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Striking effect of time variation in the estimation of groundwater age in the Wairarapa valley

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The Wairarapa Valley exhibits complex interactions between its rivers and shallow aquifers. With agriculture being an essential part of the region the risk of contamination and depletion of groundwater exists. In order to assist with water resource management in the region, we can do predictions with the help of numerical models. Among these predictions, the evaluation of groundwater age is critical for decision making. This project builds on work done by Greater Wellington Regional Council and will focus on the Wairarapa Valley. The aim of this study is to evaluate the age of the groundwater in the Wairarapa region. Investigations have already been done thanks to hydrochemistry. However radiometric age can be misleading in the sense that it does not consider the mixing process in the motion of groundwater particules.
Therefore another approach can be considered .This latter is physic based by considering the age as a property that we transport through two main processes: advection at a macroscopic scale and diffusion at a microscopic scale. The determination of the distribution age by this approach has already been done for the Lake Rotorua but in the steady state case (cf Daughney).
The unique contribution of the present study is to estimate the changes in groundwater age distribution through time within the region. Indeed transient simulations are needed to explicitly account for seasonally variable rainfall and pumping wells. This affects the simulated flow solution and then the simulated age solution.
In order to solve numerically the transport of age distribution we have chosen to use the Time Marching Laplace Transform Galerkin technique which has been developed in a research code by Fabien Cornaton.
The obtained results depict that temporal variations in groundwater age are present and have important implication for resource management