Conceptualization of Intermediate- to Large-scale Parameter Estimation of Landscape Transitions Using Proper Orthogonal Decomposition Techniques

W. Robert Bolton[1] , Vladimir Romanovsky[2], and Mark Lara[3]

[1] *International Arctic Research Center, University of Alaska Fairbanks, Fairbanks, Alaska, USA*
[2] *Geophysical Institute, University of Alaska Fairbanks, Fairbanks, Alaska, USA*
[3] *Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska, USA*
E-mail address of corresponding author: bbolton@iarc.uaf.edu

Thermokarst topography forms whenever ice-rich permafrost thaws and the ground subsides due to the volume loss when excess ground ice transitions to water. Changes in the landscape due to thermokarst subsidence, even on the order of a few centimeters, can result in profound changes to the drainage dynamics with subsequent shifts to both energy and carbon fluxes. The Alaska Thermokarst Model (ATM) is a meso-scale, state-and-transition model designed to simulate landscape transitions between [non-]thermokarst landscape units, or cohorts. The ATM uses a frame-based methodology to track transitions and proportion of cohorts within a 1-km^2 grid cell. The transition from one cohort to another due to thermokarst processes can take place if thaw reaches ice-rich ground layers either due to pulse disturbance events such as a large precipitation event or fires or due to gradual active layer deepening that eventually results in penetration of the protective layer. The protective layer buffers the ice-rich soils from the land surface and is critical to determine how susceptible an area is to thermokarst degradation. The frame-based methodology of tracking transitions between landscape units is conceptually consistent with the watershed delineation approach being developed the ALM (ACME Land Model). In the NGEE-Arctic Phase 2 study, we will utilize and apply the recent NGEE-Arctic POD-MM (Pau et. al. 2014; 2015) and POD-GPR (Lui et. al. 2015) approaches to translate the intermediate-resolution modeling results into functional responses applicable for integration into CLM. In the presentation, we present a conceptualization of this upscaling approach that will be implemented in NGEE-Arctic Phase 2.