Hydrol. Earth Syst. Sci. Discuss., 7, C2125–C2127, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C2125/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Dating of streamwater using tritium in a post-bomb world: continuous variation of mean transit time with streamflow" *by* U. Morgenstern et al.

Anonymous Referee #2

Received and published: 3 September 2010

This is potentially an interesting paper that will advance watershed hydrology in significant ways. Using simple tracers such as Si to determine age and quality of streamflow, and by consequence flow paths water has taken in the catchment, is quite compelling. Of course, so far the method has been developed and tested for just one catchment, but there must be potential to extend the applicability to other watersheds in the southern hemisphere and later in the northern hemisphere.

Having said that, I recommend that the authors spend more time with the ms so that the description of the methods is presented in a more clear and concise way. I struggled

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

(and still struggle) to understand exactly what it is that they do to determine the mean transit time of each water sample, together with an estimate of the associated error. Let me try to explain my problem.

The authors mention that they use a combined exponential/piston flow transfer function to convolute the input signal (TU in precipitation) into the output signal (TU in streamflow). That TF has 2 parameters related to the first 2 moments of the transit time distribution (TTD) of water exiting the catchment. Usually people use this approach to compute a stationary TTD given many samples of input and output tracer. By definition the water exiting the catchment has a constant mean and stdev of transit times, viz the parameters of the TF. Therefore one cannot say anything specific about each individual sample. Obviously this is not what the authors do. So, perhaps the way they estimate MTT and SDTT of each water sample from the stream is to take the long time series of input signal (TU in precipitation measured since the nuclear testing era) and convert that into a time series of output signal (TU in streamflow as precipitation has passed through the groundwater system of the catchment) by using the exponential/piston flow model (Figure 2, I believe). To do so, the authors have to choose the parameter values of the TF, and thus the MTT and SDTT of water exiting the watershed. But how do they decide these values? And how specific are they for the watershed under investigation? Or are they generally applicable such that Figure 2 can be used as a look-up figure to determine the age of any streamwater sample once we know its TU value? But why would this work? I don't see the scientific underpinning of this procedure, or at least it is not well explained in the ms. Even if the authors are able to explain the latter procedure and convince us of its validity, I still have an issue with this. Again under the assumption of stationarity and perfect mixing, the TF used to generate Figure 2 defines the MTT and the SDTT of each water sample, and Figure 2 is the output of the system, and not the transit time distribution.

Another issue I fail to understand is that the authors wheigh the input signal (TU in precipitation) by monthly precipitation AND monthly infiltration rate (which I assume

HESSD

7, C2125–C2127, 2010

has units m/s, given the name of the variable). What is the logic of that? I agree that some type of weighing is needed to account for evapotranspiration, but then why not simple correct precipitation for that through the infiltration rate. Why do they multiply that corrected signal again with precipitation amount (or rate)? Or do I interprete the infiltration rate incorrectly, and is alpha_i merely a factor between 0 and 1 to correct total precipitation? In that case it would make more sense but than the name of the variable is confusing.

I'm probably missing something basic here, and perhaps the authors have explained this elsewhere, but in order for this ms to be stand-alone I suggest that they improve the description of the methods.

Minor comments:

Title: I don't think we live in a post-bomb world, rather in a post nuclear testing world (hopefully), so I suggest to change the title accordingly.

Figure 5: I suggest not to connect the data points, they are so far apart in time that it creates the wrong impression that streamflow is increasing linearly between 2nd and 3rd sample, for instance.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 4731, 2010.