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# A systematic evaluation of surface albedo prediction error in high latitude forest environments: The case of the Community Land Model (CLM)

Hui Tang[1], **Ryan Bright**[2], and Frode Stordal[1]
[1]University of Oslo, Department of Geoscience, Oslo, Norway (hui.tang@geo.uio.no)
[2]Norwegian Institute of Bioeconomy Research, Division of Forestry and Forest Resources, Ås, Norway (ryan.bright@nibio.no)

Land surface models (LSMs) employed in global climate research continue to struggle to predict surface albedo in high latitude forests. Persistent sources of error in LSMs may originate from one or more of the following: a) the underlying land cover mapping and PFT classification; b) the parameterization of forest structure; c) canopy-snow dynamics and snow physical attributes; d) canopy radiative transfer. Among the more sophisticated, the surface albedo scheme in the Community Land Model has undergone several updates over the past decade, although it remains unclear which updates – and to what extent -- they may have contributed to improved surface albedo prediction accuracy in high latitude forest environments. Here, using Fennoscandia (Norway, Sweden, and Finland) as a case study region and a 5-year MODIS-based surface albedo time series as an empirical benchmark, we carry out a series of offline simulations using CLM versions 4.5, 5.0, and FATES (formerly ED) combined with novel land cover and structure mapping to systematically quantify errors attributable to the aforementioned sources, as well as improvements (or degradations) to predictive performance associated with incremental model developments in time. Preliminary results using CLM v. 4.5 & 5.0 suggest that both the underlying land cover mapping and the representation of forest structure contribute equally to prediction error and outweigh the error attributable to the parameterization of canopy-snow processes. As for canopy radiative transfer, the extent to which the multi-layer canopy radiative transfer scheme introduced in FATES reduces surface albedo prediction error over the single-layer scheme employed in all other CLM versions remains to be quantified.