

Highlights

- Wealth of experience from CloudSat/CALIPSO/MODIS and their validation.
- Ground networks are mature, advanced and have stable funding.
- Strong overlap between EarthCARE and ACCP pre-launch sub-orbital activities.

Open issues & uncertainties

- Target classification from active ATLID/CPR synergy suffers from blind zones (e.g. cloud base, liquid & mixed-phase cloud), with impacts on downstream retrievals including radiation.
- Uncertainties in ice and snow microphysical properties & scattering across regions/regimes, and across wavelengths. Ongoing (perennial) need for in-situ measurements.
- Cloud & precipitation over the ocean is both of critical importance and difficult to validate (especially rain retrievals leveraging CPR ocean surface return).

Recommendations & Next Steps

- Large effort to statistically validate cloud base, liquid and mixed-phase clouds & light precipitation in EarthCARE target classifications against ground-based ceilometer, lidar and radar networks.
Needs distinct coordinated efforts:
 - (1) cloud base from ceilometer & lidar networks,
 - (2) liquid and mixed-phase cloud placement using LWP & multi- λ (including standard approaches to W-band attenuation correction),
 - (3) instrument simulators to transform between bottom-up & top-down remote-sensing platforms.
- Target validation campaigns (in-situ & remote-sensed) to regions/regimes that will help improve priors & covariances for the greatest retrieval uncertainties.
Need input from L2 developers & campaign PIs to identify overlapping needs & capabilities.
- Links to radiation in validation of EarthCARE passive & synergistic cloud retrievals
Integrate high spectral and spatial resolution imagers with campaigns
- Process-level statistical validation in both measurement space (e.g. radar reflectivity & Doppler velocity) and retrieval-space (e.g. parameters of the size distribution).
Need to prioritize Doppler reference targets, and multiple-frequency radar & synergistic retrievals to evaluate scattering models & physical assumptions.
- Ongoing inter-comparison between L2 algorithms (w/ Japanese EarthCARE partners and outside EarthCARE) to cross-validate physical assumptions.
Need algorithms to be applicable to airborne and ground-based data AND suitably preprocessed ground-based and campaign data with full suite of measurements (cf. TC4 for CloudSat/CALIPSO).