

Interactive comment on “An automated method to build groundwater model hydrostratigraphy from airborne electromagnetic data and lithological borehole logs” by P. A. Marker et al.

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This manuscript is a valuable contribution to the field of airborne EM for hydrological applications. Airborne EM is regarded as an extremely useful tool to collect data for medium to large areas in a short time and at reasonable costs. The interpretation of the often large datasets into meaningful parameters in geological and hydrological modeling is an important issue that warrants further research. The approach in this paper shows that by integrating borehole data and airborne EM data, a geohydrological model can be created that shows reasonable performance when calibrated against groundwater heads and river discharge. The approach in this paper deserves

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attention in the groundwater modeling community, because it can be used in areas where airborne EM and borehole data exists, together with hydrological data to calibrate a groundwater model. There are some issues in the paper that need to be clarified a bit, I will outline them below. One issue that needs clarification is the fact that the airborne EM data is used in the inversion into resistivity, next the resistivity in an inversion together with borehole data in the Clay Fraction model and finally the clustering method uses both resistivity and Clay Fraction (which is again a derivative of the resistivity). This repetitive use of the airborne EM data is of course very clever, because the resistivity datasets provides a dense 3D coverage, but it also needs some more explanation of the potential pitfalls. There is the danger of using the same data more than once that errors that are present in the data (as there always are) propagate along several ways into the end product. Also, by using the same dataset in different - but related - methods, one might end up in a “chicken-egg” situation. Is the result achieved by processing the same dataset sequentially using different methods really contributing to an improved end-product. Especially the fact that the combination of resistivity and borehole data is both used in the Clay Fraction model and in the clustering needs some better explanation. Are we looking at real improvements or is it merely presenting the correlated datasets in different ways? For example, why not using a simple cut-off in the Clay Fraction model to derive at clusters in the data? Because the resistivity is already used in making the Clay Fraction model, I would think that the result might not be very different. I understand that the Principal Component Analysis is crucial in the clustering method, but I am not sure that it is really contributing to a better end product. I am not saying that the cluster method is not correct to use here, but I would like to have a better understanding of the implications of the repetitive use of the same datasets. Another issue with the clustering method is the fact that k-means clustering aims at producing clusters of approx. the same size. This might have an unwanted influence on the results of the clustering, since there seems no reason to assume that the clusters in the hydrostratigraphic model needs to be of equal size. In the paper, another model is used as a “benchmark” or a

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so called reference model. This model I would not call a benchmark model, because it is also just a model! Although there is some geological knowledge inserted into this model, this knowledge is later collapsed into only four hydrological units. Keep in mind the phrase: “all models are wrong, some are useful”. The results of the research in this paper indicates that for the purpose of hydrological modeling, the presented method shows better results in terms of deviation from measured groundwater heads, compared to another model. In the uploaded file I have added some specific issues about the manuscript.

Please also note the supplement to this comment:

<http://www.hydrol-earth-syst-sci-discuss.net/12/C643/2015/hessd-12-C643-2015-supplement.pdf>

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