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“Hydrogeological characterisation of a glacially affected barrier island – the North Frisian Island of Föhr” by T. Burschil et al.

Author Comment to Referee #2 by Thomas Burschil et al.

We thank Referee #2 for the careful review and constructive comments! Below we comment (indicated by **AC**) to the reviewer comments (indicated by **RC**).

RC: I have read your paper with great interest. You present a case study where a combination of geophysical investigations and borehole logs were used to improve the geological/hydrological model of the Island of Foehr. Besides the clever integration of different geophysical methods/results in the model building the main scope of the manuscript - hydrogeological characterisation- remains unclear to me.

Therefore I recommend an intensive revision of the manuscript with a much clearer focus/better objectives and a well thought-out plan - major revision.

The following comments are suggestions and I hope you find them useful in improving the quality of your manuscript:

General:

The manuscript has a good overall appearance and the gross structure is sufficient. It shows good data quality and the used methods seem to be successful in compiling and/or improving a geological model. For me the manuscript seems to be two-parted with the geophysical data and model building part much more perfected. The whole characterisation objective doesn't seem well-thought-out and feels rushed together.

The manuscript needs much more clearness, better objectives or clarity about the objectives. The initially mentioned points about groundwater situation and climate change as well as water supply for the future are not elaborated throughout the manuscript.

AC: Thanks for the idea to rename the title. This general comment summarizes the content of the paper so nice, that we used parts of it within the new title. The topic was not really a characterization but more a compiling of a 3D model with developing specific local petrophysical parameter.

Specific:

RC: Title misleading: characterisation....?

AC: new title “Compiling geophysical and geological information into a 3D model of the glacially affected island of Föhr”

RC: Abstract: needs more “results”, not concise, and not conform with Conclusions

AC: we will rewrite the abstract

RC: Section 1: Introduction lacks references, i.e. where is the work situated in these days research. The little intro paragraphs of each section seem to fit more into the general introduction of the whole manuscript. Introduction needs more objective or better definition of aim of the manuscript.

AC: The work concerns geophysics applied to coastal aquifer studies. The overall goal is to answer the question what does climate change scenarios mean for the groundwater. But for this we first need a reliable underground model. We used applications of geophysical methods to elaborate this model. This is demonstrated in this paper. We will elaborate the introduction.

RC: Section 3: I think you should either describe the geophysical data processing in greater detail or give a reference to another publication.

AC: *We wanted to concentrate on the modeling process and just give a short introduction to the specific reader of the HESS journal. We referred to more global references than our internal reports because they are not publicly available.*

RC: Section 3.4 and 3.5: Combined analysis and 3-D model should be much more explanatory, how are the data exactly used to build or improve the model, what part of the data is incorporated into the model? How is dealt with small scale bodies or uncertainties?

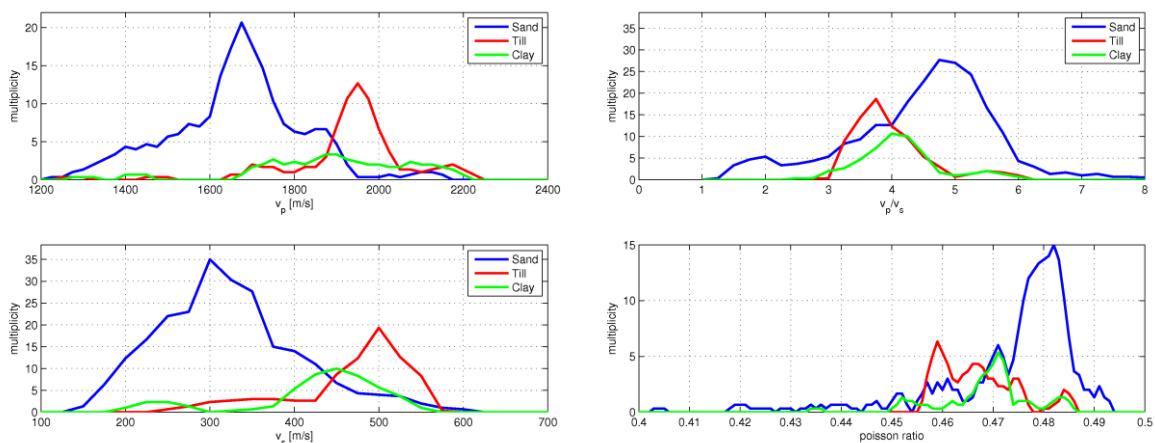
AC: *We will extent these chapters and improve clearness through new figures.*

RC: Section 4: Results chapter hard to follow, partly not understandable what the main focus is.

AC: *We will restructurate the result chapter by more a clearer separation from method section.*

RC: I'm missing comments about other relationships, such as Poisson's ration or at least V_p/V_s ratios.

AC: *We also evaluated Poisson's ratio and vp/vs , but we believe that all information are also provided within the original data, vp and vs .*

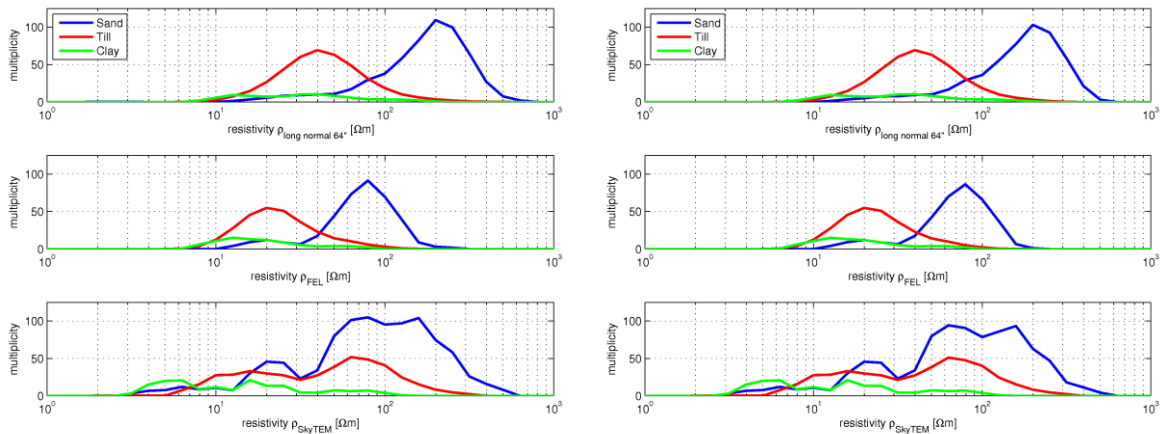


RC: For the characterisation topic velocity and resistivity cross plots of different layers would be indispensable.

AC: *as we abandon the characterization topic we think cross plots will now be dispensable or be too much for this paper. But thank you for this idea, we will try.*

RC: What happens to the petrophysical relationships with different water content (if layers bear more or less water, fluctuating groundwater table)?

AC: *The groundwater table fluctuates in a range of 0.2 m to 0.9 m annually [Hydrogeologisches Gutachten]. Since we are using only deep boreholes with a maximum depth of at least 75 m, near surface effects from dry material (first 10 m) can be neglected. We add here a plot with statistics without the first 10 m, where we can expect dry material from the groundwater table measurements. There are no significant changes between the plot with all values (left panel) and the plot without the first 10 m (right panel).*



RC: Section 5: Discussion needs a more general discussion about the results and not just data quality. On the other site data quality discussion should include some quantitative statements about resolution (limited?, but how good or bad is it , horizontal, vertical, quantitative) Error/Uncertainties discussion, what about interpolation of TEM data and small scale bodies, how can the 3D model be consistent if you are using line and point data?

AC: *We will rewrite the discussion and consider your suggestions and questions.*

RC: The discussion is partly in contradictions with the Abstract (use for groundwater modeling?).

AC: *We rewrite the Abstract.*

RC: Section 6: Conclusions need to state more clearly what the improved model is used for.

AC: *The improved model is used for a better groundwater study, using different global warming scenarios. We will emphasize that in the discussion.*

RC: Please make sure that all listed references are also in the text or remove from References. There could be a supplementary set of data (TEM, seismic).

AC: *All references are cited within the text and we check this again in the revised version.*

RC: Fig 3: needs better caption and/or explanation in text

AC: *We overworked all figures and captions.*

Technical Corrections:

RC: Please be consistent in either British or American English (e.g. analysed vs analyzed, pg 5086 line 21 or characterise vs characterize, pg 5086 line 2 and pg 5087 line11).

Check punctuation throughout the manuscript especially with long sentences.

Page 5086 line 23: island -> Island Page 5089 line 17: yr -> yrs Page 5091 line 22: good data quality -> good quality Page 5092 line 20: acquisition parameter -> acquisition parameters

A few of the figures lack in quality e.g. resolution, annotation size, e.g. Fig 1: annotation too small, Fig 2: resolution of map, etc.

AC: *we will check all these technical comments throughout the finalized paper.*