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Using ground data of the Global Terrestrial Network of Permafrost (GTN-P) for the evaluation of ESA Data User Element (DUE) Permafrost remote sensing derived products

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Permafrost is one of the essential climate variables addressed by the Global Terrestrial Observing System (GCOS). Remote sensing data provide area-wide monitoring of e.g. surface temperatures or soil surface status (frozen or thawed state) in the Arctic and Subarctic, where ground data collection is difficult and restricted to local measurements at few monitoring sites. The task of the ESA Data User Element (DUE) Permafrost project is to build-up an Earth observation service for northern high-latitudinal permafrost applications with extensive involvement of the international permafrost research community (www.ipf.tuwien.ac.at/permafrost). The satellite-derived DUE Permafrost products are Land Surface Temperature, Surface Soil Moisture, Surface Frozen and Thawed State, Digital Elevation Model (locally as remote sensing product and circumpolar as non-remote sensing product) and Subsidence, and Land Cover. Land Surface Temperature, Surface Soil Moisture, and Surface Frozen and Thawed State will be provided for the circumpolar permafrost area north of 55° N with 25 km spatial resolution. In addition, regional products with higher spatial resolution were developed for five case study regions in different permafrost zones of the tundra and taiga (Laptev Sea [RU], Central Yakutia [RU], Western Siberia [RU], Alaska N-S transect, [US] Mackenzie River and Valley [CA]).
This study shows the evaluation of two DUE Permafrost regional products, Land Surface Temperature and Surface Frozen and Thawed State, using freely available ground truth data from the Global Terrestrial Network of Permafrost (GTN-P) and monitoring data from the Russian-German Samoylov research station in the Lena River Delta (Central Siberia, RU). The GTN-P permafrost monitoring sites with their position in different permafrost zones are highly qualified for the validation of DUE Permafrost remote sensing products. Air and surface temperatures with high-temporal resolution from eleven GTN-P sites in Alaska and four sites in Siberia were used to match up LST products. Daily average GTN-P borehole- and air temperature data for three Alaskan and six Western Siberian sites were used to evaluate surface frozen and thawed. First results are promising and demonstrate the great benefit of freely available ground truth databases for remote sensing derived products.