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Assessment of snow-dominated water resources: (Ir-)relevant scales for observation and modelling

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High Alpine catchments play an essential role for many world regions since they 1) provide water resources to low lying and often relatively dry regions, 2) are important for hydropower production as a result of their high hydraulic heads, 3) offer relatively undisturbed habitat for fauna and flora and 4) provide a source of cold water often late into the summer season (due to snowmelt), which is essential for many downstream river ecosystems. However, the water balance of such high Alpine hydrological systems is often difficult to accurately estimate, in part because of seasonal to interannual accumulation of precipitation in the form of snow and ice and by relatively low but highly seasonal evapotranspiration rates. These processes are strongly driven by the topography and related vegetation patterns, by air temperature gradients, solar radiation and wind patterns. Based on selected examples, we will discuss how the spatial scale of these patterns dictates at which scales we can make reliable water balance assessments.

Overall, this contribution will provide an overview of some of the key open questions in terms of observing and modelling the dominant hydrological processes in Alpine areas at the right scale. A particular focus will be on the observation and modelling of snow accumulation and melt processes, discussing in particular the usefulness of simple models versus fully physical models at different spatial scales and the role of observed data.