Hydrology and Earth System Sciences

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Discussions

Interactive comment on "Updating hydraulic properties and layer thicknesses in hydrogeological models using groundwater model calibration results" *by* A. Lourens et al.

Anonymous Referee #2

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General comments

This paper tackles a very relevant topic. It presents a method to update layer thicknesses and hydraulic conductivities of geological layers from a geological model by using calibrated hydraulic conductivities from groundwater flow models of aquifers or aquitards that consist of some of the geological layers from the geological model. This is very relevant since geological models and groundwater flow models are often both available in a certain area. Both types of models have uncertainties. Typically groundwater flow models use model thicknesses and parameter values from the geological models, but this paper shows that also output from the groundwater flow model might

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improve the geological model. As the borehole data that is used to build the geological model is also uncertain, the authors investigate whether this uncertainty can be reduced by using results from a calibrated groundwater model. I think this is a very interesting research question.

As the approach is unconventional and as the method consists of many different sub-steps, it is not easy to understand all details of the methodology during the first reading. I suggest the authors add a flowchart showing all the different steps in the methodology. I also suggest to replace the term "groundwater model" by "groundwater flow model" so that the difference between the hydrogeological model and the groundwater flow model is clear since this is essential for a good comprehension of the paper. It might also be helpful if the authors provide some definitions in the beginning of the paper about how they define hydrogeological model, groundwater model, lithological layer, model layer, aquifer, . . . and what are the differences between all these terms.

The paper is written in good quality English.

Specific comments

- Page 4192, Line 10: which "parameters"?

- Page 4196: "we assume that the PDF of the hydraulic conductivity for a given litho-layer does not change in space". This is an important assumption. Can the method be extended without this assumption? This might be very interesting. I would like to see some discussion on this.

- If I understand correctly the optimization of the thickness and hydraulic conductivitiy is done per grid block. Is it possible that neighboring grid block are assigned very different thicknesses and hydraulic conductivity leading to big or unrealistic jumps in layer thicknesses or hydraulic conductivity?

- 2.4 Layer thickness uncertainty: The roundoff error is considered as the layer thickness uncertainty. Is misclassification of a layer by the geologist describing the borehole

material not a bigger error than the roundoff error? Is this considered?

- The variogram models are tabulated but no graphs are shown showing the correspondence between experimental and modeled variograms. This would be interesting to judge the quality of the variogram models.

- Can the uncertainty of the calibrated values be incorporated in the method? From the calibration of the groundwater flow model by PEST for example, you can get uncertainty bounds of the optimized parameters. This information could be used to decide on a trade-off between the flow model results or borehole information based on their accuracy. Could this be possible? Please provide some discussion on this.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 4191, 2015.

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