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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Field-based groundwater recharge and leakage estimations in a semi-arid Eastern Mediterranean karst catchment, Wadi Natuf, West Bank" *by* Clemens Messerschmid et al.

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Dear reviewer,

thank you very much for your comments. Please find enclosed - our answers - two additional files on longterm rainfall and key date spring flow

best regards, also on behalf of my colleagues,

Clemens Messerschmid

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2018-329, 2018.

Seven years representative for long-term rain

Initial remarks & context:

For our model, we measured rainfall, temperatures and soil moisture over a period
(2003/04 – 2009/10), resulting in a set of 7 years of DP-values for 8 respective soil r
(Fig. 2). We normalised rainfall (P) and recharge (DP) for each station/sub-catchmer
area values (mm/a). Such DP over P delivers the recharge coefficient (RC) for each s
respectively. Out of this, we formed average RC-values (%) over the whole period o
station and used this as our estimate of long-term average recharge (station- & forr
This is based on the assumption that the annual rainfall, recorded during these seve
indeed represent long-term annual weather patterns and average rainfall heights.

The important question asked by the reviewers was:

How representative is this 7-a period for long-term meteorological re

In general, a typical long-term average of meteorological records should cover at le
Therefore, our (coincidental) 7-a period should be compared to long-duration rainfa

Procedure:

Representativeness of daily measured springs

Initial remarks & context:

The annual combined spring discharge of the respective spring group outflows was necessary to establish a full annual budget, which was needed for our leakage calculations. To this end we selected 5 springs, which were measured continuously throughout the year, to get a full record of annual spring discharge at the respective springs. The annual spring outflows were then used to calculate the annual flow budget of the entire respective spring group, based on the assumption that these springs and their seasonal fluctuations in output is representative for the entire spring group.

Two of the important questions asked by the reviewers were:

How representative are these springs for the entire group?
Do we have statistical evidence for this assumption?

The following statistics show that the spring flow hydrographs of the daily measured springs are indeed representative for the entire respective spring groups. As shown in the tables below, the ratios between the combined daily measured springs and the entire spring group discharge is very stable.

During four key date campaigns we had measured each individual spring in each spring group to obtain total spring group outflows. Hence, in order to answer the above question, we must compare the results during the key date campaigns with the individual spring outflows for each of the 4 measurement campaigns in order to show that the daily measured springs indeed issue a stable portion of overall discharge in the respective spring group.

We shall here remind on the setting. The five springs belong to two different spring groups as follows:

The 3 springs Abu Sa'efan, Al-Bibi and Al-Qos belong to the spring group BEITILLU (Harat Al-Wad), as shown in Figure 6 (spring group map) of the draft article. The two springs Al-'Akkari and Salem belong to spring group WADI ZARQA. (Beitillu and Wadi Zarqa are the two most productive spring groups.)

The four measurement campaigns were conducted in summer 2003, in winter 2003/04, in summer 2004 and in summer 2007, respectively.

Procedure:

In order to investigate the above question, we documented the flow of the 2 and 3 springs in the respective spring groups during each of the four field measurement campaigns and the total group outflow during each measurement campaign. (*For example, in summer 2003, Abu Su'afan, Bibi and Qos had a daily spring flow of 4, 3 and 12 m^3, respectively. Taken together this equals 19.5 m^3 spring flow. The entire group during that same time had a combined outflow of 98 m^3 daily.*)

In a second step we compared the relative discharge portions. (*For example in summer 2003, the three springs had a share of 4%, 3% and 13% of total outflows, respectively. All three combined had a share of 19.9% of total group discharge in summer 2003.*)

This was done for all four campaigns. And it can be seen below that the relative shares of the daily springs deviates only slightly over time. This is also expressed by the low standard deviation values.

Fig. 2.