Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 7, 4149-4158, 2007
www.atmos-chem-phys.net/7/4149/2007/

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

C. P. Davis[1], K. F. Evans[2], S. A. Buehler[3], D. L. Wu[4], and H. C. Pumphrey[1]

[1] Institute of Atmospheric and Environmental Science, University of Edinburgh, Edinburgh, UK
[2] Dept. of Atmosphere and Oceanic Sciences, University of Colorado, Boulder, USA
[3] Department of Space Science, Lulea Technical University, Kiruna, Sweden
[4] Jet Propulsion Laboratory, California Institute of Technology, Pasadena, USA

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.

Final Revised Paper (PDF, 2005 KB) Discussion Paper (ACPD)

Citation: Davis, C. P., Evans, K. F., Buehler, S. A., Wu, D. L., and Pumphrey, H. C.: 3-D polarised simulations of space-borne passive mm/sub-mm midlatitude cirrus observations: a case study, Atmos. Chem. Phys., 7, 4149-4158, 2007. Bibtex EndNote Reference Manager