

Hyperspectral Arctic VEGEtation Indices

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The YAMAL2011-expedition of the teams from the Earth Cryosphere Institute Siberian Branch of Russian Academy of Sciences (ECI SB RAS), RU, and the Alfred Wegener Institute for Polar and Marine Research (AWI), DE, took place during the period from August to September 2011. This expedition was part of the AWI-project ‘hyperspectral Arctic VEGEtation Indices’ (hy-Arc-VEG), which is a component of the Environmental Mapping and Analysis Program (EnMAP), a German hyperspectral space mission with an expected launch date in 2015. Hy-Arc-VEG focuses on spectro-radiometrical field measurements of tundra landscapes to technically explore the potential of multispectral to hyperspectral satellite data for applications in the low-growing arctic tundra. Representative ground data need to come from well-described sites of a homogenous surface type. Since 2007, the NASA Yamal Land Cover/Land Use Change (NASA Yamal-LCLUC) team has established field sites in northwestern Siberia (Yamal Peninsula) to sample homogenous surface types that are representative for coarse-scale remote sensing applications. The ECI had established the Circumpolar Active Layer Monitoring (CALM) site at Vaskiny Dachi on the Yamal in the early 1990s. Vaskiny Dachi has been revisited every year for late-summer measurements of active layer depth and other system properties. The sites on the Yamal Peninsula represent a range of tundra landscapes with varying moisture regimes and vegetation structures.

For the Yamal2011-expedition, Yamal-LCLUC sites were revisited in August 2011: two at Laboravaya, southern Yamal, close to the Polar Ural Mountains, and three at Vaskiny Dachi, central Yamal, and along with the ECI CALM site at Vaskiny Dachi. New measurement plots were established along a 1.5 km transect (Tr11) crossing different permafrost regimes and vegetation communities.

With respect to spectro-radiometry, the main research goals of the Yamal2011 investigations are:

(i) remote sensing algorithms for spectral narrow-band and broad-band vegetation indices (VI): Normalized Differenced Vegetation Indices (NDVI), Leaf Area Index (LAI), fraction of Absorbed Photosynthetically Active Radiation (fAPAR). The results on NDVI-tundra,

fAPAR-tundra, LAI-tundra will be incorporated into the PAGE21 project (Changing permafrost in the Arctic and its global effects in the 21st century, www.page21.eu);

(ii) anisotropy studies on spectral reflectances using the in-house (AWI) developed portable field spectro-goniometer (EyeSight).

The spectro-radiometrical multi-zenith, multi-azimuth measurements simulate the viewing geometries of wide-angle looking satellite sensors such as AVHRR, MODIS, MERIS, or sensors with technical side-looking possibilities such as the EnMAP sensor.

The first results of the field measurements and the analyses of vegetation indices are presented and discussed.