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# MULTI-TEMPORAL MONITORING OF THERMOKARST IN THE HIGH ARCTIC

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**ABSTRACT:**
The predicted significant increase in air temperatures in high latitudes over the coming century puts a high pressure on vulnerable permafrost landscapes that dominate large parts of the Arctic. Small changes in the climatic pattern may already result in a potentially large scale permafrost thaw and consequently the mobilization of previously frozen soil organic matter. The release of this carbon as methane and carbon dioxide, both active greenhouse gases, would result in a positive feedback loop with climate warming ("permafrost carbon feedback"). The observation of permafrost landscape dynamics is therefore crucial for the estimation and prediction of the associated carbon fluxes.
Within the framework of the ERC funded PETA-CARB project (Rapid Permafrost Thaw in a Warming Arctic and Impacts on the Soil Organic Carbon Pool) different study areas in Northern Siberia and Alaska are analyzed with remote sensing techniques towards their landscape dynamics. Thermokarst processes, such as surface subsidence in conjunction with changes in surface wetness, thaw lake formation and expansion, as well as lake drainage are monitored on different spatial- and temporal scales). Intra-annual time-series of Landsat and RapidEye data are analyzed to understand seasonal short-term dynamics. Furthermore, inter-annual, as well as inter-decadal remote sensing observations serve as the main source for the detection of long-term landscape dynamics. As changes occur in different patterns and temporal scales, e.g. through gradual thaw or sudden lake drainage, state-of the art image time-series analysis and change detection algorithms are tested for their suitability in polar landscapes. The goal is to derive temporally variable spectral signatures from temporally dense image stacks that can be associated with specific landscape change processes.
Our regional observations provide a basis for an automated pan-arctic monitoring for an improved quantification of thaw processes. In conjunction with soil-sampling data and in-situ observations of permafrost degradation, these remote sensing studies will provide improved information for process-based modeling of the carbon dynamics in Arctic permafrost areas.

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