

ESA DUE Permafrost: Evaluation of remote sensing derived products using ground data from the Global Terrestrial Network of Permafrost (GTN-P)

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The task of the ESA DUE Permafrost project is to build up an Earth observation service for high-latitude permafrost applications with extensive involvement of the permafrost research community. The DUE Permafrost products derived from remote sensing are land surface temperature (LST), surface soil moisture (SSM), surface frozen and thawed state (freeze/ thaw), terrain, land cover, and surface waters. Weekly and monthly averages for most of the DUE Permafrost products will be made available for the years 2007-2010. The DUE Permafrost products are provided for the circumpolar permafrost area (north of 55°N) with 25 km spatial resolution. In addition, regional products with higher spatial resolution (300-1000 m/ pixel) were developed for five case study regions. These regions are: (1) the Laptev Sea and Eastern Siberian Sea Region (RU, continuous very cold permafrost/ tundra), (2) the Yakutsk Region (RU, continuous cold permafrost/ taiga), (3) the Western Siberian transect including Yamal Peninsula and Ob Region (RU, continuous to discontinuous/ taiga-tundra), (4) the Alaska Highway Transect (US, continuous to discontinuous/ taiga-tundra), and (5) the Mackenzie Delta and Valley Transect (CA, continuous to discontinuous/ taiga-tundra).

The challenge of the programme is to adapt remote sensing products that are well established and tested in agricultural low and mid-latitude areas for highly heterogeneous taiga/ tundra permafrost landscapes in arctic regions. Ground data is essential for the evaluation of DUE Permafrost products and is provided by user groups and global networks. A major part of the DUE Permafrost core user group is contributing to GTN-P, the Global Terrestrial Network of Permafrost. Its main programmes, the Circumpolar Active Layer Monitoring (CALM) and the Thermal State of Permafrost (TSP) have been thoroughly overhauled during the last International Polar Year (2007-2008). Their spatial coverage has been extended to provide a true circumpolar network. Ground data ranges from active layer- and snow depths, to air-, ground-, and borehole temperature data as well as soil moisture measurements and the description of landform and vegetation.

The GTN-P sites, with their position in different permafrost zones in the DUE Permafrost case study regions, are highly suitable for the evaluation of DUE Permafrost remote sensing products. Air and surface temperatures with high-temporal resolution are available for three GTN-P sites in Siberia and compared to LST products. Daily average GTN-P borehole- and air temperature data for 22 sites in Alaska and 6 sites in Western Siberia were used to validate surface frozen and thawed state. The preliminary results are promising. In addition, landform and vegetation descriptions of circumpolar GTN-P sites are used for the evaluation of global 'landcover' remote-sensing datasets like GlobeCover, Landcover2000 and EcoClimap – global datasets used as input for climate modeling.