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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Voxel inversion of airborne electromagnetic data for improved groundwater model construction and prediction accuracy" *by* N. K. Christensen et al.

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Overview This study established a framework to construct and calibrate the large-scale groundwater model using AEM data as supplement rather than using only hydrological data. First, voxel inversion approach was applied to acquire a 3D geophysical model (resulting in 3D resistivity field) using AEM data which resolved the spatial scale mismatch between traditional 1D measurement position and 3D groundwater model. Then, two shape parameters of petrophysical relationship which connect the resistivity filed and hydraulic conductivity field were inversed to produce spatial optimal 3D hydraulic conductivity. Final, the calibrated hydraulic conductivity field was implemented in groundwater model to get improved model predictions. The study compared the impact of smooth constraint and sharp constraint method used in geophysical inversion

part on four types of predictions of the groundwater model, as well as the quality of AEM data. Both the experiments design and manuscript are presented meticulously and thoroughly. However there are still some questions and comments listed below.

General comments 1. In section 3.3, depth and direction dependent horizontal constraint factors were used for both smooth and sharp inversions, and the constraint factors assigned for the two inversion methods are different. However, in the results part, the author compared the impact of the two methods on the predictions of flow model, is the comparison fair?

2. In section 3.4, the author weighted the river discharge observation more than hydraulic head observation when defined the objective function. Why the author think that the calibrated models have error in their simulation of hydraulic head but not in simulation of river discharge?

3. Figure 1 in this manuscript described the conceptual flowchart for the sequential hydrogeophysical inversion. The whole framework of the experiment process was clearly displayed by the flowchart, however the content and details of each experiment step are obscure. It is hard to understand that what kind of experiment was conducted exactly in this research without reading the text description, thus I suggest the author modify the flowchart to make it intelligible.

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