

Interactive comment on “Enhancement of snow albedo reduction and radiative forcing due to coated black carbon in snow” by Wei Pu et al.

Anonymous Referee #2

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The authors investigated the BC coating effects based on the core/shell Mie theory and the radiative transfer model SNICAR. The paper is generally well-written. It is good for the climate models to consider the BC enhancement on albedo reduction due to the BC coating effects. It is also nice to give options for different core/shell ratios. However, I feel the content is not abundant enough and have some comments below for the authors to consider.

1. In section 3.1, it is not clear to me why the absorptive shell reduce the BC enhancement compared with the non-absorptive shell. And the authors should explain what is the lensing effect. 2. In section 3.2, actually the E_{1-w} , E_{α} , and $E_{\Delta\alpha}$ tell the same story. And the impact of BC coating on spectral characteristics should be consistent with that on broadband characteristics. To make the story full, I suggest

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the authors present the direct numbers of snow albedo of various snow cases, e.g. fresh snow, old snow, of different snow depths, with different BC concentrations and core/shell ratios, other than the ratios as E_{\dots} 3. In section 3.3, the authors argued that SNICAR consider the BC coating effect of an intermediate core/shell ratio. Well, what is the result of this simplification? 4. It is good for the authors to discuss the uncertainties of imaginary RI values of OC and BC particle sizes in section 3.4. The question is how large the uncertainty is as 1% for E_{α} and 13% for $E_{\delta_{\alpha}}$? Bias of direct snow albedo is more straightforward. 5. In section 3.5, the authors mentioned the overestimated albedo as around 0.06 in the polluted snow and argued that the new parameterization of BC coating can reduce this overestimation to 0.02. I feel this statement is too strong, as there is huge uncertainty in the measurements of LAPs in snow. It is good for the climate models to have an option for BC coating effects but I suggest not exaggerate this part.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-238>, 2020.

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