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Characterizing contributions of glacier melt and groundwater during the dry season in a poorly gauged catchment of the Cordillera Blanca (Peru)

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Abstract. The retreat of glaciers in the tropics will have a significant impact on water resources. In order to overcome limitations with discontinuous to nonexistent hydrologic measurements in remote mountain watersheds, a hydrochemical and isotopic mass balance model is used to identify and characterize dry season water origins at the glacier fed Querococha basin located in southern Cordillera Blanca, Peru. Dry season water samples, collected intermittently between 1998 and 2007, were analyzed for major ions and the stable isotopes of water ($\delta^{18}\text{O}$ and $\delta^2\text{H}$). The hydrochemical and isotopic data are analysed using conservative characteristics of selected tracers and relative contributions are calculated based on pre-identified contributing sources at mixing points sampled across the basin. The results show that during the dry-season, groundwater is the largest contributor to basin outflow and that the flux of groundwater is temporally variable. The groundwater contribution significantly correlates (P -value=0.004 to 0.044) to the antecedent precipitation regime at 3 and 18–36 months. Assuming this indicates a maximum of 4 years of precipitation accumulation in groundwater reserves, the Querococha watershed outflows are potentially vulnerable to multi-year droughts and climate related changes in the precipitation regime. The results show that the use of hydrochemical and isotopic data can contribute to hydrologic studies in remote, data poor regions, and that groundwater contribution to tropical proglacial hydrologic systems is a critical component of dry season discharge.

Full Article in PDF (PDF, 852 KB)

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