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SMART – Space monitoring of Arctic Tundra landscapes

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Satellite remote sensing as well as in-situ measurements are common tools to monitor the state of Arctic environments. However, remote sensing products often lack sufficient temporal and/or spatial resolution, and in-situ measurements can only describe the environmental conditions on a very limited spatial scale. Therefore, we conducted an air-borne campaign to connect the detailed in-situ data with poor spatial coverage to coarse satellite images. The SMART campaign is part of the ongoing project „Characterization of Polar Permafrost Landscapes by Means of Multi-Temporal and Multi-Scale Remote Sensing, and In-Situ Measurements“, funded by the German Research Foundation (DFG). The focus of the project is to close the gap between in-situ measurements and space-borne images in polar permafrost landscapes. The airborne campaign SMART was conducted in late summer 2018 in north-west Canada, focussing on the Mackenzie-Delta region, which is underlain by permafrost and rarely inhabited. The land cover is either dominated by open Tundra landscapes or by boreal forests. The Polar-5 research-aircraft from the Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Germany, was equipped with a ground penetrating radar, a hyperspectral camera, a laserscanner, and an infrared temperature sensor amongst others. In parallel to the airborne acquisition, a team collected in-situ data on ground, including manual active layer depth measurements, geophysical surveying using 2D Electric Resistivity Tomography (ERT), GPR, and mapping of additional land cover properties. The database was completed by a variety of satellite data from different platforms, e.g. MODIS, Landsat, TerraSAR-X and Sentinel-1. As part of the project, we analysed the performance of MODIS Land surfaces temperature products compared to our air-borne infrared measurements and evaluated, how long the land surface temperatures of this Arctic environment can be considered as stable. It turned out that the MODIS data differ up to 2°C from the air-borne measurements. If this is due to the spatial difference of the measurements or a result of data processing of the MODIS LST products is part of ongoing analysis.