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Interactive comment on "Finite difference modelling to evaluate seismic P wave and shear wave field data" *by* T. Burschil et al.

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We thank Helga Wiederhold for the helpful short comment. Its consideration is explained below.

SC1: *I find the two models confusing. Why not rejecting model one? You write "the most prominent difference is a discontinuous till layer in the centre of the image at about 80 m depth" or "missing of a strong reflector at about 260 m depth". But you have a discontinuous till layer in your model and you have no layer at 260 m depth in your model. So, why are you astonished to have it or not have it in your modeled seismic section? The modelling is fine, but you start with a too simple model. It is simplified for hydraulic modelling but this makes no sense for seismic modelling. So my proposal: skip this model!*

AC1: The starting point for seismic modeling was the hydrogeophysical model. We wanted to use it as link between hydrogeology and reflection seismics, expecting that it would need improvement to better match the seismic data. However, since the simple model seems to somewhat confuse the readers we skipped this model and rearranged the manuscript with only one model.

SC2: *Why don't you show an example with weathering layer?*

AC2: We included a low-velocity layer (LVL) in the uppermost part of the model (10 m thickness, v_P=500 m/s, v_S=200 m/s, ρ=2000 kg/m3) with a free surface above the LVL to simulate a weathering layer. We chose these values, since the groundwater table is located approximately 10 m below the surface. This setup produced a lot of multiples. Because multiples cannot be observed in the field data we also started to include intrinsic damping (Q). Yet, this was neither able to reduce the differences between field data and modeled data. Therefore, we used the absorbing frame as suggested by Jones (2013). We believe that the simulation of a weathering layer and intrinsic damping are part of the solution. However, our tests showed us that the choice of the right parameters is not a simple task and needs systematic analysis in future work. To account for this important topic, we included a paragraph about modeling with a LVL in the discussion part of the paper.

SC3: *Is it because of computing time? An information on computing time would be nice.*

AC3: It is true, for a realistic weathering layer, we probably will have to reduce the minimum shear wave velocity significantly. This requires a denser gridding, more grid points for the model, and smaller computational time sampling. This would roughly increase the computational time by a factor of 100. So far, we have not quantified the computational time in the manuscript, because it depends not only on program setting, but also on the hardware, which has not been described. However, one shot simulated on two CPUs ran ca. 30 minutes (further settings: dimensions 1200 grid

points times 1000 grid points, time stepping dt=5e-5s, simulation time of t=1s). We added a paragraph about the used hardware and computational time in the manuscript.

Interactive comment on Solid Earth Discuss., 6, 2169, 2014.