Quantifying the impact of unknown snow depth on satellite-retrieved Arctic sea-ice thickness

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The thickness of the snow layer covering sea ice is a crucial parameter in any algorithm deriving sea-ice thickness or volume from satellite-retrieved sea-ice freeboard. The assumptions on snow depth applied by these algorithms are, however, usually based on sparse observational data with large uncertainties. In this study we evaluate these assumptions with a simulated ice-thickness retrieval based on model simulations performed with the Max Planck Institute Earth System Model. We convert the simulated Arctic sea-ice freeboard to ice thickness assuming the same incomplete knowledge of snow depth as state-of-the-art retrieval algorithms, and compare the obtained ice-thickness estimate to the actual ice thickness simulated by the model. Our results point towards substantial errors of the retrieved ice thickness in particular in mid-winter, originating from snow-depth estimates used by ice-thickness retrieval algorithms.