NAME: Scott Painter
ORGANIZATION: NGEE
PROGRAM AFFILIATION: TES
ABSTRACT TITLE: Overview of NGEE Arctic Fine- and Intermediate-Scale Model Development

ABSTRACT: NGEE-Arctic is developing a process-rich hierarchical modeling framework to better estimate carbon releases from warming Arctic tundra. The scaling framework includes a climate-scale model and intermediate- and fine-scale models. An overview of the processes represented in the fine- and intermediate-scale models will be presented. Both models will represent non-isothermal surface and subsurface flows accounting for phase change using newly developed constitutive relations. Surface energy balance processes and carbon dynamics will also be represented. The fine-scale model will resolve microtopography at the scale of tens of centimeters horizontally with domain sizes of 100 m by 100 m. The computationally meshes for the fine-scale model will be derived from triangular surface meshes that track surface elevation and honor boundaries of individual ice-wedge polygons. These surface meshes are then extruded in the vertical direction to form prismatic elements. The intermediate-scale model is based on three grid cells per ice-wedge polygon, representing center, rim, and half-trough. The intermediate scale model uses the PFLOTRAN code and will use domains of size 10 km by 10 km in the horizontal. Development of the fine-scale model is proceeding on two tracks. Track 1 uses a static microtopography and the PFLOTRAN (Lichtner et al 2013) code. Track 2 will account for dynamic topography induced by ice-wedge thawing. Track 2 will use either PFLOTRAN or the Amanzi-ATS code (Coon et al. 2012).

Lichtner, P.C., Hammond, G.E., Bisht, G., Karra, S., Mills, R.T., and Kumar, J. (2013) PFLOTRAN User's Manual: A Massively Parallel Reactive Flow Code.

ET Coon, M Berndt, R Garimella, JD Moulton, and S Painter. A flexible and extensible multi-process simulation capability for the terrestrial Arctic. Frontiers in Computational Physics: Modeling the Earth System. Boulder, Co. Dec 2012.