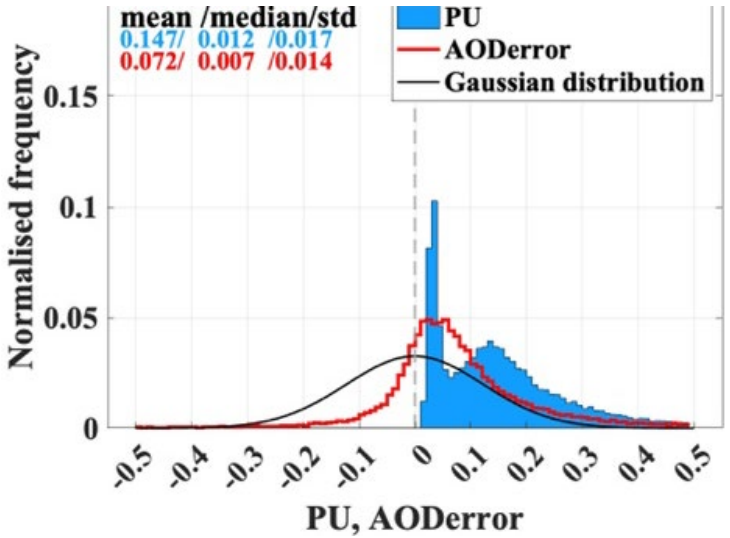
Examples for visualization of validation results (5)

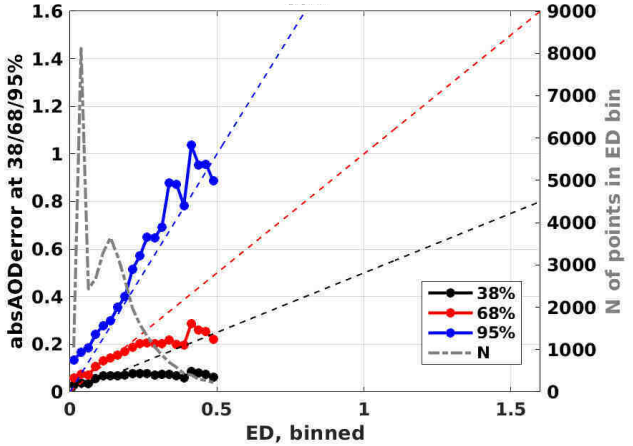
Validation of AOD uncertainties



χ2 test



Prognostic uncertainties
AOD error
Gaussian distribution



Potential of
Expected Discrepancy

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Where to go

- Column aerosol validation approaches have to be adapted for EarthCARE
- Consider lessons learnt from the validation / evaluation of Caliop products

- Explore funding opportunities

Thank you for your attention