Isotopic assessment of groundwater patterns in Challapampa aquifer, Bolivia
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In the Bolivian semiarid highlands, groundwater has become the most important and safe source of water for consumption when rivers and lakes have been reduced due to the effects of climate change. In the Challapampa aquifer, used to supply Oruro city, decades of exploitation combined with the limited information available, represent a challenge for the groundwater management. This study analyses isotopic compositions in different hydrologic cycle stages to assess flow patterns in this aquifer and therefore elucidate processes poorly known in the reservoir. Data records of stable isotopes, tritium, radiocarbon and electrical conductivity, are more abundant in the area of the alluvial fan of River Paria, where a production well-field is located. Previous studies applying stable isotopes have been used in several climate and paleoclimate investigations in the region. However, the scarcity of data, gaps in series and lack of consistent sampling methods are common problems reducing accuracy of the results. This study includes that information and new data collected during 2014 and 2015 to propose a conceptual circulation model. This study estimates about 80 % of the annual precipitation over the region, falling during the summer from December to March, is comprised of the most depleted stable isotopic values. This fingerprint is similar to the majority of the groundwater samples collected in wells. The linear tendency of the isotopic compositions in groundwater, below that in the Global Meteorological Water Line, exposes the effect of evaporation in shallow and intermediate circulation systems. Modern precipitation is the most important recharge source until about 100 m below surface. Conversely, deeper levels seem to be recharged by different processes, possibly at higher altitudes or ancient times. A circulation model comprised of four systems with distinctive characteristics is proposed in the alluvial fan area.