**Using synthetic EarthCARE Cloud Profiling Radar data to develop validation methodologies for ground-based cloud radar sites**

Lukas Pfitzenmaier1, Ulrich Löhnert1, Pavlos Kollias2,3, Bernat Puigdomenech3, Nils Risse1, and Imke Schirmacher1

*1) Universität zu Köln, Köln, Germany*

*2) Stony Brook University, Stony Brook, NY, USA*

*3) McGill University, Montreal QC Canada*

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).

Core of the work presented is the use of the developed transformation of suborbital to orbital radar data by orbital-radar.py. This simple L1 transformational operator convert L1 suborbital (surface-based or airborne) measurements to the EarthCARE Cloud Profiling Radar (CPR) L1 observations. The transformational operator ensures that the orbital-suborbital comparison accounting for differences in the sampling geometry, measurement uncertainty, instrument sensitivity and simulates the impact of the surface echo. Furthermore, the operator simulates the EarthCARE characteristic reflectivity and Doppler velocity errors.

Applying such a tool a long-time data sets make it possible to generate the optimal foundation for a statistical analysis of the EarthCARE CPR performance. So, the optimal sampling for CPR and ground base data can be estimated or the CPR detection of clouds and precipitation processes near ground analyzed and evaluated. In addition, it shows how important ground-based networks are, and that they play an important role in the evaluation of satellite measurements and products. Tools such as orbital-radar.py may help to evaluate future CPR satellite missions - expanding the L1 transformational operator to other spaceborne radar systems.