Hydrol. Earth Syst. Sci. Discuss., 4, S519–S521, 2007
www.hydrol-earth-syst-sci-discuss.net/4/S519/2007/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Tracing and quantifying groundwater inflow into lakes usingradon-222" *by* T. Kluge et al.

T. Kluge et al.

Received and published: 11 July 2007

We thank the reviewer for the appreciation of our work and the constructive comments.

We will consider shortening the section about gas exchange rates. Below we discuss the detailed comments of the reviewer.

Specific Comments:

Page 1521 and 1533: Hydraulic heads of a large piezometer network in the area of Lake Willersinnweiher from the year 1998 have been used by Wollschläger et al. (2003, 2007, s. references in manuscript) to calibrate a groundwater flow model (MODFLOW) in order to determine the groundwater inflow. A sensitivity analysis showed that the groundwater inflow to the lake depended strongly on the rather uncertain hydraulic conductivity field. This resulted in a large span of possible inflow rates, as cited on

p. 1533 of our paper. We might insert a reference to the study of Wollschläger et al. (2007) on p. 1521 to substantiate the statement that uncertainties about hydraulic conductivity hamper the determination of groundwater inflow. In the present study we did not focus on the hydraulic heads and made no attempt to use them for an inflow estimation. We do not have the necessary extended data base from piezometers as used previously. The results of Wollschläger should be sufficient for comparison of hydraulic estimates with our inflow rates derived from Rn.

Figure 4: The groundwater flow direction is from southwest to northeast, which we will indicate in the caption. For the hydraulic gradients we do not have sufficient recent data, as mentioned above. The differences in the hydraulic heads between GWM B and GWM C was hardly measurable, because it is within the uncertainty of our instrumental setup of a few cm.

Page 1522: We will include outgassing to the atmosphere as a reason for concentration gradients between groundwater and lakes. We note, however, that this is not necessarily the main reason for low Rn concentration in lakes. During a summer stratification period, hypolimnic water may effectively be isolated from gas exchange, nevertheless the Rn entering from groundwater inflow will quickly be reduced by decay as it is no longer supported by local production. As the cited report of Rogers (1958) is quite old and actually focused on mountain streams rather than lakes, we do not think that it invalidates our statement that the use of radon to asses groundwater exfiltration into lakes has received less attention than in the context of submarine groundwater discharge. At least this is the impression we get from the recent literature. We are not aware that such a statement is contained in Corbett et al. (1997).

Technical Corrections

Page 1520: These points as well as the typo on p. 1525 will be corrected.

Page 1525: Yes, the buckets have been tested concerning their tightness for radon, as stated on p. 1527/28. Fig. 3 shows the results for buckets that have been filled with the

HESSD

4, S519–S521, 2007

same water at the same time. We filled the buckets with tap water, which has a more than 1000 times higher Rn concentration than water at equilibrium with the ambient air. Even in case of this high concentration gradient, no significant deviation from the decay curve is detectable. Thus, the buckets are tight at least for 8 days.

The equilibration in general does not require several hours, if flow rates are appropriately adjusted. In case of our usual setup only 40 minutes are necessary to reach the equilibrium, as stated on p. 1526. The difference to the Rad Aqua method is, inter alia, the possibility to take samples with very low activities from a whole depth profile in a lake and to measure them in the lab at optimum conditions. In case of the Rad Aqua method, for every depth the measurement in the field would take several hours to reach the counting statistics. Thus only a few data points can be achieved with only one detector.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 1519, 2007.