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Towards the use of polarimetric radar observations in the AROME-France convective scale NWP

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Dual-polarized meteorological radars (DPOL) give informations about the distribution, the shape and the phase of hydrometeors sampled by the radar beam, such as rain or snow flakes. These information, deduced from different variables, are retrieved from the polarimetric properties of the backscattered radiations in both vertical and horizontal directions. An observation operator, based on the T-matrix method, is used to simulate these variables from hydrometeors contents simulated by the AROME-France NWP system at convective scale. Such operator is able to simulate the horizontal and vertical reflectivities, the differential reflectivity ZDR, the specific differential phase KDP and the copolar correlation coefficient RHOHV. Comparisons between observed and simulated variables will be shown, and statistics of their differences will be discussed. The associated simulation errors have also been studied by perturbing different parameters used by the operator, especially those related to the shape and to the orientations of the scatterers.
This non-linear observation operator is further used in a one-dimensional variational (1D-Var) data assimilation scheme, which aims to explore the capability of DPOL radar for the retrieval of hydrometeor contents in a NWP context. In such scheme, a linearized version of this operator is required. It could be obtained by the estimation of the associated jacobian matrix with the finite differences method, which allows to quantify the sensitivity of the simulated polarimetric variables to different hydrometeors contents perturbations. The sensitivity study highlights the polarimetric variables which are likely to modify the simulated hydrometeors contents in a variational analyse. Among them, horizontal reflectivity, KDP and ZDR seem to be the most informative, while little sensitivity has been found for RHOHV. However, as this variable is linked to the homogeneity of the sampled volume, its simulated values strongly depend to microphysical scheme used by AROME-France. These results, as well as their projection on the radar geometry, will be illustrated and discussed.