Hydrol. Earth Syst. Sci. Discuss., 7, C1587–C1590, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C1587/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "An approach to identify urban groundwater recharge" *by* E. Vázquez-Suñé et al.

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Received and published: 27 July 2010

We thank the reviewer for his kind assessment and comments. Both contribute to improving the final version of the paper. The revised version will accommodate Technical Corrections. Regarding the rest, we discuss them below.

1.- It is true that our work could be more directly linked with " the literature dealing with decision support systems for the management of water and wastewater networks as there is a great potential for interaction of that area of research with the material presented here". We were a bit shy on this regard, because we are not familiar with this literature. After this comment, we have started looking for it. We have observed that there is quite a bit of work seeking the efficiency of water management. In general

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this efficiency must be the reduction of losses and the increase in performance of distribution systems (Thornton et al, 2008). There are several "water associations" (IWA, AWWA, see their web sites) that deal with Water Loss Control working to provide accountability in their operations by reliable auditing their supplies, and by implementing controls to keep system losses to reasonable minimal levels. Most of the leakage management related methods developed so far can be broadly classified as follows (Puust et al, 2010): (1) leakage assessment methods focus on quantifying the amount of water lost; (2) leakage detection methods primarily concerned with the detection of leakage hotspots and (3) leakage control models focus on the effective control of current and future leakage levels. Thus, no methods are based on groundwater hydrochemistry and quality assessment. The methodology presented here deals with the identification and quantification of the origin of residence water in a sampling point (well, piezometer, seepage ...). A significant proportion of this water can come from losses of the distribution networks (water supply and sewer distribution systems). In many places of water distribution system is possible to lose significant volumes of water through leaks and pipeline ruptures. Precise location of such leaks is not possible with the presented methodology without a huge groundwater control network, this is not the case and it's very difficult to implement. However, we consider that it is possible to quantify it as an integrated value corresponding to a representative area in a time interval. So, here there is a great potential for interaction between the methodology presented and the management of water networks. In the revised version, we will refer to this literature in the introduction. Still, we would be open to specific suggestions.

2.- We hesitated about including the actual values of variances adopted in the paper because it is a lengthy table (a value for each species at every observation well). Instead, we opted for describing the general criteria we generally use to assign variances (this is described in Section 2.4). However, it is true that the actual application of those criteria to the Barcelona case is not described. We will do it in the revised version.

3.- It is true that the presented work only shows the results of the application method to

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a single groundwater sampling campaign. It is also true that more measurements are available and that "results from more campaigns, set in an appropriate time frame, can be linked to groundwater dynamics". In fact, mixing ratios obey the transport equation, so that they do provide information on transport processes. However, actual application (like most transport simulations) is tricky because sources strengths evolve in time and the history of pumping in the aquifer is also complex. Our objective in this paper was simply to show an easy, clear and comprehensive application and some different issues related with the methodology implementation. But the point made by the reviewer is well taken.

At present we are working on a new application of this methodology to the Barcelona urban aquifers. This is including a new and extended groundwater sampling network and also more chemicals species analyzed in each sample (from about 20 parameters in 90′s to more than 50 at present). The results of this new application are consistent and provide more consistency to the previous results that are shown in this article. Given the many parameters analyzed in these new campaigns is still possible to identify and quantify not only mixing, but also the existence of degradation processes of many compounds. Some of these compounds are those called emerging contaminants, of which in many cases is not known its conduct on the ground.

To address this point, we will mention these possible extensions of the methodology in the revised version of the paper.

References

AWWA: (http://www.awwa.org/Resources/WaterLossControl.cfm? ItemNumber=47846&&navItemNumber=48155)

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 2543, 2010.