

Interactive comment on “Simulated tritium concentrations in river waters of the western Lake Taupo catchment, New Zealand with MODPATH particle tracking” by M. A. Gusyev et al.

Anonymous Referee #2

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General Comments:

This paper presents simulated tritium concentrations in river waters in five watersheds within the Lake Taupo catchment, New Zealand. Findings include differences in the shape of transit-time cumulative distribution functions for watersheds with partially penetrating streams and watersheds with streams that preclude underflow. In addition, the paper demonstrates that the relative magnitude of tritium among watersheds is not simply a function of mean transit time combined with constant tritium decay (p. 3093/lines 9-12) and that the relative magnitude of tritium among watersheds can change over time—one of the more novel contributions of the paper. The paper also presents a

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comparison of simulated transit time distributions generated by using particle tracking (MODPATH) and by using a solute transport model (MT3DMS). This methods comparison makes up the bulk of the abstract and conclusions but is not reflected in the title of the paper. It should be. Overall, there exists a bit of a disconnect between the title, abstract, and conclusions (and literature cited), which makes it difficult to sort out what new contribution to the literature is intended by the authors. Perhaps the title should be “ ‘Simulation of’ tritium concentrations in river waters . . . ” if the focus is to remain on the simulation methodology. On the other hand, perhaps the abstract and conclusion should contain simulated tritium results, such as those mentioned above, if the title is to remain ‘as is’.

Nonetheless, once the different sections of the paper are tightened up and the authors clarify the main objective of the paper, publication is warranted as the paper contains interesting results.

Specific Comments:

3084. The utility of simulated transit time distributions (CDFs, PDFs) should be apparent in the abstract given that most of the abstract focuses on how best to obtain one. For example, transit time distributions are necessary to understand tracer and contaminant output functions at discharge points.

3085/20-23. It’s not clear how this reference fits in as the manuscript is currently written. It’s the Eberts et al. comparison that is relevant. What about, “For example, Eberts et al. (2012) compared simulated tracer concentrations computed using TTDs from particle tracking and LPMs for wells in four aquifer systems by using the Excel workbook TracerLPM (Jurgens et al. 2012), which can use either TTDs from MODPATH or LPMs as input to the convolution integral for obtaining tracer concentrations at wells. They found that . . . ”

3085/1. Tracer-based ages rather than tracer concentrations were simulated in many of the examples from the literature that is cited here. Thus, it is not strictly correct to

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state, “. . . have also been used to simulate isotope tracers at wells . . .”. In other words, isotope tracers were not necessarily simulated for each of the cited works; rather, groundwater ages were frequently simulated. Consider something like “. . .” have also been used to simulate isotope tracer concentrations and (or) tracer-based groundwater ages.”

3091/14. What “adjustment outlined in Abrams (2013)”? Is this the adjustment described in 3089/6-14? Can the adjustment be succinctly described here?

3092/18-25. It seems likely that the narrower range of travel times associated with the Omori catchment compared with the other catchments contributes to its relatively high peak concentration. In other words, the relatively high peak concentration for the Omori catchment may not simply be related to the relatively small amount of time that the tritium stays in the aquifer but also to the relatively small amount of mixing of waters with different tritium concentrations in the Omori, resulting in concentrations that are more similar to recharge concentrations compared with the other catchments. Similarly, it seems likely that the relatively gradual decrease in tritium concentrations from 1970-1990 (fig. 3b) in the Whareroa catchment is, in part, the result of the wide range of travel times reflected in the baseflow, resulting in proportionately longer flush times.

3092/26. Figure 3b does not show tritium in rain. Consequently, the reference to the figure at the end of this sentence does not seem appropriate.

3093/7-13. This is an interesting result.

3098/16. The first sentence of the Concluding Remarks states, “. . . we presented an approach to calibrate the steady-state MODFLOW/MODPATH model to measured tritium concentrations in rivers waters at baseflows . . .” implies that the approach used in this study is new; however, the use of travel time distributions and the convolution integral for computing time-dependent tritium concentrations at discharge points is not new. (An example is shown in the reference by Jurgens et al. 2012.) Furthermore,

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much of the conclusions are focused on how to generate tritium concentrations with MODPATH transit time distributions. Again, such work ‘in and of itself’ is not new. On the other hand, the comparison of MODPATH and MT3DMS based transit time distributions does appear to be new, as do findings related to relations between simulated tritium concentrations among watersheds within a larger catchment.

Technical Corrections:

3084/26. Haitjema, 1995 is missing from the References, and Kaufman et al. 2001 . . . “Kauffman” should be spelled with two ‘f’s (here and in the References)

3085/16. Something is grammatically incorrect . . .”MODPATH/MODFLOW allows one to evaluate age groundwater tracer directly . . .”

3086/8. “groundwater flow MODFLOW” . . . groundwater flow is not necessary before MODFLOW

3086/15. The word “a” should not precede “groundwater flow models”

3087/20. SWS, 2012 is missing from References

3088/18. SWS, 2013 is missing from References

3090/8. Should have a reference for tritium decay rate

3092/28. “tritium decay of 12.32 year” . . . should be “tritium half-life of 12.32 years”

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