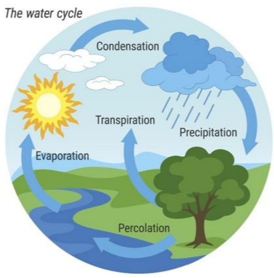
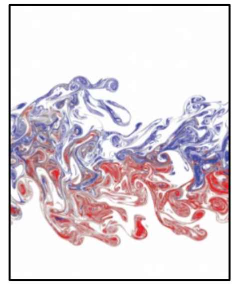
Boase Seminar Series in Hydrology and Water Resources Engineering

Department of Civil, Environmental and Architectural Engineering





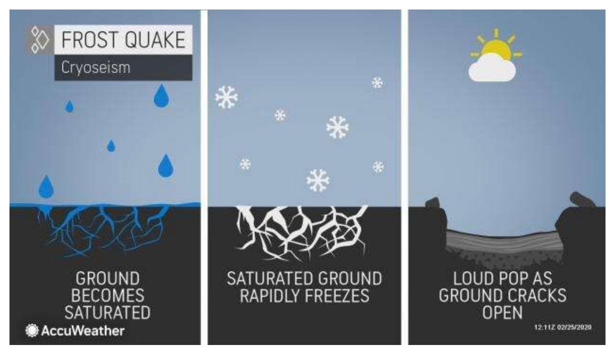
Frost Quakes: Crack Formation by Thermal Stress

Prof. Roseanna Neupauer
Department of Civil, Environmental and Architectural Engineering &
University of Colorado, Boulder, CO

Wednesday, November 30, 2022 | 11:15 AM | ECCE 1B41 &
Zoom: https://cuboulder.zoom.us/j/95668504496
(passcode: water)

Abstract:

Fractures in frozen soils (frost quakes) can cause damage to buildings and other infrastructure, but their formation mechanisms remain poorly understood. A methodology was developed to assess thermal stress on soil due to changes in climate and weather conditions and to investigate the connection between thermal stress and frost quakes in central Finland due to brittle fracturing in uppermost soils. A hydrological model was used to simulate snow accumulation and melt, and a soil temperature model was used to simulate soil temperature at different depths beneath the snow pack. The results of modeling, together with measurements of air temperature, snow cover thickness, and soil temperature, were used to calculate temporal variations in thermal stress in soil. We show that frost quakes occur when thermal stress caused by a rapid decrease in temperature exceeds fracture toughness and strength of the soil-ice mixture. We compared calculated thermal stress on soil, critical stress intensity factor, and a seismogram recorded in a suburban region in central Finland. Our results suggest that this methodology can be used to predict thermal stresses on soil and identify stress values that may lead to fractures of frozen soils, that is, frost quakes.



Speaker Bios: Prof. Neupauer's research involves modeling investigations of the behavior of water flow and chemical transport in natural systems (e.g., groundwater aquifers) and engineered systems (e.g., groundwater remediation systems). On-going projects include evaluation of methods to improve in situ remediation of contaminated groundwater, investigation of chaotic advection in natural groundwater systems, protection of ecological resources from heat transport in subsurface environments, investigation of stream depletion due to aquifer pumping, and behavior subsurface water in frozen and near-frozen environments.

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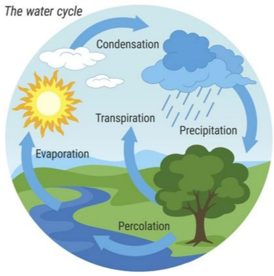

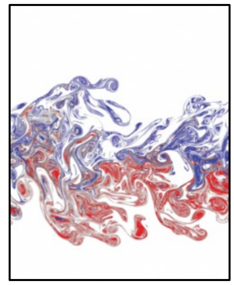

Climate change impacts on Alaskan river discharge, temperature, and ice

Mr. Dylan Blaskey

Ph.D Candidate

Department of Civil, Environmental and Architectural Engineering

&

INSTAAR

University of Colorado, Boulder, CO

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Abstract:

Arctic hydrology is experiencing rapid changes including earlier snow melt, degradation of permafrost, increased active layer depth, altered river flow, and reduced river ice. Climate change will continue to alter the hydrology of the region. Rivers integrate all these dynamic hydrologic variables, so they provide an aggregate measure of changing conditions. Recently, long-term (>60 years) climate reanalysis and streamflow observation data became available. We utilized these data to determine the extent of changes in streamflow occurring in Alaska. However, river temperature observations are rare in Alaska with limited spatial coverage. Therefore, we created a high-resolution river discharge and temperature dataset from 1990 to 2020 of rivers in Alaska and the Canadian Yukon River Basin. The changes already present in the observed and modeled records have substantially impacted ecosystems, wildlife, and humans that are dependent on these rivers.

Speaker Bios: Dylan is a third year doctoral student in CEAE and a research assistant with the Institute of Arctic and Alpine Research (INSTAAR). His research focuses on the nexus of large scale computational hydrology and risk to under-served communities, with specific interest in how climate change will affect river systems and Indigenous communities in the Arctic. Previously he has researched green infrastructure, coastal restoration, and nearshore hydrodynamics.