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# Flow and Transport Characteristics of Ice-wedge Polygons

Nathan Wales[1*], Brent Newman[1], Jesus Gomez-Valez[2], Cathy Wilson[1], Daniil Svyatsky[1], Julie Jastrow[3], and Stan Wullschleger[4]

[1]Los Alamos National Laboratory, Los Alamos, NM
[2]New Mexico Institute of Mining and Technology, Socorro, NM
[3]Argonne National Laboratory, Argonne, IL
[4]Enivironmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN

Contact: bnewman@lanl.gov

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In an effort to better understand flow and transport processes in ice-wedge polygons and provide data to inform permafrost models, such as the Arctic Terrestrial Simulator (ATS), tracer studies were conducted on a low- and high-centered polygon in the Barrow Environmental Observatory (BEO). With this experiment we found that tracer breakthrough was highly heterogeneous in both polygons. Horizontal flux occurred in more locations and at higher rates in the low-centered polygon than in the high-centered polygon. Hydraulic connectivity was shown to exist between polygon centers and troughs. Results also suggest that most of the tracer mass still remains in polygon centers. In its current state, the ATS does not represent heterogeneous horizontal transport of tracer as observed in the field experiment. While time series sampling for the field experiment has concluded, results of the experiment have given rise to new questions. Moving into NGEE Arctic Phase 3, key factors have been identified for further investigation. We plan to investigate the influence of active layer heterogeneity on tracer transport. For example, we speculate that ice lenses play a role in heterogeneity of tracer transport and the higher occurrence of tracer breakthrough observed in the low-centered polygon. Soil properties also likely influence tracer distribution. Understanding soil structure, stratigraphy, and cryoturbation could potentially provide insight into the existence of preferential flow paths or systems of secondary porosity and their influence on tracer transport. Finally, an estimate of tracer mass remaining in polygon centers is needed to better understand the residence time of tracer in polygon systems. To answer these questions, we are considering a several paths forward including: 1) initializing ATS simulations with soil cross-section data derived from J. Jastrow's soil pits on the BEO, 2) end of winter coring of the tracer polygons and 3) trenching both tracer polygons. Simulations with better representation of cryoturbation features would help us diagnose the role of soil heterogeneity in our observations, and cores and trenches would provide site specific data to close our tracer mass balance for the experiments. Current tracer results are being used to make improvements to the ATS model and Phase 3 investigations will also serve to improve ATS representation of flow and transport in ice-wedge polygons.