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The dissolved organic carbon export in a cold alpine catchment, the Qinghai-Tibet Plateau

YALU HU

China University of Geosciences

Presenting Author: yaluhu@cug.edu.cn

The dissolved organic carbon (DOC) export in the permafrost area due to permafrost degradation has been widely reported. However, the DOC export in the cold alpine area remains uncertain, and it is not clear how the complex hydrological processes from the permafrost area to the seasonally frozen area would alter the DOC export on a catchment scale. We focused on a small catchment located in the northeast Qinghai-Tibet Plateau and investigated the DOC characteristics in the stream water and groundwater from the recharge area to the discharge area in 2013-2016 and carried out daily sampling work for a hydrologic year at the catchment outlet in 2018-2019. We also investigate the characteristics of microbial communities in groundwater and soils to reveal the influence of the microbial process on DOM features. Results show that the freeze–thaw process significantly influenced the groundwater flow paths and DOC features. During the thawing period, with a shallow groundwater flow path through the organic soil layer, the stream water was characterized by high aromaticity and high DOC concentrations. During the thawed period, the deepening groundwater flow path through the mineral layer and dilution by overland flow, resulted in low DOC concentrations and DOC with lower aromaticity in stream water. Our work also highlights the role of the thick, porous aquifer in the seasonally frozen area in regulating DOC export, which leads to lower peak DOC concentrations, higher proportions of protein-like DOM, and a higher percentage of annual DOC flux exported in frozen seasons than DOC exported from the permafrost area [1]. The organic matter-degrading functional microorganisms play an important role in the groundwater system in the catchment, which may lead to the increasing proportion of microbial-origin DOM in groundwater from the permafrost area to the seasonal permafrost zone. These differences may bring about a stronger positive feedback to climate warming in the cold alpine area than that in pan-Arctic areas.

[1] Hu *et al.* (2023) *WRR*, e2022WR032426.