Atmos. Chem. Phys. Discuss., 6, S5408–S5411, 2006
www.atmos-chem-phys-discuss.net/6/S5408/2006/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "3-D polarised simulations of space-borne passive mm/sub-mm midlatitude cirrus observations: a case study" *by* C. P. Davis et al.

Anonymous Referee #1

Received and published: 14 December 2006

The paper presents detailed simulations for three instruments (AMSU-B, CIWSIR and EOS-MLS) using a Monte Carlo model which takes into account 3D spherical geometry and polarization. The model can also be run in 1D geometry. Different approaches are compared: the full 3D treatment, 1D calculations and the 1D independent pixel approximation (IPA). It is shown that for CIWSIR and AMSU-B, the 3D model agrees very well with IPA; hence it seems possible to neglect 3D radiative transfer effects (horizontal photon transport). Furthermore the results suggest, that for EOS-MLS, a limb scanning instrument, this assumption is not valid. The differences between 1D and 3D/IPA are mainly caused by the so-called beam-filling, i.e. the averaging of the cloud properties over the field of view, which leads systematically to an overestimation of the cloud

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

EGU

effect in the 1D model. The paper is generally well written and well structured. The study presented is the first detailed comparison between 1D and 3D radiative transfer through cirrus clouds for microwave frequencies. The results should be of considerable value, especially for the development of retrieval algorithms for the CIWSIR instrument. Therefore I suggest publication after minor revisions.

General comments:

The title is not well chosen and the abstract is not very well written. I think the most important results of the study are the differences between 1D, 3D and IPA. The title could be for example "Comparison of 3D and 1D radiative transfer approaches for the simulation of polarized space-borne passive mm/sub-mm midlatitude cirrus observations". The abstract is not very concise regarding the results of the study.

Some more simulations using the same cloud scene but different footprints would be nice to substantiate the results.

Specific comments:

page 2:

line 2: "Passive mm/sub-mm has some advantages ...": Which advantages? Remove this phrase from the abstract.

line 10: "Although ..." This phrase sounds strange. The original purpose of the work is not that important; the results should be summarized in the abstract.

page 4:

line 6: "Instead the approximations of a 1D-spherical shell ... are often made". 1D-spherical shell models including scattering are very rare, in almost all existing models the 1D-plane-parallel approximation is made.

line 9: References for the instruments are missing.

ACPD

6, S5408–S5411, 2006

page 5:

line 11: Explain the term "pencil beam"

line 16: The description of the IPA method is not very clear. An illustrative figure might help to understand the concept.

page 7:

line 6: Why is the size distribution by McFarqhuar and Heymsfield used? This one is typical for the tropics but not for mid-latitudes.

page 9: Eq.3: What are the integration limits? You need the FOV in latitude, longitude, pressure coordinates, right?

page 10:

line 10: What exactly is shown in the figures as polarization difference? Which unit is used (Rayleigh Jeans or Planck brightness temperatures)? What does horizontally and vertically polarized mean? Commonly polarization is defined w.r.t. the scattering plane and Q = I_l -I_r (parallel - perpendicular), how are I_v and I_h defined?

page 11:

line 12: Section 8 is not just "Discussion". The title should include the word "beam-filling correction" or something similar.

page 14:

line 10: Why did you use a 3rd degree polynomial and not a 2nd degree?

Technical corrections:

page 8:

line 1: Include "." after cirrus

page 9:

ACPD

6, S5408–S5411, 2006

Eq.1: Define $d\Omega$

page 10: line 22: Expand FP.

page 13: Eq. 7: Define σ.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 12701, 2006.

ACPD

6, S5408–S5411, 2006

Interactive Comment