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3-5 Advances in Airborne Altimetric Techniques for the Measurement of Snow on Arctic Sea Ice

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Current sea ice observations and models indicate a transition towards a more seasonal Arctic ice pack with a smaller, and geographically more variable, multiyear ice component. To gain a comprehensive understanding of the processes governing this transition it is important to include the impact of the snow cover, determining the mechanisms by which snow is both responding to and forcing changes to the sea ice pack.

Data from NASA's Operation IceBridge (OIB) snow radar system, which has been making yearly surveys of the western Arctic since 2009, offers a key resource for investigating the snow cover. In this work, we characterize the OIB snow radar instrument response to ascertain the location of 'sidelobes', aiding the interpretation of snow radar data. We apply novel wavelet-based techniques to identify the primary reflecting interfaces within the snow pack from which snow depth estimates are derived. We apply these techniques to the range of available snow radar data collected over the last 6 years during the NASA OIB mission. Our results are validated through comparison with a range of in-situ data. We discuss the impact of sea ice surface morphology on snow radar returns (with respect to ice type) and the topographic conditions over which accurate snow-radar-derived snow depths may be obtained. Finally we present improvements to in situ survey design that will allow for both an improved sampling of the snow radar footprint and more accurate assessment of the uncertainties in radar-derived snow depths in the future.