



# Summary and Recommendations

## Aerosol session block 1 and block 2

Co-chairs: David Donovan and Tomoaki Nishizawa  
Ulla Wandinger and Yoshitaka Jin

2<sup>nd</sup> ESA-JAXA EarthCARE In-Orbit Validation Workshop

17 – 20 March 2025 | ESA-ESRIN | Frascati (Rome), Italy

# Overview of Talks

- **Tomoaki Nishizawa : Overview of L2 aerosol products produced by ESA and JAXA**
  - JAXA ↔ ESA Aerosol algorithm and product overview
  - Good concise overview of available JAXA and ESA aerosol products.
  - Differences and similarities between approaches were covered.
- **Ulla Wandinger: Comparison of ATLID aerosol products produced by ESA and JAXA**
  - Emphasized the different scales and techniques for all the aerosol products
  - Discussion about different averaging approaches is needed.
  - Generally good agreement with JAXA/ESA and ground-based lidar !
  - Having both JAXA and ESA algorithms/products allows for consistency checks and increases the confidence in both sets of products !
- **Yoshitaka Jin: Evaluation of JAXA ATLID L2a products using AD-Net lidars**
  - Good results for JAXA aerosol lidar products
  - PBL height retrievals look plausible.
  - Cloud case: Reasonable agreement. Good depol agreement.
  - More results expected when dust season is in full swing !

# Overview of Talks (II)

- **Diko Hemminga: Evaluation of the ATLID integrated surface returns for calibration and retrieval of an independent column-integrated aerosol.**
  - Use of Sea Surface return for AOD estimation.
  - Good initial results ! CAMS comparison presented.
  - If AOD is assumed could be used as 10-meter wind retrieval.
- **Will McLean: Monitoring and assimilating EarthCARE ATLID aerosol products in ECMWF's IFS-COMPO**
  - ECMWF Aerosol monitoring and Assimilation preparation studies. Eventually both (L2) backscatter and extinction will be used.
  - Near-real time monitoring of L2 aerosol product will begin soon.
  - Work based on earlier ALADIN work
  - Work is still in early days but promising.
- **Sergey Khaykin: Assessment of ATLID stratospheric performance using ground-based lidars and satellite limb aerosol profiling**
  - Stratospheric work: Nice comparison of Raung results.
  - Separate Strat processing based directly on L1 gives good results for ATLID.
  - Very good NDACC lidar vs ATLID !
  - L2 comps not very good !
  - ATLID processing is focused on Troposphere. Separate dedicated strat processing makes sense.
  - GSAW ATLID Viewer looks nice !

# Overview of Talks (III)

- Eleni Marinou: Validation of EarthCARE products under ACROSS Mediterranean activities (EVID23)
  - L1 lidar tool comparisons: Good and less-good but generally good results.
  - L2 comparisons: very good layer detection, dep in AD better than in AE and AC ?
  - Improvements in classification are needed. Improvements with baselines are visible. Layering improvements are needed?
- Rodanthi Elisavet Mamouri: EarthCARE Aerosol products intercomparison with CARO Polly Lidar in Limassol, Cyprus
  - Fair cirrus S even though 25 km difference.
  - 04365D: Nice Dust case...S and Depol good but A-TC is not perfect. → Maybe a good case for tuning of depol-S space -vs- type ?
  - It would be useful to look at back trajectories to better understand comparisons. Perhaps guidance on what tools to use could be formulated ?



# Overview of Talks (IV)

- **Henriette Gebauer: Validation of EarthCARE L2a products using ground-based lidar measurements at Cabo Verde, ~~Tajikistan~~ and Germany in the framework of the German Initiative for the Validation of EarthCARE (GIVE)**
  - Mindelo: Issues with S and depol when dust layer above (cloudy) marine BL
  - Layering going wrong when water clouds are around?
  - Lower resolution slightly better agreement with Polly than higher resolution for aerosols
- **Silke Gross: Airborne lidar measurements: PERCUSION's contribution to validate EarthCARE ATLID L2 optical properties**
  - WALES: 13 Aug 24, 01193E (dust/mixture case)
  - Again: layering issues when water clouds are around ?
  - Conclusion: Aerosols when BL clouds are around needs attention.
  - Problem with: depol. going from HR to Med and LR ?
- **Franco Marengo: Validation of EarthCARE Aerosol Products Using Ground-Based Lidar and UAV Observations in Cyprus and Greece**
  - Cyprus: Sea Salt under clouds...should be filtered or set to unknown...consequence of low SNR depol ?
  - Decent consistency between In-situ and with A-TC aerosol types.
  - Need simple to use A-TC confidence flag.
  - Spatial variability in aerosols should be investigated.

# Overview of Talks (V)

- **Iwona Stachlewska (given by Afwan Hafiz): EMORAL lidar ATLID L2 data validation effort: contribution to EVID47**
  - EMORAL lidar used at different locations close to EC track
  - Scattered results, compare SCC with in-house SW
  - A comparison of target classifications was attempted (generally agreed, some discrepancy).
  - ATLID extinction in fog was much stronger than EMORAL lidar
- **Ping Wang: Validation of EarthCARE ATLID aerosol products using EARLINET measurements: preliminary results**
  - Statistical approach with data from different stations
  - Explicit about quality control procedures she used as well as other selection criteria!
  - (but maybe she is not using the right TC !)
- **Christina-Anna Papanikolaou : First Insights into ATLID Level 2A Data: Comparisons with ACTRIS/EARLINET observations as part of EVID05**
  - Excellent agreement often ! Sometimes not... Why ?
  - Calculation of errors in percentage for very small values of measurement may be misleading

# Overview of Talks (VI)

- **Kerstin Stebel: An Initial Assessment of EarthCARE ATLID and MSI ESA L2a Uncertainties (NEVAR, EVID38)**
  - Important to look at !
  - MSI focused
  - M-AOT is not doing so bad (vs AERONET)!
  - Even ATL\_ALD vs AERONET looks reasonable !
- **Eduardo Landulfo: Progress of CAL/VAL activities for EarthCARE aerosol products at SPU Lidar Station, Brazil**
  - Sao Paulo: Good layered aerosol case..but they are right on the coast so aerosol properties can change strongly with exact location.
  - They are in the middle of the SAA...so may be more Rad-spike affected.
  - Looking at A-ALD and Aerosol AOD for different sites (different surface conditions).

# Overview of Talks (VII)

## Aerosol, Cloud and Precipitation session (Day2)

### **David Donovan: Overview and status of the ATLID Featuremask (A-FM) and profile processor (A-PRO)**

- Overview of ESA ATLID L2 products and algorithms
- Provides useful guidance on product features and important precautions for use
- Encourage feedback on accuracy, precision, and usability.

### **Jasper Lewis : EarthCARE Cal/Val Using the NASA Micro Pulse Lidar Network**

- Initial validation of aerosol (cloud) layer heights using MPLNET lidar (GSFC & EL Arenosillo, USA)
- Good agreement with MPL L2 and MPL L3-EC

### **Arnoud Apituley: Validation of EarthCARE ATLID and CPR products using Cabauw measurements: preliminary results (EVID14)**

- Aerosol (ATL\_AER, ATL\_EBD) and cloud validation using Cabauw ground-based measurements
- Good agreement on extinction/backscatter/dep/lidar ratio

### **Jean-Baptiste Renard: BAIVÉC project - Validation of Atlid products using the in-situ aerosol and cloud measurements performed with the LOAC2 instrument under weather balloons**

- Ground validation using balloon-borne measurements with aerosol counter (LOAC) in France

### **Nathan Feuillard: Comparison between EarthCARE and ATR42 measurements and products during the MAESTRO field campaign**

- Aerosol (and cloud) validation using air-borne 355nm HSRL during MAESTRO campaign
- Agreement on extinction/backscatter/lidar ratio
- Agreement on target classification, but some discrepancy (warm liquid cloud => surface / sub-surface)



# Specific points

- Discussion points:
    - There is value to in looking at and using both ESA and JAXA products.L2 outreach .
    - L2 outreach is needed !
    - 100 km colocation criteria is “not set in stone” judgment is needed.
      - Maybe e.g back-trajectory guidance/tools can be made available ?
- <= It seems necessary to set the collocation (and the average range of ground observation data) considering the spatial resolution of the product.
- <= Also note that the wind direction changes with altitude.
- ATLID vs ground-based comparisons presented ranged from very good to “not-so-good”. It is currently unclear under what circumstances the comparisons are not good. Identifying contributing factors would be very helpful (e.g. when low broken clouds are present?).

(Recommendation?)

Along with a comparison of Extinction/Backscatter/Dep/Lidar ratio, a comparison of Feature mask and Target classification is also desired (there were few results of these comparisons).

When averaging depolarization ratio and lidar ratios for comparison with ground-based lidar, backscatter or extinction (backscatter is better?) weighted averaging is needed (but L2a backscatter or extinction sometimes includes extreme values?..needs investigation)

# Notes drawn from the aerosol, cloud, precipitation session (Holger Baars, Kaori Sato)

- Best practice document for validation of space-borne profilers published:  
<https://zenodo.org/records/15025627>
- Different resolution for A-EBD and A-AER product. Please always indicate what was used.
- Dependency of these different products is not clear to some users.
- Change medium resolution of A-EBD to 10 km? here are some pro's, e.g. Japanese products have also this resolution.
- Vertical resolution of extinction in A-EBD is 100 m and 1 km in A-AER BUT S, depol and  $R_{\text{eff}}$  are layer-based--> check layer identification
- “Strong” (e.g. Cloud) features are not smoothed in A-EBD.
- Validation needs for improving target classification ( e.g., supercooled water from CPR, supercooled drizzle and rain classification, classification in PBL, simplification of classification) and investigating impacts on higher level products.
- How to validate the target categorization? to be discussed?
- Same Baseline can be based on different Level 1 Baseline always indicate time of processing.
- Use only data between the “frameStartCoordinates” and “frameStopCoordinates”

# ...continued...

- MPLNet validation results:
  - MPLNet statistics yet not many data points, because for MPLNET Level 2 Data AERONET Level 2 is needed, which is not there yet.
  - See differences in target categorization depending on different resolution
  - Generally, report that EarthCARE horizontal resolutions (high, medium, low) can affect results, but differences are expected to be minor for long-term comparisons

# Seed questions

- *What are the positive findings about the data quality that can be highlighted?*
- *What aspects have been identified for improvement and are there clear/proposed ways to address that?*
- *Which L1 and L2 products or aspects are not yet (optimally) validated? (due to e.g. late release to Cal/Val users)*
- *What are the recommendations/suggestions for future L1 / L2 validation activities (e.g. validation needs, gaps) and for mission planning?*