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KuKa altimeter mode data gathered during MOSAiC: scattering from snow covered sea ice and snow depth determination using dual-frequency and polarimetric approaches

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Retrieving the thickness of sea ice, and its snow cover, on long time- and length-scales is critical for studying climate. Satellite altimetry has provided estimations of sea ice thickness spanning nearly three decades, and more recently altimetry techniques have provided estimations of snow depth, using dual-band satellite altimetry data. These approaches are based on assumptions about the main scattering surfaces of the radiation. The dominant scattering surface is often assumed to be the snow/ice interface at Ku-band frequencies and the air/snow interface at Ka-band and laser frequencies. It has previously been shown that these assumptions do not always hold, but field data to investigate the dominant scattering surfaces and investigate how these relate to the physical snow and ice characteristics were spatially and temporally limited. The MOSAiC expedition provided a unique opportunity to gather data using a newly-developed Ku- and Ka-band radar 'KuKa' deployed over snow-covered sea ice, along with coincident field measurements of snow and ice properties. We present transect data gathered with the instrument looking at nadir to demonstrate how the scattering characteristics vary spatially and temporally in the Ku- and Ka-bands, and discuss implications for interpretation of dual-frequency satellite radar altimetry data. We compare KuKa data with field measurements to demonstrate snow depth retrieval using Ku- and Ka-band data.