The Cryosphere Discussions

TCD

Interactive
comment

Interactive comment on "Inter-comparison and improvement of 2-stream shortwave radiative transfer models for unified treatment of cryospheric surfaces in ESMs" *by* Cheng Dang et al.

Anonymous Referee #1

Received and published: 14 March 2019

This paper aims to unify the treatment of the optical properties of snow and ice in ESMs, because, historically, there have often been different albedo schemes in one and the same ESM, applied to seasonal snow, snow on sea ice, and snow on land ice masses like ice sheets. In particular, the authors focus on SNICAR (used for land ice and land masses), and Icepack/CICE (for sea ice). All radiative transfer schemes in ESMs are two-stream approximations. They assess the accuracy of the 2-stream approximations of different flavors against DISORT in a 16-stream configuration and consider this as the benchmark.

Printer-friendly version

Discussion paper

I have few comments on the research itself. This is solid and has been carefully designed, and conducted.

I do have critical remarks on the presentation of the results. They are surprisingly unclear in a few key parts, to the extent that I am unsure what the authors have actually done and what they haven't done.

The problem lies in the fact that there is (1) a correction for high SZA > 75 degrees, and (2) mention of a hybrid model SNICAR-AD. To me it is unclear whether these are the same thing or not. The high-SZA correction seems to be carried out on CICE rather than SNICAR. The authors suggest that a correction (equations 13 a and b) can be conducted for any 2-stream approximation, so also for SNICAR.

So what is the situation after this paper? Do the authors now have 1 model for all snow and ice surfaces? Or did they present a correction for CICE only? Or also for SNICAR? And is this then SNICAR-AD? And what are the recommendation in section 8 about? Is this for future work? Or are these points that have been taken into account while a unified model framework was developed?

All in all, there are two possibilities: (1) either the authors have forgotten to mention that the correction for SZA > 75 degrees is actually called SNICAR-AD. In that case, Figure 12 needs different figure axis labels and the text needs to clarify that this correction is called SNICAR-AD in a few places. In this case, I would suggest to move section 8 forward between the current sections 5 and 6, so as to present first the requirements for a unified model, and then the actual unified model.

Or, (2) the correction for SZA > 75 degrees is not the same as SNICAR-AD, but rather an intermediate step in the unification of Icepack and SNICAR. In that case, the paper is incomplete. Results from the to-be-developed SNICAR-AD need to be incorporated here. If this would be paper 1 presenting the SZA-correction, and in a future paper 2 we will see SNICAR-AD fully developed, then I recommend that this paper is postponed to when SNICAR-AD is finished.

I recommend to the editor to inquire with the authors which of these possible situations is the case, and then reach a decision.