Groundwater $\delta^{18}O$ record of paleorecharge and climate for the last 35ka in south-west Western Australia

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The isotopic composition of groundwater can be a useful indicator of rainfall isotope compositions and help to determine the drivers and impacts of rainfall and climate change. Additionally, as most large groundwater basins can contain 'old' groundwater where extraction exceeds groundwater recharge, knowledge of the past conditions and timing under which groundwater was recharged is needed to sustainably manage groundwater resources. Applying isotopic tools to groundwater contained in regional aquifer systems can provide low-resolution information on recharge intensity, recharge source and past climatic conditions for the region. Furthermore, an understanding of how groundwater recharge and climate have been connected in the past can be used to inform climate adaptation strategies for sustaining groundwater resources during climate change.

Groundwater from south-west Western Australia located at the northernmost extent of the westerly wind belt can help constrain the drivers and impacts of rainfall and climate change in this region. Large regional groundwater systems contained within the Perth Basin in south-west Western Australia were used in this study to provide information on groundwater recharge and climate over the past 35,000 years. This dataset containing groundwater ages ($^{14}C_{DIC}$) and stable isotopes of water ($\delta^{18}O$ and $\delta^{2}H$) from two regional groundwater systems within the Perth Basin provides a unique opportunity to produce a low-resolution palaeo-archive of groundwater recharge, and hence interpret rainfall and climate change, for south-west Western Australia. The trends in stable isotopes of water over time in the regional groundwater data are consistent with the groundwater flow line data supporting our hypothesis that groundwater stable isotopes are a proxy for palaeo-recharge. The Southern Perth Basin groundwater isotope record is interpreted to be a low resolution archive of recharge driven by changes in the relative intensity of past rainfall, moisture source from changes in the position of the westerlies and recharge thresholds. This long-term stable isotopic recharge record provides a greater understanding of groundwater palaeo-recharge, and the connection between recharge and climate in the past.