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Collocated OLCI optical imagery and SAR radar altimetry from Sentinel3 for enhanced sea ice surface classification

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The Copernicus operational Sentinel-3A since February 2016 and Sentinel-3B since April 2018 build on the CryoSat-2 legacy in terms of their synthetic aperture radar (SAR) mode altimetry providing high-resolution radar freeboard elevation data over the polar regions up to 81N. This technology combined with the Ocean and Land Colour Instrument (OLCI) imaging spectrometer offers the first space-time collocated optical imagery and radar altimetry dataset. We use these joint datasets for validation of several existing surface classification algorithms based on Sentinel-3 altimeter echo shapes. We also explore the potential for novel AI techniques such as convolutional neural networks (CNN) for winter and summer sea ice surface classification (i.e. melt pond fraction, lead fraction, sea ice roughness). For lead surface classification we analyse the winters of 2018/19 and 2019/20 and for summer sea ice feature classification we focus on the Sentinel-3A &3B tandem phase of the summer 2018. We compare our CNN models with other existing surface classification algorithms.