Preparing for EarthCARE synergy retrievals of cloud and precipitation with airborne and ground-based observations

Shannon Mason (1,2), Alessio Bozzo (3), Robin Hogan (3,1), Christine Chiu (4,1)

(1) Department of Meteorology, University of Reading, Reading, UK, (2) National Centre for Earth Observation, University of Reading, Reading, UK, (3) European Centre for Medium-Range Weather Forecasts, Reading, UK, (4) Colorado State University, Fort Collins, CO, USA

EarthCARE will build on the success of the A-Train of satellites, maximising the synergy of active and passive sensors, introducing novel radar and lidar measurements of the vertical profile of clouds, aerosols and precipitation, and linking atmospheric processes with top-of-atmosphere radiation.
The first Doppler cloud profiling radar in space will measure the vertical motion of hydrometeors through the atmosphere, revealing new information about the microphysics of rain and snow.

The Cloud, Aerosol and Precipitation from mulTiple Instruments using a VAriational TEchnique (CAPTIVATE) algorithm will provide radar–lidar–radiometer synergy retrievals from EarthCARE, but is also configurable for applications to instruments aboard airborne and ground-based platforms.
We demonstrate CAPTIVATE synergy retrievals using existing A-train, airborne and ground-based data in studies carried out in preparation for EarthCARE, with a focus on the contribution of Doppler radar measurements.
Airborne radar–lidar–radiometer synergy provides insights into the microphysics of tropical cloud and precipitation, and ground-based instruments are used to study ice and mixed-phase cloud and precipitation at high latitudes. EarthCARE synergy retrievals exploiting Doppler radar will facilitate improved estimates of the properties of precipitating hydrometeors, and of microphysical processes through the atmospheric profile. Looking beyond EarthCARE, we investigate the potential for additional insights from future dual-frequency Doppler radar satellite missions.