

Interactive comment on “On the measurement of solute concentrations in 2-D flow tank experiments” by M. Konz et al.

Anonymous Referee #2

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This paper provides two methods to evaluate salt concentrations in a 2D tank and compares the results. The first approach uses a photographic image analysis method and relates digitally measured intensities markers (dye levels) to salt concentration. The second method uses a resistivity method to directly measure salt levels. Overall, I think the paper requires a major revision to improve the presentation and to provide a better literature review. Several key papers are not cited - I suggest they read Catania et al. 2008 Assessment of quantitative imaging of contaminant distribution, Experimental Fluids, 44, 167-177. The Catania paper has a very detailed literature review some of them are highly relevant to this work. In the sections, below I have provides several specific comments/questions (11 total).

Specific comments/questions

1) The resistivity method is claimed to be "New". However, it is unclear exactly what is new in this well-established method. The authors claim that no one has provided a detailed presentation of resistivity measurement system and compared this results against photometric method. Such a presentation is a worthy tutorial-type contribution but it should NOT be claimed as "New". The authors should state upfront that the goal is provide the practical details for implementing a commonly used resistivity method for porous media systems. In that case, perhaps they should expand the discussions on resistivity methods and provide a cook-book type step-by-step procedure to use the method.

2) The generic conclusion of this work is that the image analysis is better than resistivity approach for variable-density problems involving salts. If that is the case, why should one learn about resistivity methods? Image analysis is relatively easy and in-expensive, isn't it??

3) In the image analysis section, the key contribution appears to be the idea of relating measured intensities directly to concentration without standardization of optical densities. They identify this need based on Schincariol 1993 work. Interestingly, Schincariol and also the co-author Frank Schwartz have published multiple papers since then, including a recent 2007 paper in the journal of contaminant hydrology. The proposed "idea" should be evaluated in the context of all these recent work.

4) Page-7- How can you relate intensity of dye to salt concentration? What is the salt and the dye move at different rate due to differences in the diffusivity values? Have you checked this?

5) The intensity figures (e.g, fig 3) has several spikes, what are causes of these spikes? Did they affect your overall data quality?

6) The authors state that they get 16 bit tiff images (after conversion) giving them

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65536 intensity values. However, their camera Nikon D 70 acquires only 12 bit images which provide 4096 intensity values. Which means rest of the intensity values are numerically generated (from a proprietary algorithm-dcraw) and cannot be used as true representation of intensity values from the experiment. It is unclear what is really gained by artificially generating 16 bit information from a 12 bit native image?

7) If is unclear how dye concentration was decided (100 g/l of salt was marked with 1 g/l of dye). How much dye should be used? Is dye concentration a function of salt concentration? Need some discussions that address the relative advantages and disadvantages of using very-high or very-low dye concentration levels?

8) Abstract does not read well, need to clearly emphasize your contribution in both abstract and conclusion sections

9) I remember reading some papers on image analysis using other technique (e.g., gamma ray by Oostrom et al. in vadoze zone journal 2007, I think?). These analysts have done extensive review of error analysis. The analysis in this paper appears to be too simple, please review these studies and develop your error analysis based on literature information.

10) The authors explore the impact of image resolution and lens flare. However, there does not seem to be any generality in their approach/analysis that will be of use to readers. Try to establish some guidelines on what to do and what not to do. Also, the entire problem of lens flare will become minimum if one does transmissive experiments, which the authors acknowledge is a better approach. Hence is the real use is unclear.

11) Only temporal variations in concentrations are provided. Can you use the method to map plume contours? This is important since most analysts use image analysis to study spatial variations.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 4175, 2007.

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