Dear Reviewer;

We thank you for your review and comments; we attach a detailed response indicating the changes we have made considering all suggestions. We are confident that we have given a satisfactory response to your suggestions, and we are grateful for the exhaustive review of the manuscript, which has allowed us to correct some mistakes and clarify some issues.

A document differentiating the proposed changes in red text has been attached. In addition, the modified and new figures, which could not be included in the interactive response, are included.

In response to the issues raised by the reviewer general comments:

- It is not clear in the writing if this procedure is mandatory for getting reliable information.

  The need for an exhaustive treatment of the flowmeter logs arose initially to avoid doubts on observed anomalies in the characteristic curves of the step-drawdown test could stem from the reliability of the flowmeter log results. Thus, it had to be shown that such effects were not due to head losses along the well. In addition, considering that the flow velocity used in the Darcy-Weisbach equation is raised to a power of two, the differences between the head losses resulting from considering the actual flow velocity instead of the velocity directly measured by the sonde is greatly amplified.

- One can doubt on the usefulness of all that stuff in small wells.

  Applying the rigorous formulation presented to process the flowmeter logs (Eqs. 3 to 7) and considering that the sonde has a significant diameter (r_D), the values of $\langle V\rangle/V(r_D)$ vary between 0.85 and 0.94. However, if the well diameter is smaller (close to the diameter of the sonde, $V(r_D)$ approaches Vmax, resulting that the $\langle V\rangle/V(r_D)$ ratio presents a greater variation (from 0.50 to 0.83) for the range of Re found, than if the diameter of the well analyzed is used.

- Not that much tricky but absolutely not clearly explained at all in the paper… especially in Section 4.6, on the way they derive conductivities from local measurements of flow rates (from flow logs) and an overall head drawdown between the monitored well and a distant location.

  Following the reviewer's recommendation, several changes have been introduced in sections 3, 4.3, 4.4, 4.5 and 4.6.

  1) In section 3, L-215, the following changes have been made:

  "In most flowmeter logging with several pumping steps, the drawdown used in the Thiem (1906) equation is the same for all of the aquifer stretches in a well, $d_0(s)= h_{DL}(s)-H_{SL}$ where $h_{DL}(s)$ is the dynamic level for the 's' pumping step and H_{SL} is the dynamic level of the entire well. However, under the hypothesis presented in this work, the hydraulic head of each stretch, and therefore the corresponding drawdown, can be different. Numerically, the drawdown of each flow stretch τ_N will be given by the following relation:

  $$d_N(s) = h_{DL}(s) - h_{SL}(N), \qquad (8)$$

  where $h_{SL}(N)$ is the static level for flow stretch τ_N. In short, the proposed method consists of replacing the single drawdown d in Eq. (2) from Rehfeldt by a drawdown for each stretch."

  2) In L-225, we have corrected

  "The proposed method for obtaining the hydraulic head of each flow stretch is to 1) correct the drawdown values of the total head loss due to flow along the pipeline and 2) modify the height of the hydraulic head for each flow stretch until the straight line fitted to the data, $q_N(s)$ versus $d_N(s)$, reaches the maximum regression coefficient (where $q_N(s)$ is the water input in flow stretch N for the s pumping step)."

  3) In section 4.3, L-307, we have added:

  "The static level H_{SL} was measured at a depth of 157 m before the beginning of flowmeter logging. Flowmeter logs were obtained for pumping rates of 20 l/s (measured dynamic level at 172 m), 30 l/s (dynamic level at 178 m), and 70 l/s (dynamic level at 205 m). The drawdowns of the entire well for each pumping rate, without including the head losses, hence are 15 m, 21 and 58 for 20 l/s, 30, and 70 respectively.

4) In section 4.4, L-334, we have added:

"The obtained values of the head loss Δh(s) for each pumping rate are shown in Table 2, which will be used in the calculation of the effective drawdown produced."

In L-370, we have added:

Table 2. Head loss values for each pumping rate in the case study

Q (l/s)	Δh(s) (m)
20	0.06
30	0.92
70	5.42

5) In section 4.5, table 3, we have the next changes:

Table 3. Water inputs of flow stretches for different pumping rates and fractions over the total flow rate Q_T in the case study.

		Pumping rate Q_T (l/s)					
		20		30		70	
Stretch	Depth (m)	Input (l/s) q_N(20)	% of Q_T	Input (l/s) q_N(30)	% of Q_T	Input (l/s) q_N(70)	% of Q_T
Top	0 - 200	10.2	0.53	14.8	0.49	44.5	0.64
T1	203 - 250	7.0	0.34	9.8	0.33		
T2 (*)	250 - 300	0.4	0.02	0.4	0.01	0.8	0.01
T3	300 - 360	1.1	0.06	1.7	0.06	3.8	0.05
T4	360 - 400	−0.9	−0.05	0.1	0.00	5.8	0.08
T5	400 - 430	−0.3	−0.02	0.4	0.01	4.6	0.07
T6	430 - 470	1.6	0.08	2.9	0.10	10.5	0.15

(*) As cited above, this flow stretch is not analyzed because its water inputs are very low for all pumping rates

6) In section 4.6, the following changes have been made:

Before L-385 we have added the explanation of the calculation of permeability, which, as the reviewer rightly points out, had not been specified.

"The permeability of each stretch has been calculated using Eq. (2). Instead of the contribution of each layer q_j, the sum total of the contributions of each stretch q_N(s) is considered (see table 3). The unique initial drawdown d considered in Eq. (2) has been modified by the drawdown of the entire well d_0(s)= h_{DL}(s)−H_{SL}− $\Delta h(s)$ for each pumping rate (s) ($\Delta h(s)$ being the head losses showed in table 2). The static level H_{SL} is 157 m (as determined before the flowmeter logging was conducted) and the dynamic levels h_{DL}(s) are 172 m for pumping rate of 20 l/s, 178 m for pumping rate of 30 l/s y 205 m for pumping rate of 70 l/s. The thickness of each layer Δz_j has been replaced by the thickness of each stretch $\Delta z(T_N)$ (depth intervals in Table 3). The radius of influence (R_0) considered is 950 m (as in the previous calculations), and the well radius (r_w) is 0.404/2=0.202 mm. The characteristic curves of each stretch are shown in Fig. 9.a."

Following the reviewer's comments on Fig. 6, the axes of the graph in Figure 9 have been inverted, being now d_N(s) versus q_N(s). A new figure has also been added (Fig. 9.a) showing the resulting curves considering a unique hydraulic head for all stretches. It should be noted that by inverting the axes (d_N(s) versus q_N(s) instead of q_N(s) versus d_N(s)), the coefficients of the fitting curves are the inverse of those shown in the old figure.

7) In the paragraph of L-385 we have made the following changes:

"Analyzing the specific capacities of different flow stretches, τ_1 and τ_3 show the expected proportionality for a confined aquifer. However, this is not the case for flow stretches τ_4, τ_5 and τ_6, whose $d_N(s)$ versus $q_N(s)$ data fit to a power function with exponents of 0.22, 0.37 and 0.67, respectively (see Fig. 9.a). Not only does this not reflect Darcian behavior, but it also indicates an exponent p in the Jacob equation of less than 1, as is the case with the well as a whole (see Fig. 6)."

8) In the paragraph of L-390 we have made the following changes:

"However, if it is considered that flow stretches τ_4, τ_5 and τ_6 have different hydraulic heads, the results vary. Through an iterative process, the value of the static level (hydraulic head) of each flow stretch for which the total water input of the flow stretch versus the drawdown acquires greater alignment can be determined. This means that when the data are fitted to a straight line, the regression coefficient is maximum. In other words, the resulting exponent in the Jacob equation when the data are fitted to a power function is p=1. Thus, for flow stretch τ_6, the static level for which inputs versus drawdown acquire greater alignment occurs at a depth of 165 m. Similarly, the resulting static level for flow stretch τ_5 is located at a depth of 175 m. For a pumping rate of 70 l/s, flow stretch τ_4 undergoes an "activation" effect (even higher than flow stretch τ_5) when the dynamic level exceeds the true static level of τ_4, which is computed at a depth of 177.5 m. Summarizing, the hydraulic heads $h_{SL}(N)$ obtained with this criterion are 157 m for τ_1 and τ_3; 177.5 m for τ_4; 175 m for τ_5; and 165 m for τ_6."

9) In L-398 we have added:

"Figure 9.b shows the regression lines of water inputs versus drawdown for each stretch, with the corresponding relationships and R^2 coefficients"

New Fig. 9 and its caption:

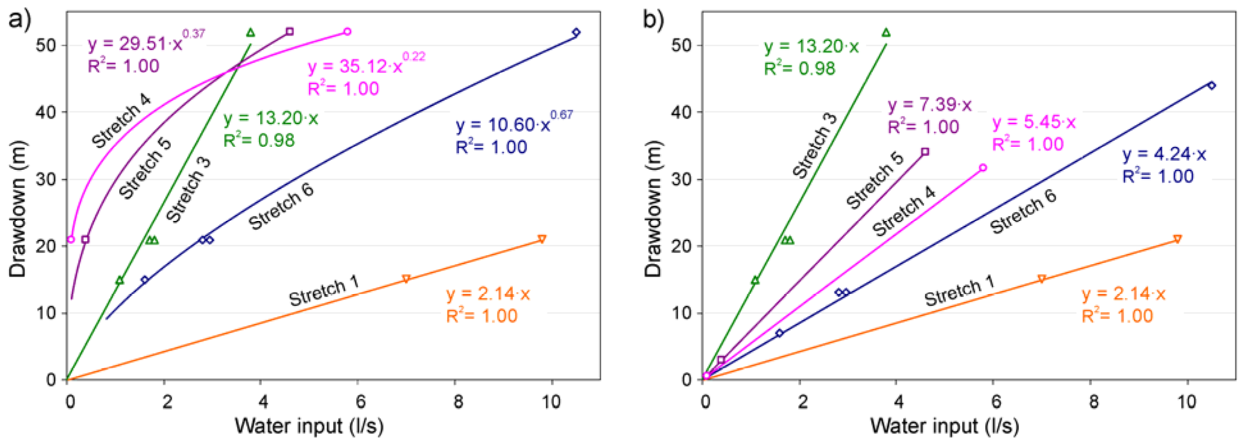


Figure 9. Drawdown versus water inputs for different flow stretches in the case study. a) $d_N(s)$ # $q_N(s)$ with a unique hydraulic head for all the stretches. b) $d_N(s)$ # $q_N(s)$ with the modified hydraulic heads for each stretch obtained considering that p is at least equal to one in the Rorabough equation).

10) In L-401, the next changes have been added:

With these differentiated static levels, the hydraulic conductivities of each flow stretch were obtained using a next change of Eq. (2) (Rehfeldt et al. 1989) replacing $d_0(s)$ by $d_N(s) = h_{DL}(s) - h_{SL}(N) - \Delta h(s)$, which values are presented in Table 4.

Next, we have added:

The successive relationships used to arrive to the actual permeability with depth have been:

Thiem (1906)	→	Rehfeldt et al. (1989)	→	Adapting to stretches	→	With actual T_N hydraulic heads
$k = \frac{Q}{2\cdot\pi\cdot b\cdot d} \ln \frac{R_0}{r_w}$	→	$k_j = \frac{q_j}{2\cdot\pi\cdot\Delta z_j\cdot d} \ln \frac{R_0}{r_w}$	→	$k_N(s) = \frac{q_N(s)}{2\cdot\pi\cdot\Delta z(T_N)\cdot d_0(s)} \ln \frac{R_0}{r_w}$	→	$k_N = \frac{q_N(s)}{2\cdot\pi\cdot\Delta z(T_N)\cdot d_N(s)} \ln \frac{R_0}{r_w}$

It must point out that the k_N is the same for the different (s) because the ratio $q_N(s)/d_N(s)$ is the same for any pumping rate ($d_N(s)$ versus $q_N(s)$ are fitted to a straight line).

11) In L-403, table 4, the next changes have been made:

Table 4. Specific capacities and permeabilities of flow stretches for the static level determined in the case study

Stretch	$h_{SL}(N)$ (m)	$q_N(s)/d_N(s)$ (m^2/s)	k (Darcy)
Top	157.0	-	-
T_1	157.0	$4.7\cdot10^{-4}$	$1.3\cdot10^{-3}$
T_2	157.0	-	-
T_3	157.0	$7.5\cdot10^{-5}$	$2.0\cdot10^{-4}$
T_4	177.5	$1.8\cdot10^{-4}$	$5.3\cdot10^{-4}$
T_5	175.0	$1.4\cdot10^{-4}$	$5.4\cdot10^{-4}$
T_6	165.0	$2.4\cdot10^{-4}$	$1.0\cdot10^{-3}$

12) Sentence in L-406 has been modified as follows:

"The average hydraulic conductivities of the stretches in the studied part of the well (200 to 470 m) have values between $2\cdot10^{-4}$ and $1.3\cdot10^{-3}$ Darcy, providing a geometric mean value of $5\cdot10^{-4}$ Darcy, which is close to the average hydraulic conductivity obtained with the pumping tests."

Specific Comments

– Line 96. Not well said. A single scalar value (that of a conductivity in a layer) is always proportional to another one (that of the whole wellbore) up to a multiplying constant: a = (a/b)*b!

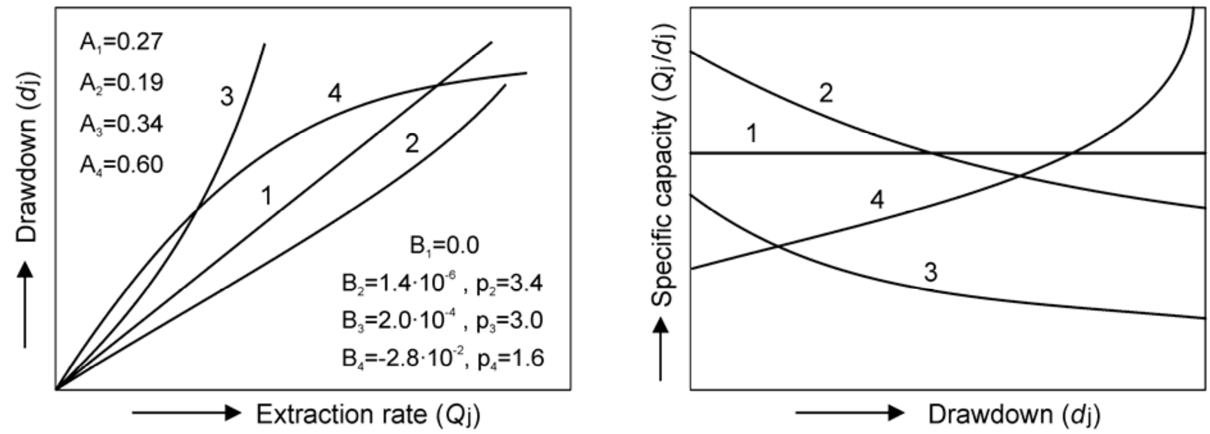
We appreciate the reviewer's recommendation; we have added the following in L-97:

"To achieve hydraulic interpretation from flowmeter logs, most authors (Molz et al., 1989; Rehfeldt et al., 1992; Ruud and Kabala, 1996; Zlotnik and Zurbuchen, 2003a; Barahona-Palomo, et al. 2011; Riva et al., 2012) start from the basis that hydraulic conductivity values for each permeable layer (from each screen) are proportional to the hydraulic conductivity of the entire well up to a multiplying constant."

– Fig. 1-left (or Fig. 6). I would have swapped in one of the figs the horizontal and vertical axis, so they can read exactly the same way without leaning the head at 90° in Fig 1-left, to find the same plot as in Fig-6.

By the way, in Fig. 1-left the coefficient "A1" = 0.6 should read "A4" = 0.6.

Many thanks for the correction; we have replaced A1 by A4.



We appreciate the reviewer's suggestion. We have opted to modify the Fig. 6 (instead Fig 1-left as proposed by reviewer) because it is easier to recognize the Jacob (1947) or Rorabaugh, (1953) behavior ($d=A\cdot Q+B\cdot Q^p$). We have divided figure 6 in two graphs, one with the drawdown in ordinates versus pumping rate, and the other with the drawdown in abscissas versus specific capacity.

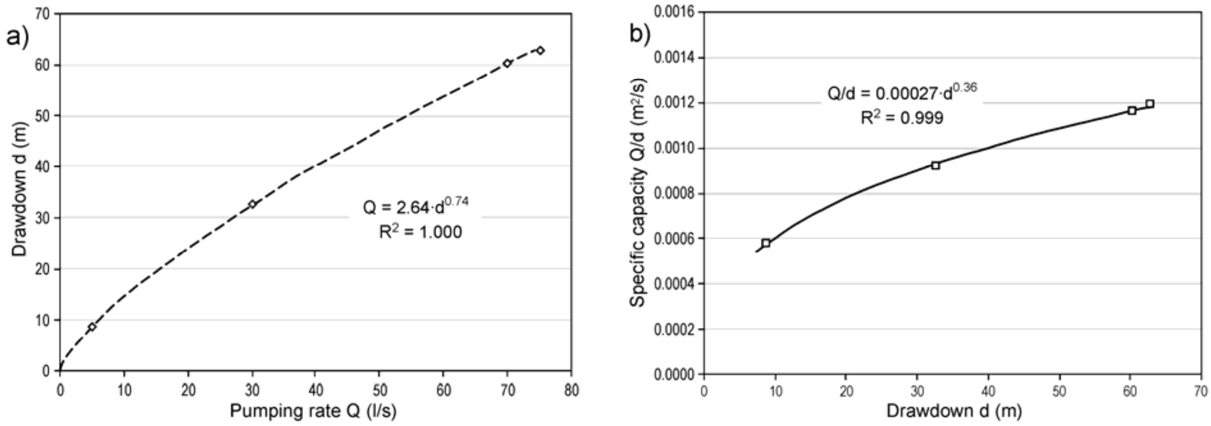


Figure 6. a) Drawdown versus the pumping rate, b) and the specific capacity versus drawdown in the case study.

– Line 180. Specify which terms are involved in the Reynolds number, especially the "length" that I guess to be the diameter (radius) of the well.

Following the reviewer's recommendation, we have added in L182:

"It begins by taking the measured velocity V_{meas} at a given depth as the initial flow velocity and the initial Reynolds number Re_{ini} according to its definition, that is, $Re=\rho\cdot\langle V\rangle\cdot D/\mu$, where ρ is the water density, D the well diameter and μ the dynamic viscosity."

– P. 7, Fig. 2. Specify that k in the notations Re_k is the iteration index of the convergence algorithm, and not anything else.

We appreciate the reviewer's recommendation. We have modified the subscript of Re according to the one used in Figure 7 and we have added the following clarification in L-187:

"Then, using the relationship for the velocity factor $F_{vel}(\tau)$, defined as the ratio between Vmax and the flow velocity $\langle V\rangle$, the first flow velocity is obtained with the corresponding Reynolds number Re_{ini}, which is closer to the actual value. Applying $\tau(Re)$, $V(r_D)$, and $F_{vel}(\tau)$, a new Re value Re_k is obtained (k being the iteration index of the convergence algorithm). This process is repeated until a given convergence criterion c_{CR} is reached, following the flow chart in Fig. 2 (adapted from Díaz-Curiel et al., 2020), to obtain Re(z)."

– Line 200, Eq. 7. Please also remind the form employed for the Darcy-Weisbach equation. Several form exist, even if one can guess that in here the form is: Gradh (or Deltah) = (f/2g)*(V^2/D) (D effective diameter of the well, g gravity, V water velocity, and f friction factor).

Following the reviewer's recommendation, we have added in L-198-199:

"Once the Reynolds number at each depth is known, the head loss can be obtained by the Darcy-Weisbach equation (Darcy 1857; Weisbach 1845), given by $\Delta h = f \cdot (\ell/D) \cdot (\langle V \rangle^2/2g)$, where g is the gravity acceleration ($m \cdot s^{-2}$), $\langle V \rangle$ is the average flow velocity ($m \cdot s^{-1}$), D is inner diameter of the well (m), ℓ is the length of each considered pipe element (m), and f the friction factor (dimensionless) for smooth pipes given by Eq. (7):"

– P. 13, Table 2. Not clear how the deltah in the table are calculated. Is that a mean from bottom to top handling a mean friction factor and a mean velocity over the whole depth investigated? Or is that (what I think better) the cumulated Delta h adding the successive local delta values relying upon local friction factors and local water velocities?

The reviewer is right in his assessment, and to make it clearer we have added in L-333:

"The total head loss below the pump is obtained by integrating the head loss throughout the well based on the flow velocity obtained at each depth (see Fig. 7), that is, the cumulated Δh adding the successive local head loses values relying upon local friction factors and local water velocities."

Reviewing the manuscript, we have noticed an error in L-340:

"In this case, the friction factor reaches values six times higher at the bottom of the well than at the initially recorded depth, and the value of the head loss is low (0.006 m) because …"

would be:

"In this case, the friction factor reaches values six times higher at the bottom of the well than at the initially recorded depth, and the value of the head loss is low (0.06 m) because …"

– P. 15, Fig.8-a (the three left plots). It I unclear to me what mean the alternating grey and white bars beneath (left to) the three curves. They do not seem to be the alternation of geological layers, as they are not the stretches (#1 to #6) reported in Fig. 8-B (the three right plots). Do they correspond to intervals where the monitored velocities in the flow logs are quite uniform?

This was not its purpose. The bars only reflect the depth intervals of each screen (we segmented the measured continuous logs with vertical segments thinking that it reveals that flow only increases in screens, and it better shows the flow steps between them, but if you think we should return the bottom and top points of the flow rate in each screen to its center, please let us know). To clarify this we have added in the caption of Figure 8:

"Figure 8. Flowmeter results in the case study (grey horizontal bars reflect the depth intervals of each screen). a) upward flow rate versus depth; b) water inputs from each screen."