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The SPLASH Action Group – Towards standardized sampling strategies along the soil-to-hydrosystems continuum in permafrost landscapes

Julien Fouche¹, Sarah Shakil², Catherine Hirst³, Lisa Bröder⁴, Yannick Agnan³, Ylva Sjöberg⁵, and Frédéric Bouchard^{6,7}

¹LISAH, Univ Montpellier, INRAE, IRD, Institut Agro, Montpellier, France

²Department of Biological Sciences, University of Alberta, Edmonton, Alberta T6G 2E3, Canada

³Earth and Life Institute, Université catholique de Louvain, Louvain-la-Neuve, Belgium

⁴Department of Earth Sciences, Swiss Federal Institute of Technology, Zürich, Switzerland

⁵Department of Geosciences and Natural Resource Management, CENPERM, University of Copenhagen, Copenhagen, Denmark

⁶Géosciences Paris-Saclay (GEOPS), Université Paris-Saclay, Orsay, France

⁷Centre d'études nordiques (CEN), Université Laval, Québec, Canada

The Action Group called 'Standardized methods across Permafrost Landscapes: from Arctic Soils to Hydrosystems' (SPLASH), funded by the International Permafrost Association, is a community-driven effort aiming to provide a suite of standardized field strategies for sampling mineral and organic components in soils, sediments, surface water bodies and coastal environments across permafrost landscapes. This unified approach will allow data to be shared and compared, thus improving our understanding of the processes occurring during lateral transport in circumpolar Arctic watersheds. This is an international and transdisciplinary effort aiming to provide a fieldwork "tool box" of the most relevant sampling schemes and sample conservation procedures for mineral and organic permafrost pools.

With climate change, permafrost soils are undergoing drastic transformations. Both localized abrupt thaw (thermokarst) and gradual ecosystem shifts (e.g., active layer thickening, vegetation changes) drive changes in hydrology and biogeochemical cycles (carbon, nutrients, and contaminants). Mineral and organic components interact along the "lateral continuum" (i.e., from soils to aquatic systems) changing their composition and reactivity across the different interfaces. The circumpolar Arctic region is characterized by high spatial heterogeneity (e.g., geology, topography, vegetation, and ground-ice content) and large inter-annual and seasonal variations in local climate and biophysical processes. Common sampling strategies, applied in different seasons and locations, could help to tackle the spatial and temporal complexity inextricably linked to biogeochemical processes. This unified approach developed in permafrost landscapes will allow us to overcome the following challenges: (1) identifying interfaces where detectable changes in mineral and organic components occur; (2) allowing spatial comparison of these detectable changes; and (3) capturing temporal (inter-/intra-annual) variations at these interfaces. In order to

build on the great effort to better assess the permafrost feedback to climate change, there is an urgent need for a set of community-based protocols to capture changes the dynamics of organics and minerals during their lateral transport.

Here, we present the first results from an online survey recently conducted among researchers from different disciplines. The survey inputs provide valuable information about the common approaches currently applied along the "soil-to-hydrosystems" continuum and the specific challenges associated with permafrost studies. These results about the 'WHAT, WHERE, WHEN, and HOW' of field sampling (e.g., sample collection, filtration, conservation...) allow for identifying the most relevant sampling strategies and also the current knowledge gaps. Finally, we present examples of the protocols available to investigate organic and mineral components from soils to marine environments, on which a synoptic sampling strategy can be built. All forthcoming contributions from our community are still welcome, helping the SPLASH team to fill up the most adapted tool box to Arctic permafrost landscapes.