Submitted Abstract

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Abstract

Peru has been ranked as one of the top 10 most water abundant places in the world for freshwater resources; however this masks the acute spatial (mountain – coast) and temporal (dry – wet season) disparity in water supply. Seasonal water storage and release dynamics of glacial and non-glacial stores in the tropical high Andes modify the water availability to the more densely populated lowlands where demand for water is higher. In parts of the high-Andes, meltwater from glacierized headwaters provides an important additional source of supply throughout the dry season. The mosaic of water stores in these catchments requires investigation in terms of space-time dynamics, and especially in relation to the high-altitude wetlands known locally as 'bofedales', which may be significant sites of surface water – groundwater exchange.

For generations local people have made use of the pastures provided by these wetlands, adapting to pressures on supply and demand through livestock rotation and modifications to the drainage network. Maintaining and extending wetlands has been an effective 'nature-based solution' for water security at the local scale, but the potential benefits of replication at the regional scale are not well understood, in part because the water source dynamics are poorly known. Whether local communities are able to adapt to shrinking glacial contributions and changing precipitation patterns under climate change will also depend on the contributions of these inputs to wetlands.

Whilst remote sensing-based studies have postulated an association between peak glacial melt and downstream wetland extent, field-based studies downstream of glacierized catchments have suggested minimal connectivity between melt-dominated streams and nearby wetlands. However, in the headwaters, exchanges between glacial melt streams, deeper groundwater stores, and wetlands may be an important mechanism of connectivity.

To understand the processes by which glaciers influence the hydrological behaviour of high-altitude wetlands, we take a nested catchment approach at the subcatchment, catchment and basin scale, comparing wetlands at different positions in the landscape and with differing glacial contributions. We present the initial results from campaign sampling of stable isotopes, geophysical mapping of the subsurface, and low-cost water level sensors in order to address the following question:

How does the contribution of glacial melt to wetland water and streamflow vary at different positions in the landscape, and what does this tell us about the optimal locations for storing water?