Cloud water content characterization by multifrequency weather radar observations and numerical scattering simulations

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The research presented in this study is fully situated in the general field of the inversion of the radar parameters, which we address by comparing the outputs of numerical simulations of hydrometeor populations with multifrequency weather radar observations.

In a recent attempt (Marra et al., European Journal of Remote Sensing, 2013, accepted for publication) we have combined CloudSat Profiling Radar returns with that of a ground C-band radar simultaneously inspecting the same reflecting volume. In the present study we are applying the same methodology by adding computations at Ka-band in order to be ready, with proper conceptual instruments, when the group will have two C-band fixed radars, and one Ka band mobile radar, soon operative continuously in a field dedicated experiment. So we address both populations of cloud particles (water and ice particles) and precipitation particles, including hail.

The code we are using is the classical T-Matrix scattering simulation codes, freely available (http://www.giss.nasa.gov/staff/mmishchenko/t_matrix.html) and slightly modified to answer the specific questions of the project, but it seems to us promising also the use of a Python package (http://scattpy.github.io/download/), for the possibility to simulate optical properties of non-spherical targets, especially suitable for hailstones and melting graupels.

Ancillary to this is our effort to simulate radar returns of an archive of cloud microphysical, observed, characteristics collected as a thesis work (Cavazzini and Prodi, unpublished report). In this way we plan to prepare a sort of tutorial, based on real cloud observations, especially useful when investigating the synergy of radar and lidar observations.