

A L1 transformational operator for the objective evaluation of the EarthCARE Cloud Profiling Radar data products using suborbital observations

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The value of permanent, multi-sensor surface-based observatories that collect continuous long-term observations for satellite L2 data products has grown significantly the last 10-15 years. Examples of such established surface-based networks include: The Aerosol, Clouds and Trace Gases Research Infrastructure (ACTRIS) network, the US Department of Energy Atmospheric Radiation Measurements (ARM) observatories and the recently established 94-GHz Miniature Network for EarthCARE Reference Measurements (FRM4Radar). At the same time, there is a significant increase in the availability of airborne platforms (e.g., DLR Halo, French Falcon and the NASA airborne program) with comprehensive instrument payloads that mimic the satellite primary measurements.

Here, a simple L1 transformational operator that can convert L1 suborbital (surface-based or airborne) measurements to the EarthCARE CPR L1 observations is described. The L1 transformational operator ensures that the orbital-suborbital comparison accounts for differences in the sampling geometry, measurement uncertainty, and instrument sensitivity. Furthermore, the operator account for the impact of the surface echo on satellite-based radar observations. Examples of the application of the operator on surface-based observations measurement from the ESA FMR4Radar network are presented. Such long-time data sets are the optimal foundation for a statistical analysis of the CPR performance. The analysis will emphasis on clouds and precipitation processes near ground. In addition, it is show how important ground-based networks are that they can play an important role in the evaluation of future CPR satellite missions. The L1 transformational operator can be easily expanded other spaceborne radar systems. Our plans include the application of the L1 transformation operator to high resolution cloud resolving model output.