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Multi-decadal Arctic sea ice roughness.

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The transformation of Arctic sea ice from mainly perennial, multi-year ice to a seasonal, firstyear ice is believed to have been accompanied by a reduction of the roughness of the ice cover surface.

This smoothening effect has been shown to (i) modify the momentum and heat transfer between the atmosphere and ocean, (ii) to alter the ice thickness distribution which in turn controls the snow and melt pond repartition over the ice cover, and (iii) to bias airborne and satellite remote sensing measurements that depend on the scattering and reflective characteristics over the sea ice surface topography.

We will review existing and novel remote sensing methodologies proposed to estimate sea ice roughness, ranging from airborne LIDAR measurement (ie Operation IceBridge), to backscatter coefficients from scatterometers (ASCAT, QUICKSCAT), to multi angle maging spectroradiometer (MISR), and to laser (Icesat) and radar altimeters (Envisat, Cryosat, Altika, Sentinel-3).

We will show that by comparing and cross-calibrating these different products we can offer a consistent multi-mission, multi-decadal view of the declining sea ice roughness. Implications for sea ice physics, climate and remote sensing will also be discussed.