

Interannual variability in glacier contribution to runoff from a high-elevation Andean catchment: understanding the role of debris cover in glacier hydrology

Burger, Flavia

Ayala, Alvaro

Farias, David

Shaw, Thomas E.

MacDonell, Shelley

Brock, Ben

McPhee, James

Pellicciotti, Francesca

© 2018 The Authors. Hydrological Processes published by John Wiley & Sons Ltd. We present a field-data rich modelling analysis to reconstruct the climatic forcing, glacier response, and runoff generation from a high-elevation catchment in central Chile over the period 2000–2015 to provide insights into the differing contributions of debris-covered and debris-free glaciers under current and future changing climatic conditions. Model simulations with the physically based glacio-hydrological model TOPKAPI-ETH reveal a period of neutral or slightly positive mass balance between 2000 and 2010, followed by a transition to increasingly large annual mass losses, associated with a recent mega drought. Mass losses commence earlier, and are more severe, for a heavily debris-covered glacier, most likely due to its strong dependence on snow avalanche accumulation, which has declined in recent years. Catchment runoff shows a marked decreasing trend over the study period, but with high interannual va