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Presentation title:

“Depth-resolved groundwater chemistry by longitudinal sampling of ambient and pumped flows within long-screened and open borehole wells”

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Abstract

Groundwater chemistry samples are essential to many investigations. If a well intersects intervals with different concentrations, the pumped sample is a composite of the inflows, which mix in the well. Excessive mixing diminishes the value of samples and potentially gives misleading information. However, dedicated sampling installations at discrete depths (e.g. nested piezometers) are expensive so there is an incentive to make the most of existing infrastructure (e.g. supply wells) where possible. Despite potential complications, long-screened or open borehole wells can provide valuable data and insight with a little extra work and appropriate methods. In particular, the resolution of groundwater chemistry derived from such wells can be improved by measuring and sampling the in-well vertical flow regimes in ambient (un-pumped) or/and pumped conditions. The head-driven ambient flow regime is shown to be particularly useful to sample groundwater native to defined inflow zones within the screen (head in the zone > head in the well), and avoid zones impacted by the invasion of intraborehole flow (head in the zone < head in the well). Longitudinal samples from specific depths in the well are interpreted as either native groundwater from a defined source, subject only to analytical error, or a mixture from multiple sources that can be deconvolved, incorporating error in both flow and concentration measurement. Depth-resolved age tracers (CFCs, Carbon-14 and He) in groundwater from three supply wells are verified with samples from a multi-depth nest of piezometers. Results show old groundwater at all depths and the simultaneous occurrence of young water at shallower depths, particularly near a watercourse, in undisturbed dual-porosity fractured aquifers in the Pilbara region of Western Australia. Although this approach does not completely replace the need for piezometers, it does provide valuable data and helps to minimise the expense and impact of additional drilling.