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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Investigating the spatio-temporal variability in groundwater and surface water interactions: a multi-technical approach" *by* N. P. Unland et al.

Anonymous Referee #2

Received and published: 20 May 2013

General comments:

This is a very interesting paper which focuses on the integrated use of different methodological approaches in order to characterize surface water-groundwater exchange processes. The multi-technical approach applied is of great help in the characterization of surface water-groundwater connectivity, especially in catchments where the water table morphology cannot be easily determined. In particular, the application of the radon method and the results achieved are of value to scientific community since this method, despite its popularity, still needs further data to be validated, especially with respect to the gas exchange rate constant.

A weak point of the work is the poor characterization of the groundwater end-member, which is, as the authors outline, one of the main sources of uncertainty in the groundwater fluxes estimation, especially when using chloride for mass balance calculations. This weakness is balanced by the explanations the authors give in the Discussion section.

Moreover, the estimation of the groundwater-surface water gradients should be done along the flow lines rather than perpendicularly to the river channel. The overall text is fluent in reading except for a few parts, especially in the Results section, which need to be summarized (e.g., in tables or graphs) in order to avoid to be dispersive for the reader. Summary tables or box plots could be of help. Some of the graphs reported can be eliminated. In summary, this is a good contribution to the scientific community coping with surface water-groundwater connectivity and can be accepted for publication in HESSD following minor revisions.

Specific comments:

Abstract. Page 3796

Lines 11-14: Please, explain better the meaning of this sentence. Line 14: occur.

Introduction.

Page 3796

Line 26: Lambs, 2004 NOT Luc, 2004.

Page 3797

Line 28: Cook, 2012 NOT Cook et al., 2012.

Page 3798

Line 4: "..its spatial AND TEMPORAL variability".

Lines 9-12: This is not the only and the main reason why Radon-222 has a lower

specific activity is surface water than in groundwater. The authors should include here the degassing as a main control of radon in surface water.

Line 12: Cook, 2012 NOT Cook et al., 2012.

Lines 16-18: Maybe this sentence can be combined with the paragraph at the lines 9-12.

Line 26: ". . .recent workS haVE focussed. . ."

Page 3899

Line 5: Delete -'s-.

Line 9: Lately many works applied the multi-technical approach, so it is not so "uncommon". Please, use a more appropriate adjective.

Page 3800

Line 12: "has groundwater" has not the subject. Please, reformulate the sentence.

Line 13: "This" is not clear to what is it referring to. Please, reformulate.

Page 3801

Line 2: What kind of gauging?

Line 7: How was river velocity calculated?

Line 15: Please, report the precision of the EC/temperature measurements.

Line 15: Please, report the precision of the DGPS method.

Line 22: Please, report the uncertainties for the gradients calculations.

Line 26: What was estimated by Google Earth? The river width? And the river depth? What are the uncertainties?

Sampling

Page 3802

Line 13: Was the sampling of river and groundwater carried out in one day?

Page 3803

Line 6: Why Radon specific activities have been reported as Bq/mˆ3 and not in Bq/L which is more common? To convert in Bq/L should the values be divided by 1000?

Line8: How many replicates?

Lines 11-13: Were the samples collected in air tight containers?

Line 23: Put a space between Bq and m-1.

Page 3804

Line 6: Please, explain better what do you mean by "net flux". In the reported method, usually the lateral or the horizontal downstream flux in the HZ is considered zero.

Line 9: Put Runkel, 1998 before Wagner and Harvey, 1997. Runkel is missing in the reference list.

Line 15: DobBins.

Results

The paragraph 3.1 is very difficult to read due to all those data written in the text body. It should be desirable to summarize the data, using for example box plots or summary tables. Moreover, please put the standard deviation (1 sigma) EVERY TIME an average value is reported. When a range is reported it has ALWAYS to be used the "from. . .to. . ." expression. Many times the author reports the range as " from 10-20", while the correct way is "from 10 to 20".

Page 3805 Line 9: Figure 3 does not "summarises" but "reports".

Page 3806

Line 23: "..over the study PERIOD...".

Page 3807

Line 25: Please explain why only two months are reported.

Page 3808

Line 13: put a space "and15".

Line 20: Again, what is the uncertainty of the T measurements? If it is 0.1 °C, the word "increasing" is not very appropriate, since 15.3 and 15.5 could be the same number within the uncertainty.

Page 3809

Line 1, 3, 5: ranged from...TO...

Line 11: "concentration ranges are..." instead of "concentrations ranged from..".

Page 3810

Line 7: "...over the study PERIOD."

Line 10: "higher" than?

Lines 19-21: What are the values used for the Nicholson River?

Page 3811

Line 21: What "study stretch"?

Line 23: August 2011?

Line 25: Add "respectively" in the parenthesis.

Page 3812

Lines 20-22: It is not very clear why concentrations from Location 2 reflect the concen-

tration of gw neighboring the Nicholson River, since these concentrations (close to the Nicholson river) have not been measured at all.

Page 3813

Lines 3-9: I am not very confident in these data. An estimation of the uncertainties should be done in order to give them a chance to be reported.

Line 23: It is not clear to what "in this area" is referred to.

Page 3814

Line 9,10: from...TO...

Line 20: temperature rising from 19.5 to 19.8 °C cannot be considered a sharp increase.

Page 3816

Line 5: DobBins.

Line 10: What do you mean by "less apparent"?

Line 15-18: Please explain better this paragraph.

Page 3818

Lines 1-3: See discussion before about the use of the gw values from Location 2 for chloride massa balance calculations in the Nicholson river.

Lines 4-6: Substitute C with Cl.

Line 13-15: Please explain better this sentence.

Page 3819

Lines 20-27: It would be desirable to give less certain statements about the results for the Nicholson river for the reasons above discussed.

Line 21: “were similar” is a vague term. Please, substitute with a more appropriate adjective.

Line 21-22 an 25: There is a repetition “this suggests. . .”).

Hydrological drivers

It would be nice to summarize the main results in a conceptual model (such as for example in Stellato et al., 2013) in order to immediately visualize the studied hydrological processes.

Page 3820

Line 14: How fast?

Line 15: “consistent WITH. . .”

Page 3821

Lines 5-17: Please give a clearer explanation of this paragraph.

References

Delete: Luc, (2004)

Missing in the reference list: Runkel et al. (1998)

Missing in the text: Cartwright et al. (2008) Corbett et al. (1998) Cook et al. (2010) Gonfiantini et al. (1986) Grayson et al. (1997) Hallegraeff, (1992) ISOHIS, 2012 Lerner et al. (1990) Meredith et al. (2009) Panno et al. (2006) Vanderberg et al. (1992) Zhang et al. (1990)

Table 1 Correct : Aug 11 and Mar 12.

Figure 5 Correct in the caption: February 2011 and March 2012. The head gradients have to be reported with their uncertainties.

Figures 8 and 9 Please, uniform the Y-axis scale.

Figure 11 Not sure that this graph add something to the work.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 3795, 2013.