1.24 ESTIMATION OF OBSERVATIONAL AND FORWARD-SIMULATOR UNCERTAINTIES IN THE CONTEXT OF MICROPHYSICAL STUDIES USING DOPPLER SPECTRA AND POLARIMETRIC RADAR OBSERVATIONS

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Use of polarimetric radar observations to improve our understanding of cloud microphysics is often best accomplished with the help of a dynamical model that accounts for the dynamic and thermodynamic evolution of the cloud system. However, such efforts are hampered by an inability to account for uncertainties associated with the comparison of simulated weather to that observed by radars or in situ observations. These uncertainties include, but are not limited to, initial and boundary condition uncertainties, inaccuracies in model numerical integration, and approximations in microphysics scheme. Here we focus primarily on the first and third sources of uncertainty. In the case of the first, we quantify uncertainties associated with the assumption of a steady-state in radar observations of the atmosphere — a common assumption in comparisons between observed quantities and idealized 1D or 2D atmospheric simulations. In the case of the third source, we consider the uncertainties that arise from: (a) the assumption of a particular functional form for the hydrometeor particle size distribution (e.g. gamma or exponential distribution) and, (b) the assumption of complex crystal shape for ice hydrometeors in the common case where the microphysics scheme assumes a simplified form (e.g. spheroids). We use large disdrometer databases of liquid drop size distributions, as well as extensive ice scattering libraries to perform these tasks. Quantification of these uncertainties is the first step in preventing the problem of over-fitting when estimating model microphysical quantities from radar observations.