

## ***Interactive comment on “Assessment of Halon-1301 as a groundwater age tracer” by M. Beyer et al.***

**Anonymous Referee #2**

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I agree with the comments and remarks of reviewer 1, and concur with his opinion on the potential usefulness of this manuscript for groundwater dating. The methodology presented by the authors seems sound, and is presented in a very clear and systematic manner. I also find the response of the authors to the comments of reviewer 1 convincing and satisfactory (with the exception of the MRT comparison, which I come back to further below). Thus, I will simply add additional suggestions along the same lines as reviewer 1. But for minor modifications, the manuscript seems to me ready for publication

specific comments:

P1398, L1-3: “assess” twice in the first sentence.

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L8: there are other ways to complement tracer information. Discharge recession analysis or groundwater level fluctuations, for instance.

L9: “vital” may be a bit strong. How about “useful” ?

L20: “investigated aquifer” may be more correct than “investigated groundwater”.

P1399, L4: “revealed by elevated CFC concentrations” rather than “via elevated...”

L5: “no sample showed” rather than “no sample revealed”

L6: “the absence” and not “the lack”

L 11: “standalone indication for quality”. References?

L25: “can be calculated from tritium measurements” rather than “with tritium can be faced”

L27: “this is particularly true” rather than “this is particularly relevant”

P1400, L2: Is there a reason for not citing the papers in chronological order (either from younger to older or the other way around) ?

L5: An important reference is missing: Grabczak, J., P Maloszewski, et al (1984). “Estimation of the tritium input function with the aid of stable isotopes.” Catena 11(2/3): 105-114. In my opinion the soundest way to weight the tritium input function.

L8: Your statement is too performative. If the limitations you mention can be overcome, why would we need “complementary groundwater age tracers” ? I do not disagree with you, but I think such a statement needs qualification. As it is, it reads more like an activist appeal to politicians than an scientific utterance.

L11: “in” instead of “within”

P1401, L4: “like THE structurally similar CFCs”

L 9: “Does its use as a fire suppressing agent” rather than “Does its use for fire sup-

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pression”

L 12: “note” is unnecessary

L 17: Would not “aquifer” be more appropriate than “groundwater

L 20: How about “In this way, problems such as contamination due to contact with air during sampling or local (anthropogenic) sources can be identified” ? “Issues” is not a good synonym for “problems” in this context

P1402, L4: Are the diffusion rates in air (and water) similar ? Differences between deuterium and oxygen-18 for instance are quite significant, if I remember well

L17: Is the groundwater in New Zealand so homogeneous that you can refer to it as just that, “groundwater”?

P1403, L7: “is shown” rather than “is illustrated”

L12: One does not determine observations. How about “the number of CFC (...), SF6 and tritium observations available for these sites” ?

L16: “and is recharged both by rain and river infiltration” rather than “both rain and river recharged”

L25: “not the water stagnating” rather than “not the water sitting”

L27: This is not clear. Did you always measure pH, conductivity and DO, or only sometimes ? Which sites were sampled how ?

P1404, L6: “Then the bottle is left to overflow,”

L12: “no contamination by SF6 or Halon-1301 from the air”

L14: “in the surrounding areas” and not “in our close environment”

P1405, L14: Is there a good reason to drop the intercept term ? Helsel and Hirsch, in their excellent book entitled “Statistical methods in water resources”, USGS, book 4,

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chapter 3 (chapter 9, P238-239), warn against it.

P1406, L5: “which we took into account”, not “which we took into account of”

P1407, L6: “we use the commonly used” is a bit ponderous. How about “we adopt the commonly used” ?

L25: “This guide recommends” instead of “This recommends”

P1408, L3: This is where dropping the intercept term of the regression becomes problematic, because it can influence the uncertainty estimate of the whole regression. The same applies to the SD introduced L18.

P1411, L8: There is one “(“ too many.

P1412, L19-25: Maybe you could drop this paragraph altogether ? After all, you argue that so-called “apparent” piston-flow ages are “unrealistic” (and I agree). They are also useless in practice (unless the geometry of the groundwater system and sampling design lead to the sampling of parallel streamlines, of course) and tend to confuse people. I should think that in the present study, only EPM ages are relevant at all. I would also for the same reason, and because it clutters the plot, drop the PF points on figure 7.

P1413, L10: The relationship between Halon-1301 and SF6 looks indeed rather linear, but what was exactly your criterion for “agreement” ? You use further below the word agreement again, so I think you should explain what “disagreement” would look like. Line 27 for instance, you mention an interval of +/-2 years. It is only in your conclusion that you seem to explicitly recognise the interval of +/-2 years as your criterion for “agreement”. Would not a relative measure be more adequate, since the MRTs span an order or magnitude ?

L18: “At one of the eighteen sites” instead of “At 1 of 18 sites”

L16: “of twelve out of seventeen” instead of “of 12/17”

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P1414, L13: This sentence is awkward.

P1415, L5: You do not find “lag-time” in a sample as you would measure concentration, you can only calculate it from the data

P1416:, L11: “is only likely to occur” instead of “is likely only occurring” L26: cross out the “,”

P1417, L16: “despite of the fact that” instead of “despite that”. Further below (L25), “Despite of these” instead of “Despite these”. Check how to use “despite” properly

P1418, L9: “of local contamination sources”

Table 1: The units are missing for SF6, CFC and tritium

Figure 1: I would plot both y-axis labels turned counterclockwise. As it is, one needs to twist the head first in one direction, then in the other

Figure 7: As I wrote above, I think you should use the EPM ages only

Figure 8 and table 3: Apparently, this figure shows the 12 sites for which the estimated ages were presented in the text to lie within two years between tritium and Halon-1301 (P1417, L12). The discrepancy between MRTs obtained from tritium and those calculated from Halon-1301 or SF6 seem much higher than that on the figure, and so is the difference between the MRTs given in column 9 and 16 of table 3. Reviewer 1 also pointed to this, and I do not think the authors clarified that point in their answer.

Figure 9: Bar plots do not allow to grasp synoptic differences, and this one is no exception. If you want to show the differences, or the absence of differences at two points in time, not on a station to station basis, but for the entire dataset, a scatter plot of initial versus final equivalent atmospheric concentrations might be much clearer, as it would show a possible general trend at first sight. I am also not quite sure of the meaning of the sentence “analysed directly after sampling (2 of 3)” in the caption. Does that mean that the two first bars for each site labeled “initial” were replicates ?

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