Hydrology and
Earth System
Sciences
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Discussions

# *Interactive comment on* "The effect of training image and secondary data integration with multiple-point geostatistics in groundwater modeling" *by* X. He et al.

**Anonymous Referee #2**

Received and published: 9 December 2013


_____ General Comments _____

a) The paper discusses the sensitivity of the results of groundwater flow and trasnport models with respect to different approaches for the integration of geophysical data in the multiple point simulation of porous aquifers.

b) The manuscript is more appropriate as a technical note than as a scientific paper.

c) Several details about the geophysical data processing and the mathematical model are missing. Some choices done for data processing are not satisfactory. These remarks weakens the value of the paper.

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1.Does the paper address relevant scientific questions within the scope of HESS? Yes.

2.Does the paper present novel concepts, ideas, tools, or data? Partly.

3.Are substantial conclusions reached? No, see comment c) above and specific comments listed in the answer to question 4. below.

4.Are the scientific methods and assumptions valid and clearly outlined? No, see specific comments 3), 4), 6), 7), 8), 9), 10), 11) below.

5.Are the results sufficient to support the interpretations and conclusions? Partly, see answers to questions 3. and 4.

6.Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? No, see specific comments 4), 5), 6), 7) below.

7.Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Partly.

8.Does the title clearly reflect the contents of the paper? Yes.

9.Does the abstract provide a concise and complete summary? Partly.

10.Is the overall presentation well structured and clear? No, see specific comments 1), 3), 5), 6), 9) below.

11.Is the language fluent and precise? Not always, see technical comments below.

12.Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? No, see specific comment 6) below.

13.Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? No.

14.Are the number and quality of references appropriate? Generally yes, see specific comment 2) below.

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15.Is the amount and quality of supplementary material appropriate? No supplementary material is available.

_____ Specific comments _____

1) The paper objective should be clearly stated in the introduction. It is shortly mentioned at lines 3-5, page 11832.

2) References at page 11831, lines 1-3, are quite limited. A long list of papers could be added and I wonder whether the chosen references are the more appropriate.

3) The description of the geological data (page 11832, line 23 to page 11833, line 5) is rather poor. Moreover, some cross sections could help to illustrate the geological structure.

4) Page 11833, line 9; page 11835, line 16. Which data? Field raw data, e.g., apparent resistivity? Or the results of field data inversion? These results are used to differentiate lithologies: how is the effect that the spatial variability of pore water electrical conductivity has on the bulk resistivity accounted for?

5) Page 11833, lines 14-15. What is the SSV model? I could not find the referenced paper.

6) Sections 3.1 and 3.2 should be rewritten, as the terms appearing in the equations are not clearly and completely defined, so that it is very difficult to follow the devlopment.

7) Page 11835, line 18. I do not understand how the log data, which are discretized at 0.2 m resolution, are compared with SkyTEM data, which are discretized at 5 m resolution (see page 11833, line 10).

8) Section 3.3. I think that it would have been more appropriate to work with the logarithm of resistivity rather than with resistivity itself. Equation (6) shows that $P\_S$ is related to lnR. Moreover, the difference between 10 ohm m and 20 ohm m is much more relevant, from the point of view of geological interpretation, than the difference

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between 110 ohm and 120 ohm m. Therefore, my opinion is that it would have been more appropriate to bin resistivity with a log scale.

9) The geometry of the groundwater model, in particular its bottom, should be better explained at page 11837, line 17 to page 11838, line 1.

10) The choice of a 15-meters-thick shallow layer is not coherent with the rest of the model. I understand that this choice is motivated by the difficulty of modeling cells which become dry in MODFLOW, but other computer programs are available, which could deal with this problem, or even some packages for MODFLOW (see, e.g., doi:10.1111/j.1745-6584.2011.00829.x, doi:10.1111/j.1745-6584.2001.tb02474.x, http://pubs.usgs.gov/tm/tm6a37/).

11) The boundary conditions for the flow models must be discussed.

_____ Technical corrections _____

Page 11830, lines 5-6. I suggest to specify that TIGenerator is a sofwtare code, rather than a processing method.

Page 11830, line 9. Add "a" before "TI".

Page 11830, line 10. Substitute "delivers", possibly with "yields", or - even better - rephrase the sentence.

Page 11830, line 14. I prefer the use of "interpolation" for a physical quantity, e.g., temperature, pressure, etc., whereas I think that "correlation" is more appropriate to describe the process of drawing links (correlations) among well geological data.

Page 11832, line 11. Add "es" to "reach".

Page 11833, line 12. Substitute "Besides the geological data,", possibly with "From the geological data,".

Page 11834, line 12. Substitute "possession" , possibly with "availability".

Page 11836, line 3. Erase "(Eq. 6)".

Page 11836, line 15. Add "as" after "denoted".

Page 11837, line 7. Substitute "deterministic or statistical" with "deterministically or statistically".

Page 11837, line 23. Add "the" before "geological model".

Page 11838, line 5. Substitute "to" with "with".

Page 11838, lines 15-16. Erase "In total... developed.".

Page 11840, lines 7 & 9. Substitute "discrete".

Figures 3, 5, 6, 8, 9 & 10. Add linear dimensions to the plots.

Figures 3 & 5. Substitute "Lateral", possibly with "Vertical".

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 11829, 2013.

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