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Climate Change, Water Tracks, and Soil Piping: Two Case Studies from Sub-Arctic Alaska

Debasmita Misra*, Uyanga Mendbayar, Jonathan Gates and **Kate Clancy**
University of Alaska Fairbanks, USA

When constrained by subsurface boundaries such as permafrost, clay, or bedrock, drainage water flows through the soil, channelizing into features known as "water tracks". Water tracks indicate an immature hydrological network and are widely found in the Arctic and Sub-Arctic due to the prevalence of permafrost. Despite their abundance, there is a lack of understanding of water track characteristics and their interplay with the surrounding bio-geophysical environment. In addition, water track impacts on the northern landscapes due to the warming climate makes it critical to study. An observed impact is *increased subsidence* with the progress of water track. Another major cause of soil subsidence in the Arctic is soil piping. Soil piping could be induced due to geology, slope, soil texture, hydraulic and thermal properties, and frost. The interaction of water tracks with soil pipes have caused significant subsidence in Martins' property near Fairbanks, Alaska. These subsidence patterns have progressed steadily and rapidly to threaten the foundation of their house. Hence, the first objective of our study is to examine and characterize the interplay between soil pipes and water tracks to assess the factors that are responsible for soil subsidence. We have collected soil temperature, moisture, and intrinsic permeability data along and across a prominent water track and a few soil pipes in Martins' property. We have used thermal infrared images over a period of time to study the changes in thermal regime of the water track and the soil pipes. We have mapped the geology of the area using well logs to assess the role of geology and slope. Our second objective is to develop a method to map existing water tracks on Goldstream Road near Fairbanks to investigate whether it intensifies the road damage when the flow in water tracks is blocked by the road foundation. Goldstream Road is known to have extensive and recurring damage, some of which are likely amplified by water track interceptions. Mendbayar et al. (2016) have observed water tracks intercepting the road and have collected soil temperature and hydraulic data at one water track crosscut by Goldstream Road. Geophysical data along the road have been procured in 2012 and 2016 by state agencies. However, no method is existent in mapping such narrow water tracks in densely vegetated areas. We used a DEM from a high-resolution aerial photograph to correlate it with the geophysical and hydraulic data. We mapped vegetation index around Goldstream Road using high-resolution satellite imagery to identify water tracks that influenced moisture availability to plants. *Climate change may have induced* *both of these scenarios* but the two case studies are still in progress, and we will present the progress and conclusions drawn from our study thus far.

Biography:

Debasmita (Debu) Misra was born in the state of Odisha in India. He completed his B. Tech. in Agricultural Engineering in 1984 from India and M. Eng. in Water Resources Engineering in 1986 from the Asian Institute of Technology (AIT). After a year of graduate studies in Engineering Hydrology at the University College Galway, Ireland, he joined Ph.D. at the University of Minnesota in 1988 in the field of Biosystems and Agricultural Engineering, which he completed in 1994. He is currently a Professor of Geological Engineering at UAF. He teaches undergraduate courses in subsurface hydrology, remote sensing for engineering, senior design and graduate courses in unsaturated or saturated groundwater flow and contaminant transport in subsurface. His research is focused on non-isothermal fluid dynamics in soils and its impact on transport processes.