Overview of input from PI's – tailored for ATLID and Aerosol topics

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Common practices applied to QC and calibration

- Many networks (ACTRIS, MPL-NET, AERONET, BSRN) have their **own, well established QC** and calibration approaches
- Some non-network stations follow ACTRIS QC's
- Only a few who have not thought of any QA/QC yet, e.g.:
  - "Currently there is no convergence yet on common QA or (inter)calibration procedures for our instrument type"
  - This is something that we would work on with specific funding. Such actions are on hold at the moment
- Non-network instruments may follow different approaches, e.g.:
  - HALO Airborne instrumentation undergoes specific QC agreed for HALO campaigns
  - Occasional comparison of PSC measurements with neighbouring lidar (Esrange, 30km ENE)
  - Comparison with in-situ balloon measurements of cirrus
- :

Validation approaches and strategies

Ideas with respect to the Co-Location (*Matching of observations in place and time*):

- An analysis of representativeness of measurements will be done after the measurements have been taken, using model and satellite datasets
- Coincident and validated geostationary observations will be used as a comparison for the imager products
- Direct underpasses beneath the EarthCARE track will be performed during the airborne campaigns
- Coordinate with models (e.g. DREAM) for special runs during field campaigns
- The ground-based sites follow the validation strategies developed by EARLINET and Cloudnet for previous missions (CALIPSO, Aeolus).
- Synergy is sought with EUMETNET E-Profile network of nearby (~10 km) profiling stations (AO proposal submission planned)
- CERES PSF size is bigger than BBR swath (maximum 18 km nadir) : Need to use MSI to improve matching
- Of more concern will be the biases introduced by conditional sampling arising from the difference in viewing geometry…
- Estimation of the effective impact of urban environment
- Focus on specific aerosol and cloud types

validation approaches and strategies

Ideas with respect to the use of statistical approaches:

- Long-term data sets from ground (networks like LALINET or single station like Lampedusa)
  - MPL-NET: Monthly, Annual, and Decadal diurnal averages of all product variables:
    →customized L3 products for EarthCARE validation, but altered for ideal sampling and targeted validation
  - Collocated measurements from the 3 experiments at different sites and analyze statistically and in relation to day/night differences and different aerosol types and cloud systems.
  - EarthCARE mean aerosol profiles against LIVAS-CALIPSO and Aeolus climatological profiles
  - Special attention to certain conditions, e.g. waves.
  - Deriving conclusions from ensembles of collocations
- Statistical anaylsis conducted from the aerosols measurements obtained during the long-duration balloon flights Strateole in the equatorial region around the tropopause
- Multiple scattering difference: ‚modify the Monte Carlo simulation of CALIPSO so that it can provide accurate simulations for ATLID. Simulating depolarization ratio measurements of ATLID 355 nm water cloud backscatter and computing water cloud lidar ratios for various effective droplet sizes and variances. The analysis will be statistical and global scale in nature.

validation approaches and strategies

Ideas with respect to the Wavelength dilemma:

- Using same wavelength:
  - ACTRIS/ LALINET : Operate lidars at multiple wavelengths, including 355 nm and depolarisation → who measures 355 nm depolarisation?
  - The Hyytiälä station will be equipped Vaisala CL61 ceilometer (includes depolarization) → which wavelength?
  - Specific non-network lidars at EarthCARE wavelength: UK, EVE polarization (linear and circular) lidar…
- Ideas for converting to EarthCARE wavelength
  - Aerosols profiles at 532 nm, when AERONET AOD are measured, can be extrapolated to 355 nm, using the AERONET co-located Angström exponent.
  - Expected wavelength dependence λ-1 – λ0, will be tested with model simulations
- Extinctions are calculated from concentrations and size of the particles, considering typology & mean refractive index. Conducted (in the visible domain) at the wavelength of EarthCARE measurements→ type validation
- Multiple scattering difference: Modify Monte Carlo simulation algorithms developed for CALIPSO to provide accurate simulations for ATLID. This includes simulating depolarization ratio of ATLID 355 nm water cloud backscatter and computing water cloud lidar ratios for various effective droplet sizes and variances.

validation approaches and strategies

Ideas with respect to synergistic products:

- Synergistic products of ACTRIS are already similar. Will be enhanced through combination of cloud and aerosol profiling at combined ACTRIS stations.
- Running our own retrievals combining more instruments than EarthCare or with different wavelengths.
- GARRLIC/Grasp is intended to be used often
  - the inversion provides vertical distribution of aerosol concentration, fine and coarse mode refractive index (assumed constant vertically) and the fine and coarse mode size distributions. These inverted parameters are then used to compute aerosol extinction, backscatter and depolarisation profiles at any wavelength.
  - Development of GRASP retrieval for applying the same scheme in EarthCARE and in ground measurements

validation approaches and strategies

Ideas with respect to new approaches:

- Fu-Liou-Gu model used to solve cirrus cloud radiative properties of single-layered cirrus clouds → Results from EarthCARE will be compared to similar TOA CRE from MPLNET and historical CALIPSO dataset
- Ocean surface return changes between ATLID and CALIPSO are straightforward (off-nadir angle, Fresnel reflectance coefficient of the ocean surface between 355 and 532 nm). Correction based on the polarization channel. Subsurface scattering should increase in the UV but not fully understood
- We want to explore the possibility to use dual-field of view configuration on the EVE lidar system to estimate the multiple scattering factor from ground measurements.
- Involvement of other aerial platforms that incorporate simple instrumentation.
- Involvement of solar airplanes with lidar and radiometers (research task) – see https://skydweller.aero
- Influence of ms will be evaluated with model simulations; will then be included in lidar equation as a factor
- Automated precipitation detection has been incorporated into MPLNET processing (developmental-level) → Will be used to identify potential case studies for drizzle from CPR products

Questions?

- Will be the Cal / Val information from the L1 available to the ECVT and when?
- When will EarthCARE data be made available after launch ? Will there be a delay for data processing etc
- No questions. But we really appreciate Algorithm Teams feedback and info on open issues and needs
- Are there specific ground locations / regions that are desired? Especially those that are currently under sampled by surface lidar sites? Over ocean sampling and Africa are known regions requiring improvement in lidar coverage, others needed for EarthCARE validation?
- No questions but if you think the use of ocean surface return synergies would benefit Earthcare, please let me know. That would give me arguments to secure dedicated funding to work on Earthcare

- Personal (Holger Baars) view: Many, many of the proposals are looking for funding