

Interactive comment on “Vertical hydraulic conductivity of a clayey-silt aquitard: accelerated fluid flow in a centrifuge permeameter compared with in situ conditions” by W. A. Timms et al.

Anonymous Referee #2

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Main comments

On content:

The main point of the paper appears to be the introduction of a new centrifuge for measurements of low conductivity under more flexible conditions than previously possible. Some effort is made to link this to the heterogeneity of aquitards and the occurrence of preferential flow in them, but this is unconvincing, mainly because only a small number of samples were used and centrifuge measurements of preferential flow is simply not effective for two reasons: 1) if rapid flow occurs it might also have been caused by

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flawed sampling, a gap between the sample and the column wall; 2) the samples in the centrifuge are much shorter than the length a preferential flow path must have to effectively funnel water through the aquitard. The centrifuge contribution alone should be enough to warrant publication though.

A weak point of this study is the use of deionized water for the 1g tests of some cores. Given the high clay content I suspect this makes the resulting data invalid. The authors themselves also point to this, which begs the question why these tests were not made with a solution that represents the in situ solution, and why these data are included in the paper.

In section 5.5 you use the term free drainage, which is usually reserved for unit gradient flow in unsaturated soils. In a 1g system you would have a prescribed head boundary (equal to zero). I believe that is the case here (in the centrifuge) too.

More detailed comments are given in the annotated pdf file.

On the presentation:

You employ many references to later sections in the text. This indicates the text is poorly organized and disturbs the flow of the paper. You probably need to rethink the set-up of the paper and the order of the segments. Using sections 2 through 5 to describe Materials and Methods also constitutes a clue that the organization of the paper is not optimal.

There are several references to Australian standards/regulations that seem to have little relevance for an international readership. Why not instead give an account of the methodology you adopted. A paper should be written in such a way that a competent researcher can repeat the experiment (even though that won't happen).

The paper is too wordy at the moment. It can be easily shortened (and made easier to read) by removing the information that is not relevant to the study (the power of the centrifuge's motor, all kinds background and history of the design, elaborate de-

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tails of alternative methods to measure low conductivities). Include the details of the instruments we need to follow your calculations, give the limitations of alternative measurement methods to show how you improve of them, and give references that allow us to look up the details of these methods if we need them.

Throughout the paper, check for focus. If it does not contribute to the objectives, do not include it.

When you weed out unnecessary wordiness, please also check for botched grammar. On some occasions the paper reads like part of an earlier version was not entirely deleted. This impression is enforced by the occurrence of repetitive statements.

Sections 5.2 and 5.3 have some peculiar grammar in them that makes them hard to understand. Information is given that does not really seem to pertain to the paper, which is very confusing in a Methods section.

Use SI notation throughout (the bar is not an suitable unit for pressure), and go over the number of significant digits – sometimes there are extremely few for an easily measured quantity, like the height of a tube.

HESS is a hydrology journal. You do not need to explain elementary materials such as Darcy's Law in detail.

In Table 3 I cannot match up the void ratio and the particle density with the bulk density (neither dry nor wet, in the latter case accounting for the degree of saturation). I checked this for the first core only (BF C2.8). Please check your calculations.

Why do we need Fig. 7 in a paper on a centrifuge?

Why do the pressure diagrams in Fig. 8 not have scales on two of the horizontal axes, and how are pressure diagrams reflecting 'conceptual relationships'? The message that this figure and the text discussing it try to convey did not become clear to me.

More detailed comments are given in the annotated pdf file.

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Please also note the supplement to this comment:

<http://www.hydrol-earth-syst-sci-discuss.net/11/C1923/2014/hessd-11-C1923-2014-supplement.pdf>

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 3155, 2014.

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