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Atmospheric Measurement Techniques Discussions

Interactive comment on "Aerosol optical depth retrieval in the Arctic region using MODIS based on prior knowledge" *by* L. Mei et al.

Anonymous Referee #1

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The subject of the presented manuscript is of great importance and is definitely suitable for AMT. Currently the Arctic region suffers from lack of aerosol remote sensing retrievals, and aerosols in the Arctic produce various climatic feedbacks which may affect climate on both local and global scales. In the conditions of lacking ground truth aerosol data in the Arctic, remote sensing is the only method capable of providing the necessary coverage of aerosol product. At the same time, snow covered surface is one of the most challenging surfaces for aerosol remote sensing. It is therefore clear that the task of aerosol retrieval in the Arctic is not a trivial task. Current manuscript presents an attempt of solving the task using MODIS TERRA and AQUA, and a semi-analitical approximation by Xue and Cracknell (1995). Referee #2 has already covered important points, as were some of them covered in the initial review at the prediscus-

sion stage. As the main comments about the sensitivity studies and validation were not considered at that stage, it is not needed to go into further detail. I recommend to reject the paper for the lack of scientific quality and just will repeat the main concerns here for future reference. The applicability of used approximation to the specific Arctic conditions has not been checked. The extensive theoretical part cannot substitute the accuracy study of the approximation itself and the inversion algorithm beneath it. Simple forward calculation as in Fig. 1 does not provide any information on the quality of the retrieval itself. The validation presented in the paper deals with six Arctic AERONET stations in summer conditions, which leads to only one station which features true snow surface type. This gives just a few data points that validate the AOD retrieval over snow. This is definitely not sufficient. If the authors are willing to improve the manuscript for resubmission, I recommend to take spring AERONET data of the available Arctic stations. There are regular pollution events in the Arctic in spring in the absence of melting, which presents opportunities for better validation over snow. Also, it is necessary to separate different surface types both in the theoretical part and validation part. Mixing bare soil, snow and vegetation together cannot give an impression on the quality of the retrieval over either of these surfaces.

Due to the scientific significance of the topic and the great amount of work behind the presented manuscript, I would suggest the authors take their time to still consider the comments, perform sensitivity studies, more extensive validation, and resubmit the paper.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 7597, 2011.