Atmos. Chem. Phys. Discuss., 9, C7421–C7422, 2009
www.atmos-chem-phys-discuss.net/9/C7421/2009/


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Arctic sea-ice extent and its effect on the absorbed (net) solar flux at the surface, based on ISCCP-D2 cloud data for 1983–2007" *by* C. Matsoukas et al.

**Anonymous Referee #2**

Received and published: 24 November 2009

The connections between sea ice, cloud cover, and absorbed solar radiative flux at the surface over the Arctic ocean and the whole global have been investigated in this paper by using satellite products as inputs to the radiative transfer model along with other reanalysis data from NCEP and GADS. Seeking the magnitude of the connection between sea ice and absorbed solar flux is an important step to correctly understand feedback mechanism quantitatively, and has potential to improve climate models. A number of studies have evidenced that sea ice as well as cloud and their physical properties have significant impact on the numerical simulation and real-world climate change (Liu, Y., J. R. Key, and X. Wang (2009), Influence of changes in sea ice concentration and cloud cover on recent Arctic surface temperature trends, Geophys. Res.



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Lett., 36, L20710, doi:10.1029/2009GL040708; Liu, Y., J. R. Key, and X. Wang (2008), The influence of changes in cloud cover on recent surface temperature trends in the Arctic, J. Clim., 21, 705-715.) It is appropriate to submit this kind of paper to Atmospheric Chemistry and Physics (ACP), and the topic of this paper discussing about should be interesting to the community of Arctic climate and environment change studies. However, as authors said, some inferences/conclusions may not hold for other cases because they didn't use more sophisticated radiative transfer models, e.g., radiative transfer model may be simple in this work, more advanced models might help to get more convincing conclusions such as Streamer (Key, J. and A.J. Schweiger, 1998. Tools for atmospheric radiative transfer: Streamer and FluxNet. Computers and Geosciences, 24(5), 443-451.) and/or SHDOM (Evans, K. F., 1998: The spherical harmonic discrete ordinate method for three-dimensional atmospheric radiative transfer. J. Atmos. Sci., 55, 429-446.). The study method is adequate for this kind of study. The other statistical approaches, such as typical correlation analysis technique/covariance analysis technique, might also be used in addition to the simple correlations analysis, and clarification of the definition of sea-ice forcing is needed in this paper. Overall, it is very good work about the relationship between sea ice and absorbed solar radiation.

I have several of concerns/questions that need authors clarify/response. 1. It's not clear to me what the figure 1 really means. It seems to me that seasonally freezing areas are included, only are those never-freezing areas excluded from the plot, right? 2. Please clarify that your definition of sea-ice radiation forcing is actually the net solar fluxes without ice minus the net solar fluxes with ice. So this value should always be positive. 3. Authors mention a few cells with increasing sea-ice cover and of course decreasing net solar flux, but not further more discussion on it. Those opposite trend cells may worth more discussions. 4. For sensitivity study, the cases should be selected to avoid ceiling of 100% on the sea ice extent and total cloud amount. 5. "Buffin" should be "Baffin" in many places of the paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 21041, 2009.