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Comparison of Simulated Polarimetric Signatures Using ICE3 and LIMA Microphysics Schemes in Meso-NH

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In the last years, substantial efforts have been devoted world-wide to upgrade operational weather radar networks with dual-polarization capabilities. Besides measuring the intensity and the displacement of precipitation, dual polarization provides additional information about the characteristics of the hydrometeors (water and ice particles) within the observed volume. In particular, it has been shown that specific signatures could be observed in distinct parts of severe thunderstorms (e.g., Kdp columns and Zdr arcs and columns: Kumjian et al, 2008). Concurrently, a new generation of numerical weather prediction (NWP) models with kilometer-scale horizontal resolutions and advanced representations of microphysics is making it possible to represent atmospheric processes at the convective scale with improved realism. The joint use of dual-polarization radars and high-resolution NWP models opens a new area of investigation with potential breakthroughs in terms of knowledge of the microphysics and dynamics of thunderstorms, as well as improvements in the nowcasting and short-term prediction of these hazardous weather systems. Indeed, the simulation of realistic radar observations might explain the unobserved processes that drive the evolution of thunderstorms. Besides, such simulations could be useful to create severe-convection diagnostics for nowcasting applications.
This work aims to investigate the performance of the Meso-NH model (Lac et al, 2018) in representing the dual-polarization signatures of an idealized supercell. Simulations were performed using two microphysical schemes: the one-moment ICE3 (that predicts the total mass concentration of rain, cloud water, water vapor, snow, cloud ice and graupel) and the quasi-two-moment LIMA (that also includes the prediction of total number concentration for rain and cloud ice). The Augros et al (2016) forward operator was applied to simulate the dual-polarization variables. Preliminary results show that both microphysical schemes are able to reproduce the 3D structure of the supercell. LIMA presents higher values of Zh, Zdr and Kdp, and a more pronounced Zdr column. In the presentation, the results concerning other typical dual-polarization signatures will also be shown, along with possible improvements in the microphysics schemes and/or the forward operator.

References

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