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## 3-D polarised simulations of space-borne passive mm/sub-mm midlatitude cirrus observations: a case study

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**Abstract.** Global observations of ice clouds are needed to improve our understanding of their impact on earth's radiation balance and the water-cycle. Passive mm/sub-mm has some advantages compared to other space-borne cloud-ice remote sensing techniques. The physics of scattering makes forward radiative transfer modelling for such instruments challenging. This paper demonstrates the ability of a recently developed RT code, ARTS-MC, to accurately simulate observations of this type for a variety of viewing geometries corresponding to operational (AMSU-B, EOS-MLS) and proposed (CIWSIR) instruments. ARTS-MC employs an adjoint Monte-Carlo method, makes proper account of polarisation, and uses 3-D spherical geometry. The actual field of view characteristics for each instrument are also accounted for. A 3-D midlatitude cirrus scenario is used, which is derived from Chilbolton cloud radar data and a stochastic method for generating 3-D ice water content fields. These demonstration simulations clearly demonstrate the beamfilling effect, significant polarisation effects for non-spherical particles, and also a beamfilling effect with regard to polarisation.

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