

***Interactive comment on* “Characterization of deep aquifer dynamics using principle component analysis of sequential multilevel data” by D. Kurtzman et al.**

Anonymous Referee #1

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General comments

The study deals with results of sequential multilevel profiles obtained in a well penetrating a contaminated aquifer. Chemical results analyzed by PCA, together with monitoring of the electrical conductivity of water, allowed to interpret the origin of the observed changes in the hydrochemical profile of the aquifer. The paper presents an original analysis for a contaminated aquifer case-study, strictly applying methods and tools well-known in literature. The contribution to scientific progress within the scope of HESS consists in the demonstration that sequential multilevel profiles, when correlated

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to the aquifer hydrodynamics, represent an efficient method for evaluating the contamination propagation in the aquifers. The overall quality of the discussion paper can be considered good. Some suggestions concerning mainly the presentation of the results and the structure of the paper are given in the next sections.

Specific comments

1. In Section 2.1 (Site and observation well), a concise description of the geological and hydrogeological context of the well location can better introduce the reader to the following matter of the paper, such as that reported at lines 22-24 pag. 9493 concerning the presence of discontinuous clayey lens in the aquifer. 2. I think that a better structure of the manuscript can facilitate the reading of the paper. I suggest a division of results from discussion, rearranging the contents of the sections 3.1, 3.2, 3.3 and 3.4. 3. Please indicate the reference of the equation 1 employed for the estimation of specific discharge; also the mathematical presentation of the equation and its solution could be improved. 4. Line 10 pag. 9492: Please check " $v \approx 150 \text{ m yr}^{-1}$ " (or 160 m yr^{-1} ?). 5. The contents of the section 3.3 could be replaced in the section "Results" before the presentation of the results of PCA. The contents of the section 3.3 cannot be considered "Supplemental information" but they constitute an important part of the hydraulic characterization of the overlapped aquifers. 6. The final version of the paper requests a better revision and editing, as regarding to the language, symbols and figures (see next section).

Technical corrections

Some of the aforementioned technical and typographical corrections requested are the following: 1. Line 20 pag. 9482: Please replace "data. (b) The fact" by "data; (b) the fact". 2. Line 28 pag. 9488 and lines 1, 3, 5, 13, 15 pag. 9489: Please use homogeneous symbols for the type profile (types (a), (b)... in section 3.1 and types a, b... in section 3.1). 3. Line 14 pag. 9490: Please replace "bodies: Depths" by "bodies: depths". 4. Line 22 pag. 9491 : "packed-of" or "packed-off"? 5. Line 6 pag. 9492:

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Please check the symbol “L” and unit “L”. 6. Line 13 pag. 9494: Please explain the symbol “P”. 7. Fig. 1: Please use a more appropriate lithological term for “loam” (silt ?). 8. Fig. 2: Please explain in the caption the symbols “wt”, and horizontal stripes and dash lines. Please check “red 3 cells” (red-3 cells ?). 9. Fig. 3: What does “LOQ – limit of quantification” refer to? 10. Fig. 4: Several labels are placed one upon another. Please improve this figure. I suggest a general language revision to make the reading of the paper more fluent.

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