

## ***Interactive comment on “Estimating annual effective infiltration coefficient and groundwater recharge for karst aquifers of the southern Apennines” by V. Allocca et al.***

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General comments:

The estimates of the annual effective infiltration coefficient (AEIC) and recharge over this large area, as described in this manuscript, would be an important contribution to quantification and general understanding of karst aquifers. I think the manuscript could be appropriate for publication after some moderate revisions.

Overall, I think that the manuscript would benefit from a better description of the meaning of the AEIC. I usually think in terms of a the effective precipitation as a percentage

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of total precipitation, but the AEIC is less intuitive, possibly because it is unfamiliar to me. There aren't many references given for AEIC, so I suspect that it will not be widely familiar to other readers either – all the more reason to carefully explain how to interpret this parameter. The introduction states that “for many karst areas around the world, assessment of the groundwater recharge has been carried out by estimating the AEIC.” If this is true, then there should be several references given as examples, but none are given here; if this is not true, then an argument possibly could be made as to why this could be a useful metric for classifying or categorizing karst aquifers, for example. The Discussion and Conclusions section states that AEIC for the southern Apennines is comparable to those in other areas, and references are listed here. A range or ranges of values should be summarized from these other studies as a quantitative comparison.

Presently, the presentation of the AEIC is quite confusing for several reasons. As stated in the introduction, “the AEIC is defined as the ratio between the groundwater outflow and the effective rainfall volumes in a specified time.” However, this is inconsistent with the definition in equation 5 because the denominator does not represent the effective rainfall, as stated in the introduction. To get effective rainfall, runoff  $R$  would need to be accounted for (effective rainfall =  $AP - ETR - R$ ), but  $R$  is not included in equation 5. Second, the denominator includes groundwater inflows  $U_i$  in addition to  $AP$  and  $ETR$ . The first sentence in section 3.3 states that the AEIC was estimated on the basis of the hydrologic budget equation. However, eq. 5 appears to include all budget components except  $R$ . Also,  $Q_p$  in eq. 5 is not defined, but I suspect that it is meant to be  $Q_t$  (tapped discharge from wells). If all budget components were included in eq. 5, we should have a ratio of 1, which would not be useful. But by leaving  $R$  out of the equation we get a ratio of less than one. So it seems that the meaning of AEIC has to do with the amount of excess rainfall ( $AP - ETR$ ) that the aquifer can accept, with remainder exiting the system as runoff. This seems to be alluded to in the Abstract and Conclusions, but not elaborated on anywhere. I can imagine how the AEIC could be a useful metric; however its meaning is obscured, as presented here. The authors need to explain to us what the AEIC represents and why it might be useful.

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Other comments:

Equations 3 and 4: I think that IE (net infiltration) should not be included in the budget because it is already accounted for by precipitation AP, evapotranspiration ETR, and runoff R ( $IE = P - ETR - R$ ). So IE is double counted in equations 3 and 4. I assume this why IE does not appear in equation 5.

10134 lines 2-5: “A 20-m grid spacing digital elevation model was constructed. . .” What is the source of elevation data? How was this constructed?

10135 lines 13-14: “. . .which was found to be unique at the regional scale and statistically robust.” What is meant by “unique at the regional scale” and “statistically robust?” I found it to be confusing when some of the results, such as these, are inserted in the methods section because these require additional information, which is omitted here but later is elaborated on in the results section. I suggest trying to separate methods and results more clearly to avoid confusion.

10135 line 18 to end of paragraph: What does it mean that these time series were “analyzed?” Does it simply mean that the means of the daily values were calculated for the periods of record indicated? Please clarify.

10136 line 8: Does U-i include allogenic recharge, which was described earlier? Later U<sub>i</sub> is described as groundwater inflow only. Is allogenic recharge accounted for?

10137 lines 16-17: What are these models? Are these the regression models?

Section 4.1 Aquifer extensions and lithology: I’m not sure what is meant by “extensions.” Does this mean the aquifer’s lateral extent?

10140 line 6: It is necessary to provide the confidence interval when stating that something is statistically significant. Also, please describe the hypothesis test. With linear regression, it is common to test if the regression slope is not zero. But we could also test if the slope is greater or less than a chosen value. Please elaborate; otherwise we don’t know exactly what it is that is statistically significant.

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Table 2: To me, it would be more useful to list AEP and recharge in average mm/yr over the area. This would be more comparable to precipitation rates and would make it easier to compare the rates for different aquifers in the table and to other climatic areas of the world. You could consider if it would be helpful to list precipitation in this table. Also, why is the limestone area listed but not the dolostone area?

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 10127, 2013.

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