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Hydrology and Earth System Sciences Discussions

Interactive comment on "The role of integrated high resolution stratigraphic and geophysic surveys for groundwater modelling" *by* S. Margiotta et al.

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The Authors asked me to comment their paper and I submit some comments with pleasure.

General comments

The paper is an interesting application of different methods to characterise underground – natural and artificial – structures and their effect on ground water contamination.
The work consists of three parts that describe the different methodologies that are ap-

plied in a “sequential” approach: geological survey, flow modelling, geophysical survey. The first and the third part are well written and clear, whereas the central part on flow modelling misses some details, which could be very useful to properly reveal the value of the work and improve the paper’s quality, as mentioned in the specific comments below.

A general point that requires clarification is the model calibration. At page 2860, line 6, page 2872, lines 1-5 and 14-21, it is not explicitly stated which data are used for calibration. Inverse models usually are based on comparison between observed and computed heads. Here the Authors mention also stratigraphic data. The description of the calibration procedure (which model parameters are identified, which data are used as targets for the evaluation of the goodness of fit, which method is used to adjust parameters, etc.) should be improved.

Specific comments

The title is possibly misleading, since it suggests that geological and geophysical surveys are aimed to improve groundwater modelling, whereas the work follows a different path, as it is stated in the abstract and throughout the whole paper. I suggest: “A sequential integration of stratigraphic, modelling and geophysical studies to characterize a contaminated area”.

The Authors should expand the description of the purpose of the study at page 2861, line 9. They should also give some information on the contaminants that are found in the study area and possible sources.

At page 2865, lines 27 and following, it is not clear that the Brindisi sands unit has been recognised in this work and this represents a novelty of this paper. This is stated only in the final discussion (page 2875, line 20).

There is a contradiction between lines 19 and 28 at page 2866 about the thickness of subapennine Clays: is thickness never less of several decametres or is it as small as a

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few meters at some places?

Is it possible to assess the vertical component of the hydraulic gradient, so that one could quantify the leakage from the shallow aquifer to the deep aquifer (page 2868, line 24)?

Measurements taken at different depths in boreholes were obtained isolating different portions with packers? Are the boreholes screened along their whole length (page 2869, line 8)?

The results of the model do not fully support the remark (page 2871, lines 3-4) that groundwater flow is directed toward the sea. A piezometric map obtained from field data could be useful.

Are DT and SB considered as a single undifferentiated layer in the mathematical model, despite the differences between their hydraulic conductivities (page 2871, lines 16-17)?

Details about correlation and interpolation of the stratigraphic discontinuities could be useful and interesting (page 2871, line 20).

Details about the choice of boundary conditions could also be useful and interesting (page 2871, lines 21-23). For instance, what about the contact between ground water and see water?

I understand that the model was developed for steady flow. This should be stated clearly and the sentence at lines 23-25 at page 2871 could possibly be erased.

Details on source/sink terms in the groundwater flow model are missing (recharge, abstraction from wells, springs, etc.).

At page 2872, after line 21 it would be useful a short discussion of specific conclusions from the modelling study and how this was used to choose the characteristics of the geoelectrical survey.

At page 2875, line 3, it could be useful to mention the expected type of pollutants and

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how they could alter (increase or decrease) electrical resistivity; this could be recalled and discussed again at page 2877, line 15.

Technical corrections

In figure 3 it is not apparent the lack of topsoil where eluvial deposits outcrop, as stated at page 2863, line 25.

At page 2863, lines 5 and 11, is “private research” used for “professional studies”?

At page 2871, lines 14 and following “layers” and “surfaces” are somehow mixed.

At page 2874, I would prefer the term “geoelectrical unit” instead of “electro-layer”, because it could give a better idea of the complex underground setting, which is only approximately represented as a layered structure.

The discussion of the stratigraphic setting could be shortened by introducing a table where data such as thicknesses, height of the bounding surfaces, etc. are listed for the stratigraphic units.
The introduction to section 5 (from page 2872, line 23, to page 2873, line5) could be reduced.
Sections 6 and 7 could be merged.
These modifications could create some space to include the missing details on the groundwater flow model and to avoid an excessively long paper.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 2859, 2008.