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Improvements to a global-scale groundwater model to estimate the water table across New Zealand

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Groundwater models at the global scale have become increasingly important in recent years to assess the effects of climate change and groundwater depletion. However, these global-scale models are typically not used for studies at the catchment scale, because they are simplified and too spatially coarse.

In this study, we improved the global-scale Equilibrium Water Table (EWT) model, so it could better assess water table depth and water table elevation at the national scale for New Zealand. The resulting National Water Table (NWT) model used improved input data (i.e. national input data of terrain, geology, and recharge) and model equations (e.g., a hydraulic conductivity - depth relation).

The NWT model produced maps of the water table that identified the main alluvial aquifers with fine spatial detail. Two regional case studies at the catchment scale demonstrated excellent correlation between the water table elevation and observations of hydraulic head.

The NWT water tables are an improved water table estimation over the EWT model. In two case studies the NWT model provided a better approximation to observed water table for deep aquifers and the improved resolution of the model provided the capability to fill the gaps in data-sparse areas.

This national model calculated water table depth and elevation across regional jurisdictions. Therefore, the model is relevant where trans-boundary issues, such as source protection and catchment boundary definition, occur. The NWT model also has the potential to constrain the uncertainty of catchment-scale models, particularly where data are sparse.

Shortcomings of the NWT model are caused by the inaccuracy of input data and the simplified model properties. Future research should focus on improved estimation of input data (e.g., hydraulic conductivity and terrain). However, more advanced catchment-scale groundwater models should be used where groundwater flow is dominated by confining layers and fractures.