Hydrol. Earth Syst. Sci. Discuss., 8, C2461–C2464, 2011
www.hydrol-earth-syst-sci-discuss.net/8/C2461/2011/


Hydrology and Earth System Sciences Discussions

# *Interactive comment on* "Calculating the average natural recharge in large areas as a factor of their lithology and precipitation" *by* E. Sanz et al.

**Anonymous Referee #2**

Received and published: 27 June 2011

Review of "Calculating the average natural recharge in large areas as a factor of their lithology and precipitation" (doi:10.5194/hessd-8-4753-2011)

In general the attempt of the authors to calculate the groundwater recharge based only on two input parameters is honorable in terms of simplification of the diverse, complicated, and sometimes even not understandable small scale or local approaches of the calculation in a very wide range of publications. The question arises if this approach is useful in a more practical way or if it is a nice application of a rather simple statistical method. This statistical approach may lead even to more questions if there is for instance a scale for which this approach is appropriate – and for which scale it is not. The publication does not answer these questions at all. Let's go through the title first: The



"calculation" method described in 2 is rather simple although it seems to be imressive with the integration. The simple statistically based approach reduces all processes to only rainfall and lithology. Lerner et al. (1990) showed clearly that this approach may be a first attempt to get at least the ablity to classify the processes in one way but there are a lot of problems in detail and these problems do not only arise from spatial or temporal scales. This leads to the next expression, the "average". What is the "average" meant here? There is no detailed information for which scale the proposed method is applicable. First of all only springs with discharges greater than 10 l/s are regarded. The question arises if this preselection is not influencing the statistics. The preselection is not discussed in detail and it must be assumed that this already underdetermines the approach at all. The recharge is in wide regions not comparable to the discharge of only the bigger springs. The spatial scale or even the size of the catchments is not given. Therefore only via the summary statistics a rough estimation about the average catchment area is possible. The same with the time domain: Does the limit hold for the whole year? Are the averages of long terms (e.g. 30 years) regarded? Especially for karst springs a high variability has to be assumed. How is the applicability for a one year estimation? The next question regards the "natural" hydrological status of the springs in the statistics. In Spain the hydrological conditions are influenced highly by irrigation, pumping and other impacts on water cycles and balances like dams etc. The question then is how the "natural" behaviour (and therefore the discharge of the springs) is stated. The question of the definition of recharge is already mentioned above. The groundwater recharge can not only be estimated based on the discharge of springs. A lot of groundwater flows to rivers and does not feed a spring. This may to a certain extent also be bound to the "lithology" but this has to a much bigger extent to be proven. The terminology "in large areas" is not supported by measures as already mentioned above. With respect to Spain the whole water balance has to be regarded and this will be a complex calculation because the evapotranspiration has to be encountered, too. A lot of the water of springs is used also for irrigation purposes etc. so that a summary approach as given in the paper is not acceptable. "... a factor

for their lithology. . .” means in this case that for only a few classes of rocks a factor is estimated that is multiplied by the classified region of some precipitation pattern. This “lithology” factor does not take into account any vertical differentiation. The dependencies between rocks and morphology are not regarded at all. The “precipitation” parameter is also not used as rainfall as it is measured, but classified in certain regions. There may be a hidden influence of the kind of precipitation via these regions but the effect is not properly described: How are the differences between mountainous areas with snow and lowlands with perhaps also shallow groundwater reflected in the calulation method? The method is poorly documented: There are no correlations given, no graphs support the assumptions and just by summary statistics the spreading of values can not be estimated. Such an approach is not really a scientific contribution and is going back to the beginning of the 20th century because the (by now well known) processes of groundwater recharge are not reflected in the method. The test of the method in Spain as well as in Italy and Ireland is no test but an application. There is no independent measurement used to compare with the calculated values. In the end it is a circular reasoning to use the measured discharge of springs to find a factor between precipitation and this measured discharge and then use the factors only in another area – where the factors are adopted. This is no proof of the method but a proof of the (factor) values. This simplified method is also to a certain extent dangerous because the improper work any application in the end is misleading especially in terms of spatial and temporal scales and in terms of process description. The recommendation for the authors is to work more scientifically. Please use the available statistical methods to identify (or verify or falsify) statistical relationships. If for some reasons (e.g. lack of data) a simplification of process description is needed then a serious comparison with measurements and more complex (process oriented) approaches should line out, why which components of detailed process descriptions are not necessary.

Reference cited in review: Lerner, D.N., Issar, A.S, Simmers, I. (1990): Groundwater Recharge: A Guide to Understanding and Estimating Natural Recharge.- International Assoc. of Hydrogeologists; Hannover, Heise.



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