Hydrol. Earth Syst. Sci. Discuss., 7, C323–C326, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C323/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Landuse effects on runoff generating processes in tussock grassland indicated by mean transit time estimation using tritium" *by* M. K. Stewart and B. D. Fahey

Anonymous Referee #2

Received and published: 30 March 2010

General Comments

I enjoyed reading this paper describing the evaluation of transit times of old water using tritium data in two New Zealand sub-catchments. The paper is well written and the methodology is mostly well explained. The content of the paper is suitable for HESS and will be of interest to many readers. The approaches used expand on previous studies in demonstrating the utility of atmospheric tracers for understanding residence times of catchment systems, and particularly highlight the importance of old groundwater in small upland catchments, which has been commonly ignored in many studies.

The content of the paper did not reflect my initial expectations on reading the title,

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

as the land use change aspect was only discussed quite briefly. The rationale for undertaking the study, over and above scientific curiosity did not come across very strongly, so perhaps more discussion of the land use change implications would be beneficial. Greater inter-comparison between the G1 and G2 sub-catchments could be helpful in this regard, particularly since the modelling results seem to imply a greater fraction of deep groundwater contribution to the afforested catchment.

I have some concerns about the rigour of the modelling analysis undertaken, due to the limited availability of data for calibration of the model parameters. Only 3 sets of measurements have been made and since they are all from surface or near surface waters they reflect very damped tritium responses. Hence there are very many different models and parameterisations of these models that could give a good fit to the simulated tritium response in the stream. In particular, there was apparently little difference between the standard deviation of modelled fit for a mean transit time of 4 years as compared with 25 years. These results would lead to very different interpretation of the catchment processes and there needs to be strong justification for selecting the MTT of 25 years over that of 4 years. Perhaps further interpretation of the measurements of CFC, Si, δ18O and δD could be used to help support the tritium modelling results. In addition, current day measurements of tritium from boreholes in the catchments could be extremely valuable for an experimental study of this type, but do not appear to have been collected. I would like to see a simple uncertainty analysis of the modelling included in the paper.

Specific Comments:

Title : Doesn't really reflect the content of the paper

P1075 l 7-8: Reader has not yet been introduced to the different sub-catchments

P1075 l9:"and therefore also to quickflow" – this is not logical

Abstract – some concluding statement of significance would be useful e.g. this study

HESSD

7, C323–C326, 2010

has reinforced the hydrological significance of land use change from native tussock grass to forestry plantation.

P1080 l14: There is an inference that CFC responses will also be modelled but no results are presented for this. I assume this is because the CFC at the outlet had equilibrated with the atmosphere.

P1080 l 22: Note that in the case of CFCs the decay constant = 0

Fig 3: clarify black dotted lines on 3b – lower is CFC-11 atmos and upper CFC-12 atmos

P1085 l1-8, Fig 4: It is not clear, here, how the DDM has been fitted using the available observation data, although this id discussed a bit more in relation to Fig 5. Given that only 3 recent measurements of tritium in the stream are available for model calibration it must be feasible to fit a very wide range of different model parameterisations to the recharge data and achieve a very similar fit to the recent tritium. The number of observations is too few to give any statistical meaning to the calculated standard deviation measure and some analysis of the uncertainty in the model parameterisation is essential to justify the results presented.

Fig 5: It took me some time to understand this figure and the corresponding text. Plotting the time-series of tritium recharge data is a distraction and confuses the interpretation (in fact one might be lead to think that the current measurements of tritium in the streams give quite a good match to the current recharge). I would prefer to see here a number of simulation responses highlighting the differences between model parameterisations. Fig 5 c is poorly explained, although I eventually worked out what it was trying to present. It is a very important figure in terms of understanding the uncertainty in the results.

General: There is inconsistency in terminology between the use of “mean transit time” and “MRT” (never defined).

HESSD

7, C323–C326, 2010

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 1073, 2010.