

## Application of UAS in the analysis of the spatial distribution of active layer thickness in Palsa mounds

Mariana Verdonen (1), Paolo Tarolli (2), Pasi Korpelainen (1), Tiina Kolari (3), Teemu Tahvanainen (3), and Timo Kumpula (1)

(1) Department of Geographical and Historical Studies, University of Eastern Finland, Joensuu, Finland

(mariana.verdonen@uef.fi), (2) Department of Land, Environment, Agriculture and Forestry, University of Padova, Legnaro, Italy, (3) Department of Environmental and Biological Sciences, University of Eastern Finland, Joensuu, Finland

Palsas, peat-covered mounds with perennially frozen core, occur in the zone of discontinuous and sporadic permafrost, and are often the southernmost patches of permafrost in the Northern Hemisphere. Previous studies have reported degradation of palsas due to warming climate and increasing precipitation. However, the degree of changes seems to vary largely, mainly due to different microclimatic conditions, vegetation cover as well as their shape and height above surrounding peatland surface. In this study, we applied Unmanned Aerial System (UAS) to better understand the effects of different variables on current and future state of these permafrost features. UASs were used to collect ultra-high resolution optical data (RGB and NIR) alongside the field observations, such as active layer thickness (ALT) measurements and vegetation plots in July 2018 from three peatlands in Finnish Lapland at different altitudes: 1) Nierivuoma ( $68^{\circ}48'N$ ,  $22^{\circ}15'E$ ; 440 m a.s.l.), 2) Rommaeno ( $69^{\circ}01'N$ ,  $21^{\circ}34'E$ ; 550 m a.s.l.) and 3) Balsaláhku ( $68^{\circ}56'N$ ,  $21^{\circ}35'E$ ; 730 m a.s.l.).

The orthomosaics, and Digital Elevation Models (DEM), derived by photogrammetric technique at 0.03 – 0.05 m grid cell resolution improve notably our ability to delineate palsa mounds from the surrounding peatland surface and explore their attributes, in comparison to previously available aerial imagery (1960 – 2012) and 2 m resolution DEM from Airborne Laser Scanning (2016). Combining these datasets with UAS data and field measurements provided a new approach for mapping of the palsas, and estimating the ALT at palsa peatlands not covered by field investigations.