The Lena River Delta, Arctic Siberia: an Arctic Ground Data Observatory of the DUE Permafrost Remote Sensing Project

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1 INTRODUCTION

1.1 *ESA DUE Permafrost Remote Sensing Project*

The major task of the European Space Agency ESA Data User Element DUE projects is to develop Earth observation services for specific user communities. Since June 2009, ESA DUE PERMAFROST develops a wide range of remote sensing services and remote sensing products for permafrost monitoring and modelling of permafrost, fluxes and climate.

1.2 *Lena River Delta (Arctic Siberia)*

The Lena River Delta (about 29,000 km2) located at the Laptev Sea coast in North-Eastern Siberia is a prime area for ESA DUE PERMAFROST. Since 1998, the Alfred Wegener Institute for Polar and Marine Research in collaboration with the Lena Delta Reserve in Tiksi has operated a German- Russian research station on Samoylov Island (72° 22' N, 126° 28' E), in the central delta. Samoylov Island (appr. 1200 ha) is part of the young Holocene delta. The measurement stations, experimental plots and installed sensors are located on the main terrace that is characterised by a wet polygonal tundra landscape with mossy tundra and wet fen and flooded sedge communities. The Kurungnakh Ice Complex is an adjoining Pleistocene geomorphological and stratigraphical ice-rich unit portraying different tundra moisture regimes and plant community structures. Since summer 2008, various surface characteristics have been mapped with wide-area coverage.

1.3 *Diagnostic Ground Data*

On Samoylov Island, automatic climate stations are continuously logging relevant parameters (air temperature, radiation, snow, soil temperature and moisture). The high landscape heterogeneity (wet polygonal centres, dry polygonal rims, ponds and lakes) may challenge that field observations of surface, soil and permafrost can be directly used to evaluate remote sensing products. Automatic thermal infrared TIR camera measurements mounted on 10 m masts provide high resolution surface temperature data, which can be used for upscaling techniques (Langer et al., submitted).

A land surface classification is obtained through high spatial resolution spectral imaging (VIS, NIR) using unmanned platforms (Muster et al., 2009).

1.4 *Satellite Data Products*

Operational NASA and ESA spaceborne missions provide multiyear remote sensing data to process optical, thermal and microwave products, such as averaged 'surface temperature', 'surface moisture' products, maps of vegetation and surface waters. The ESA DUE PERMAFROST datasets will be provided with weekly to monthly resolution. High-spatial resolution data are used at selected local sites. Further information is available at: www.ipf.tuwien.ac.at/ permafrost

2 METHODS

Match-up data sets, i.e. field observations and satellite data coincident in time and location are being built up. Exclusion and selection criteria will be based on experience, especially the knowledge on parameter variability in time and space. This also will influence if point estimations or weighted averages, and a-priori logarithmic transformation are applied. Clustering and sub-setting of the match-up data will assess regional specific (e.g. vegetation and moisture dependent) and temporal specific (intra- and inter-annual) variations.

3 OUTLOOK.

We will identify systematic biases, conditions, for which the ESA DUE PERMAFROST products are invalid/valid, and provide an estimation of 'environmental' and 'thematical' accuracy to establish confidence in their utility.

References

Langer, M., Westermann, S., Boike, J., Spatial and temporal variations of summer surface temperatures of wet polygonal tundra in Siberia-implications for MODIS LST based permafrost monitoring, *subm. to Remote Sensing of Environment.*

Muster, S., Langer, M., Boike, J. 2009, Estimating seasonal changes of land cover, surface wetness and latent heat flux of wet polygonal tundra (Samoilov Island, Lena-Delta, Siberia) with high-resolution aerial and hyperspectral CHRIS Proba satellite imagery, AGU Fall Meeting 2009, San Francisco, USA, C51C-0491.