

## ***Interactive comment on “Microwave and submillimeter wave scattering of oriented ice particles” by Manfred Brath et al.***

### **Anonymous Referee #2**

Received and published: 9 December 2019

The manuscript "Microwave and submillimeter wave scattering of oriented ice particles" is well-written, logically constructed, and highly impactful. Databases of such oriented particles, particularly with complete phase and extinction matrix information, are not available, so this dataset is expected to be groundbreaking for microwave, millimeter-wave, and submillimeter-wave sensor modeling applications. The radiative transfer results are very encouraging, and show that the authors have done a good job of creating a useful dataset. After addressing some minor clarifying issues, this manuscript is ready for publication.

My biggest concern is the precision to which these calculations have been run (see lines 176-178; 283-285). I understand that these are computationally-expensive calculations, so improving on these numbers is beyond the scope of this paper. However,

Printer-friendly version

Discussion paper



the cross-polarization terms, i.e.,  $Z_{12}$  and  $Z_{21}$ , are orders of magnitude smaller than  $Z_{11}$ , so these terms may be unreliable, and looking at the processed data, there seems to be a lot of noise that is of the same order of magnitude as the signal. Luckily these terms are small, and the largest expected contribution would be to radar polarimetric variables, especially LDR. I think the authors should make a note of this when discussing the precision relative to  $Z_{11}$  (and the other phase matrix terms).

The authors should make clear that the amplitude scattering matrix (equation 11) operates on the complex electric field terms.

The authors should explicitly state that orientational averaging must be done incoherently, that is at the the Mueller (or Phase) matrix stage, due to the power terms in the top left block of the Phase matrix.

When discussing mirror partners and mirror symmetry, please cite van de Hulst (1957) and Mishchenko (2002). There is a really nice explanation with stick figures in both publications.

Also in reference to mirror particles, for the RT simulations in section 6.1, were the particles averaged with their mirror partners (with respect to the incidence plane)? This is important for properly conditioning the  $Z_{12}$  and  $Z_{21}$  Phase matrix parameters for the target medium of preferential alignment with zero mean canting angle.

Technical Corrections:

There are minor typos throughout the manuscript that need to be fixed, but the document as a whole is very clear.

There are a few symbols that did not render properly, one of which was the asymmetry parameter.

---

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-382, 2019.

Printer-friendly version

Discussion paper

