GC41C-0819: High resolution monitoring of lake object structure changes in arctic permafrost regions

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- The natural ecosystem of arctic permafrost regions underlies changes caused by climate driven variations in freeze/thaw processes. As a result in many locations degradation of permafrost could have been observed during the last decades, which leads to the transformation of existing landforms like changes in terrain (thermokarst effects), hydrology and vegetation. In order to quantify the variance of thermokarst water bodies, historical and recent high spatial resolution optical remote sensing data are utilized to identify fine scaled changes according to their size, density, extent and distribution. This study presents an object oriented monitoring strategy for lake object structure changes using multi-temporal remote sensing imagery as part of ESAs Data User Element (DUE) Permafrost. Spatial growth and shifting effects of thermokarst lakes are quantified by classifying satellite imagery of the photo-reconnaissance satellite systems of the “Key Hole”- series (e. g. Corona) from the 1960s and recently recorded RapidEye data. Four different test sites located in the far east of Russia (Yakutsk and Lena river delta) and North America (North Slope/Alaska and Beaufort Sea Region/Canada) are analyzed. The co-registration of the CORONA and Rapideye imagery is done by the LCPC (Lake Center Point Correction), which guarantees a high geometric fit of the derived lake objects. Specific lake object characteristics such as object shape, area, elliptical fit, direction and density are extracted in order to generate a structural water body change product. The synergetic analysis of the data provides statements about spatio-temporal lake transformation within this time period. The presented methodological approach provides a robust and transferable concept for large scale change mapping and is important to quantify changes under potential permafrost degradation conditions.