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Interactive comment on "Snow albedo reduction in seasonal snow due to anthropogenic dust and carbonaceous aerosols across northern China" *by* Xin Wang et al.

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The authors conducted extensive field measurements of BC, OC, and dust concentrations in snow over the northern China and employed the SNICAR and SAMDS model simulations to investigate snow albedo reduction caused by the light-absorbing aerosols. This study provides a valuable observational dataset to improve our understanding in the effects of light-absorbing aerosol deposition on snow albedo reduction. I have a short comment on snow albedo modeling.

The authors mentioned that the SAMDS model considers aerosol-snow mixing state and the irregular morphology of snow grain by using asymptotic radiative transfer theory. However, the authors did not provide enough discussions on the effects of

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BC/dust/OC-snow mixing state and snow grain shape on snow albedo reduction as well as compare with some recent studies. These factors are not trivial in evaluating aerosol-snow albedo effects, in addition to snow grain size and aerosol concentration. For example, recent studies by Liou et al. (2014) and He et al. (2014) developed and applied a stochastic snow model to study BC/dust-induced snow albedo reduction, which explicitly simulates different aerosol-snow mixing states and snow grain shapes. They found that using a realistic snowflake shape reduces BC-induced snow albedo reduction by 20–40% compared to a spherical snow grain, while multiple internal mixing of BC and snow increases the albedo reduction by 40–60% relative to the external mixing. I would suggest discussing these recent findings, which could be very helpful for people to understand potential uncertainty and improvement in snow albedo modeling.

References:

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