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Hydrology and Earth System Sciences
Discussions

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 #1

Received and published: 13 April 2014

The manuscript describes an application of the USGS particle tracking software MODPATH to characterize conservative solute transport of tritium through five catchments in New Zealand. The first moment (mean travel time) is used to characterize the manner in which the catchment alters the precipitation time series input signal, compared to the measured tritium concentrations at stream gaging locations. The particle tracking approach is compared to an approach using the solute transport software MT3DMS. The two approaches are also compared using a set of small 1D, 2D, and 3D synthetic basins.

The manuscript is well written, and logically and carefully presents its point. It is a good

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example of a modeling methodology, comparing two different approaches under both real-world and synthetic circumstances. I think the manuscript should be published in HESS, after minor revisions and technical corrections.

Specific comments: ————————————————

1) The authors should consider the following applicable references

1A) Dagan & Nguyen (1989), Journal of Contaminant Hydrology "A comparison of travel times and concentration approaches ..."

1B) Goode (1996), Water Resources Research "Direct simulation of groundwater age"

1C) Jury (1975), SSSAJ "Solute Travel-time Estimates " (parts I and II)

2) page 3091 line 10: "ground watersheds do not always coincide with surface watersheds"

2A) should this be "groundwater watersheds"?

2B) The extent of the model domain was chosen to conincide with surface watershed boundaries. What implications does this have for the flow to or from other watereds into the modeled domain?

3) p 3092 l 9: "purely advective MTTs from MODPATH" While it is true that MODPATH doesn't consider non-advection transport processes explicitly, any simulation will experience "numerical dispersion" or "grid dispersion" due to the discretization of reality. This is discussed in reference to the representation of streams and rivers using 80-m square model cells elsewhere in the manuscript.

4) Figure 4(a-f): It may be useful to plot concentrations on a log y-axis, since the variability related to the bomb peak (1960s) is really the only thing that can be clearly seen, and the data basically are crammed into the corner of the plot. Much of the discussion in the text is about details that are hard to make out in the linear-scale plots. Log scale would show both the highs and lows.

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5) The manuscript quantifies comparison between mean travel times (the first moment of the concentration breakthrough at the observation location) for the different watersheds and modeling approaches. the manuscript then also makes qualitative comparisons of "shape" (e.g., p 3094 l 5). Quantified comparison of higher moments (variance, skewness, kurtosis) might be more meaningful and less subjective.

6) All the figures would be clearer if larger axis label, axis ticks, and legend text fonts were used. Line weights could be heavier in Figures 2-4. When the figures are shrunk down to fit into the small journal format, the text becomes hard to read (especially the inset figures in Figure 4), and there is plenty of white space in the figures otherwise.

Technical Corrections: ————————————————

1) page 3085 line 24: "simulated" -> "simulate"

2) p 3086 l 10: delete "the" before "Trout"

3) p 3086 l 16: "models" -> "model"

4) p 3087 l 18: move "MODFLOW" to second word (before "groundwater flow")

5) p 3088 l 22: "grid" -> "cell"

6) p 3088 l 23: delete "custom" (are there non-custom Python scripts?)

7) p 3088 l 25: add "the" before "VMOD"

8) p 3090 l 8: is the "1" before "year ^{-1}" part of the number? (i.e., should there be a space between the "62" and "1"?) Is this number of significant digits in lambda necessary or appropriate?

9) p 3093 l 27-28: "can be attributed to the fact that" -> "is because the"

10) p 3094 l 4: "are very similar in scale of MTTs" -> "have very similar MTTs"

11) p 3095 l 2: delete "Note that"

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12) p 3095 l 8: "ubiquitously" -> "uniformly"

13) p 3099 l 1: "convoluted" -> "convolved"

14) p 3099 l 19: delete "It should be noted that"

15) p 3099 l 20-21: delete "It is noted that"

16) p 3100 l 1: delete "It is very important to note that"

17) Table 1: Is there a way to make it clearer that "MTT, years" is a column heading that spans three columns?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 3083, 2014.