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The hydrological significance of mountains: from regional to global scale

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Abstract. Mountain regions supply a large share of the world's population with fresh water. Quantification of the hydrological significance of mountains, however, is subject to great uncertainty. Instead of focusing on global averages in advance, the present analysis follows a catchment-based approach using discharge data provided by the Global Runoff Data Centre (GRDC). The River Rhine originating in the European Alps is chosen as a first study area, revealing the hydrological relationship between mountainous and lowland regions in a well-documented area. Following the findings from this analysis, different aspects of runoff characteristics for a total of 22 case-study river basins world-wide have been investigated and compared, for a global view. The view has been extended through aspects of climate and human use of mountain runoff. The particular hydrological characteristics of mountain areas are characterised by disproportionately large discharges. In humid areas, mountains supply up to 20–50% of total discharge while in arid areas, mountains contribute from 50–90% of total discharge, with extremes of over 95%. The overall assessment of the hydrological significance of mountain areas reveals that the world's major "water towers" are found in arid or semi-arid zones where they provide essential fresh water for a significant proportion of a quickly growing global population.

Keywords: mountain hydrology, global comparative assessment, runoff, water resources, sustainability, Rhine River, European Alps

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