Using a Combined Hydrodynamic and Mixing Model Approach to Quantify Small Saline Groundwater Inputs into Rivers

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The flow of groundwater into a stream is difficult to quantify. Several techniques exist, however they all have limitations with both practicality and accuracy difficult to achieve. This study develops a method that is accurate, within the limits of input data, and practical for use in areas where groundwater inputs have a detectable level of some tracer (in this case salt). The study is undertaken on the Darling River in north-western NSW. At a single location along the river, highly saline groundwater seeps from the bank into the river at a very low rate. This input causes increasing salinity in times of low flow, but this is quickly diluted during higher flow events.

This study used a one dimensional hydrodynamic model (Mike11) of the river with the coupled advection-dispersion module to model the transport of salinity concentrations. Using a simple mixing model, a time series of saline ground-water discharge was generated and input into the model and then altered to calibrate salinity concentrations against downstream EC measurements. The resulting saline-groundwater discharge hydrograph agrees with conceptual understanding of groundwater-surface water processes and closely approximates the actual measured EC values in the river.

Due to the extremely low inflow rate, a hydrodynamic or hydrological model alone cannot detect or quantify this groundwater input, while a mass balance or tracer approach alone cannot predict values moving downstream. The approach taken in this study removes the disadvantages of both of these approaches while being both accurate and practical using readily available tools.