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The effect of saline groundwater exchange, evaporation and variable river flows and on stable isotopes (^{18}O and ^{2}H) and major ion concentrations along the Darling River, NSW, Australia

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Australia's longest river, the Darling River, faces extreme pressure from drought and over extraction of water from its catchment. The lack of detailed baseline hydrochemical and isotopic data for the Darling River has prompted research aimed at using hydrological tracers to assess water gains and losses within the Darling River Drainage Basin.
This study uses temporal hydrochemical and stable isotope data (^{18}O and ^{2}H) that has been monitored from gauging stations along the Barwon-Darling catchment over a five-year period from 2002 to 2007 as part of the Global Network for Isotopes in Rivers (GNIR) monitoring programme. Stream flow data, monthly δ^{18}O and δ^{2}H values and major ion chemistry is presented.

Individual flow events were found to be isotopically distinct but the LELs that develop after these events have a very similar slope indicating similar climatic conditions across this region. During low flow conditions, salt concentrations increase systematically, δ^{18}O and δ^{2}H become enriched and d-excess becomes more negative indicating significant evaporation. Flow events input isotopically depleted fresh waters to the system and the d-excess returns towards the local meteoric water line. The major ions increase in concentration at a greater rate at Louth than they do at upstream at Bourke or downstream at Wilcannia, despite similar decreases in flow rates for all three sites. The hydrological response of the river to drought has had detrimental affects on the surface water system because it provides a pathway for saline groundwater to discharge into the river system.