

Revision-Review Xie et al. „ZJU-AERO V0.5: An Accurate and Efficient Radar Operator Designed for CMA-GFS / MESO with Capability of Simulating Nonspherical Hydrometeors “

General remarks

The revision of the manuscript includes a number of clarifications that I appreciate. In my opinion, the ratio of presented content (or amount of text and figures) to scientifically interesting and novel content is quite high making it fairly tedious to read. Readability and tangibility, hence quality, of the paper could significantly improve in my opinion if the manuscript were purged from not-too-relevant or basic details (that were much better placed in the user guide) as already pointed out in the initial review.

The amount of present, though hidden-by-clutter, “core content” is sufficient for publication in my view, so rejection is uncalled for. And while I’d personally strongly recommend the authors to make the manuscript more concise, I leave it to the editor to decide how strongly to request that.

Specific remarks

L20: “database [...] with a multi-layered architecture” – Here, it remains unclear what that might refer to, hence meaningless. I suggest to spend a few more words on this.

L39f: “non-linear [...] nature of the observation operator” – The challenge is not the operator nonlinearity, but the nonlinearity of the processes the operator describes.

L48ff: I suggest to cover all mentioned RFOs in roughly the same detail (eg Zeng16 also provides a melting/mixed-phase particle scheme, makes use of Mie/T-Matrix-based bulk scattering lookup tables for speedy calculations and is online-coupled to the COSMO and ICON models).

L70: The meaning of both “accurate” and “multi-layered” in this context is not clear.

L84: “The formulas [...] are briefly presented” – Remove brief here; it’s fairly detailed.

Fig1: This figure is only shortly mentioned in text, as far as I see without an actual clear purpose (“certain factors, such as beam-broadening, beam-bending, and beam-blocking among others (as shown in Figure 1)”). Remove it unless you give it a proper description/explanation and purpose.

L130: “can also interface with the output of WRF NWP model” – what is the difference/add-on to the general NWP variable reading from external storage files from the 1st sentence in this module description?

L131ff: This bullet point first suggests that trajectory are solved online (L131), then mentioning choice of (the same or a different?) online solver and an offline solver. Confusing.

L137: “radar variables are averaged” – More precisely, that should be an integration.

L167 & L173: Is the averaging (or integration) really done over the observable dual-pol parameters, specifically ZDR and rho_hv? This seems wrong since these variables are not additive.

L175: “procedures of steps 1-5 (excluding [...]) are independent” – doesn’t that imply, it’s steps 2-5 only?

L266: What are the S^{fwd} ?

L358: “possibility-weighted averaging” – probability-weighted

L430: “various orientations” – Mishchenko refers to them (steps 1-3) as “fixed orientation” in contrast to orientation-averaged ones (step 4). Might be helpful to make use of this established terminology.

L435: “while for particles without axial symmetry or those that are inhomogeneous, we applied the invariant-embedding T-matrix (IITM) code” – To which particles does this refer in the current state? According to later parts of the manuscript, IITM has been applied for the Chebyshev-shaped rain drops (which are actually both axial symmetric and homogeneous). For any others yet?

L439f: Add reference to conversion formulas.

L451ff: The $\sin(\beta)$ does not really belong to the Gaussian probability distribution, but to the integration over polar angle (differently formulated: the $\sin(\beta)$ has to appear in any integration over polar angle regardless of the purpose of that integration (compare eg phase function integration formulas) and of the probability distribution applied (compare eg formula for total random orientation)). Moreover, Eq31 specifically gives a Gaussian around $\beta=0^\circ$.

L467: “To improve the accuracy of raindrop modeling” – Since your paper is on radar forward operator, this is misleading. Make clear that this only refers to the geometric model of the raindrop, not to any radar modeling. Also, formulation seems to (wrongly) imply that you will do/develop these improvements.

L468f: “By incorporating these factors, a more accurate representation of raindrop model” – more accurate geometric(!) representation of raindrop shapes (of real, observed shapes, not of a model!).

L524: Why inventing a new name for this, when it is nothing more than the attenuation cross section?

L528f: “describe how a particle with a diameter D_{eq} affects the radar reflectivity” – It’s not the effect (ie a contribution) that is shown, particularly not when it later regards [zDR], but the equivalent radar parameter of a single, monodisperse particle of that size.

FigA1: Most of the caption does not describe what is seen in the figure, but explanation of theory or approach, hence belong in the manuscript text.