

# ***Interactive comment on “Quantifying bioalbedo: A new physically-based model and critique of empirical methods for characterizing biological influence on ice and snow albedo” by Joseph M Cook et al.***

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The authors developed a new snow/ice albedo model (Bio-SNICAR) to investigate the contamination effect of biological impurities in snow/ice. This is a powerful tool which can be used to advance our understanding on biological influence on snow/ice albedo. I have a short comment.

In radiative transfer modeling, the authors assumed spherical ice crystals and external impurity-ice/snow mixing (if I understand correctly). However, recent studies have found that ice/snow grain shape (Liou et al., 2014; Dang et al., 2016), ice/snow grain

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packing/aggregating (He et al., 2017), and impurity-ice/snow internal mixing (Liou et al., 2014; He et al., 2017) have substantial impacts on albedo of clean and/or dirty ice/snow. Therefore, all these factors could introduce uncertainty in estimates of impurity effects on snow/ice albedo in the present manuscript. Could the authors add more details in model descriptions regarding how they dealt with these issues and include some additional discussions on these recent studies and issues?

#### References:

Dang, C., Q. Fu, and S. Warren, 2016: Effect of Snow Grain Shape on Snow Albedo, *J. Atmos. Sci.*, 73, 3573–3583, doi: 10.1175/JAS-D-15-0276.1.

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Liou, K. N., Y. Takano, C. He, P. Yang, R. L. Leung, Y. Gu, and W. L. Lee, 2014: Stochastic parameterization for light absorption by internally mixed BC/dust in snow grains for application to climate models, *J. Geophys. Res.-Atmos.*, 119, 7616–7632, doi:10.1002/2014JD021665.

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