

## **Retreating snowpacks under climate change: implications for water resources management in the Austrian Alps**

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**Abstract** This paper presents three different hydrological regimes (two mountainous and one lowland) within the Danube River basin. Their importance for Integrated Water Resources Management (IWRM) within the river basin is discussed. One of these hydrological regimes – a non-glacierised mid mountain region in the Austrian Alps – is selected as a case study in order to assess the impact of climate change on both IWRM in the alpine region and the lowlands of the Danube River basin. The disproportionate hydrological influence of the Alps is demonstrated for the Danube River basin, especially during summer, late spring and early autumn. The climate normal period from 1961 to 1990 is chosen as the baseline. As future climate change scenarios, 2°C and 4°C warming with seasonal precipitation changes – as predicted for the middle and the end, respectively, of the 21st century – are chosen. The climate change scenarios show a substantial decrease in snow cover duration and snow accumulation within the case study area. The impact of this loss in the natural storage reservoir on the IWRM in both the alpine region (case study) and the lowlands of the Danube River basin is discussed. Generally, a shift in flow seasonality is observed. Total and base flow increase in winter, and decrease from spring to autumn. Regional water availability within the alpine case study, however, is sufficient to provide all demand holders throughout the whole year. However, this shift in alpine water hydrology has a strong effect on water availability in the downstream Danube River. The Alps will not provide the same amount of water to the lowlands during the critical seasons of late spring, summer and autumn.

**Key words** climate change; snowpack; mountain hydrology; IWRM; Alps; Austria