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Atmospheric Measurement Techniques Discussions

Interactive comment on "Development of the Community Active Sensor Module (CASM): Forward Simulation" *by* B. T. Johnson and S. A. Boukabara

Anonymous Referee #2

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The paper presents a forward model active radar simulator that is potentially useful in data assimilation. After the technical description of the simulator, the outputs of the simulators are compared with GPM observations. I seriously struggle in finding the novelty in this paper. 1) The simulator itself (in its current version) is the simplest possible I could imagine: just nadir, no 3D, no antenna pattern, no Doppler, no surface modelling, no multiple scattering. Current state of the art radar simulators are far more advanced (and no reference is actually provided to all the advances made in the past 10 years on this topic, e.g. see works by Tanelli, Kollias, Battaglia, Hogan and I am probably forgetting many others in preparation of future radar missions like EarthCARE, ACE). I do not see any advance even with respect to Quikbeam (paper

published almost 10 years ago) or to the simulator developed by R. Hogan. If the simulator is simpler because it wants to be extremely fast and capable of computing the adjoint and Jacobians this should be demonstrated (but is left as future work). Moreover if you claim that it is useful for altimeters and scatterometers you should show examples where you can simulate the surface returns (as seen by altimeters!). 2) The other serious problem I see is represented by the scattering libraries. How is possible to only include Mie spheres (in the current version) and only particles with sizes smaller than 1.5mm? All LUT can be very quickly updated. 3) All the description in Sect2.3 is pretty contorted and confused. Computing single scattering scattering and backscattering cross sections is straightforward. Integrating over PSD provides then extinction, scattering and backscattering coefficients (details are found in text books, no need to repeat them). Formula (6) is indeed exact (the backscattering cross section by definition is the scattering cross section at Theta=180) and not a rough approximation. A lot of imprecise statements (e.g. What is "air" (dry air)? The attenuation indeed starts from 0 not r0, kscat and kext are NOT UNITLESS but Lˆ-1 , confusion in formula (5)). 4) I do not understand what you are comparing here. If you are using Mie spheres with the same mixing rule all results should be spot on. Where is the difference coming from? 5) Sect.3. Again I do not see what you want to prove here. Essentially you are comparing your model with the GPM forward model and LUT. If you are using the same LUT as GPM your results should be spot on (not really because the retrieved profiles are not perfectly reproducing the observations but if I remember well there are forward modelled reflectivities in GPM files). The only thing that you are indeed proving is that you have some problem/bug in your code as clearly highlighted by what is happening in Fig.10 around pixels 100-120. Given all these weaknesses I deem the article not suited for publication and I would review it again only if my criticisms are seriously addressed. I do not want to demoralize the authors; their work is indeed potentially very useful but a lot more must be done to level their work with the state of the art in this research field.