

## Runoff Processes in Alpine Catchments: Challenges and Opportunities

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Runoff hydrology has a rich history of research on the mechanisms and pathways of how water is transferred from the catchment to the stream network. This work is primarily derived from observations in humid temperate mid-latitude watersheds with moderately sloping terrain and well-developed soil profiles. Runoff generation processes such as variable source area, transmissivity feedback, and fill-and-spill now dominate the literature and guide our model development. Unfortunately, runoff processes investigations in alpine catchments, particularly those dominated by glaciers, snow and frozen ground, are particularly scarce and it is unclear how concepts from more temperate latitudes apply. In this presentation, I will review the current paradigms of streamflow generation in alpine regions, highlighting the importance of surface-groundwater interactions, frozen soils, permafrost and other distinct alpine features. Data from several alpine watersheds will demonstrate the importance of the coupled energy and water cycles, and emphasise the how our understanding is advanced through multiple methodological approaches (e.g. hydrometric, hydrochemical, geophysical, modelling) to refine our understanding of the timing, rates and pathways of runoff in this logistically challenging environment. Future opportunities and research directions will also be highlighted.