

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-319

Anonymous Referee #1

Referee comment on "Review article: Parameterizations of snow-related physical processes in land surface models" by Won Young Lee et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-319-RC1>, 2022

Lee, Gim and Park review the representation of snow cover fraction, snow albedo and snow density in eight land surface models used for climate modelling. This will have been a useful exercise for informing development of the Korean Integrated Model. With regrets, however, I do not think that this manuscript meets the requirements for a The Cryosphere review article to "summarize the status of knowledge and outline future directions of research within the journal scope". The observation by Menard et al. (2021) that model documentation can be missing or inaccurate is presented as a motivation for this review but is not addressed. Instead, the authors present very dense lists of variables and equations from existing and openly available model documentation. For the reader to really understand what these models are doing, it will be easier (and in fact essential) for them to consult the original documentation. The claim in the Conclusions that this review allowed the authors "to find each parameterization's vulnerabilities" is not demonstrated. Two directions for future research are identified: influences of topographic features and vegetation on snow. The processes of variability listed in Table 9, reproduced from Clark et al. (2011), all operate on spatial scales much finer than climate model grids on which the reviewed models are applied; assessments of which processes have significant influences on coarser resolutions and how they can be parametrized are missing. All of the reviewed models already take account of "vegetation-related factors such as vegetation density, vegetation type, vegetation cover fraction, LAI and SAI" to some extent; exactly what the authors think needs to and can be done in the future is not stated.