

## Reply to Reviewer 3

### General comments:

Authors describe new analytical solutions to oscillatory pumping tests, applied to data collected at the Savanna River Site in South Carolina, USA, and published by Rasmussen et al. (2003). The solutions extend those published earlier by several authors, by now including delayed gravity drainage, finite radius pumping wells and initial conditions in the well bore. The solutions were well described and the writing was clear.

In general, I agree with the others reviewers that much of the in-depth derivations of the solutions can be moved to the appendix or supplemental section so that the authors could spend more time on the geology and results of the study. As presented, only about 1.5 pages of the manuscript was devoted the testing of the solutions with real field data. Moving derivations to the appendix would also improve readability of the manuscript, which as presented is extremely dense and likely would appeal to a very few number of applied mathematicians and/or hydrologists. Simplify the presentation of the material, and more readers will take the time to read the manuscript, and cite the work.

Response: Thanks for the suggestion. The derivation of the present solution has been moved to the supplementary material, and then the Methodology section is shortened. Please refer to the revised manuscript as attached.

### Specific comments:

L340 – Yeh and Chang (2013) not included in the references

Response: The reference of Yeh and Chang (2013) is added.

L377 – replace ‘to’ with ‘with’

Response: Done as suggested.

L385 – check sentence that begins on this line; it is unclear as written and needs some clarification

Response: The sentence is rewritten and given below:

“The phase of Solution 6 (i.e.,  $\phi_s = 1.50$  rad for panel (a) and 1.33 rad for (b)) can be replaced by the phase of Solution 3 (i.e.,  $\phi_t = 1.64$  rad for (a) and 1.81 rad for (b)) so that the  $\bar{h}_{\text{SHM}}$  prediction of Solutions 3 is identical to the  $\bar{h}_s$  prediction of Solution 6.” (Page 16, lines 351 - 354 of the revised manuscript)

L425 – replace ‘researches’ with ‘research outcomes’

L443 – re-write portion of sentence as ‘the effect of DGD on head fluctuations should be considered.’

Response: Thanks, they are modified as suggested.

## Reference

Yeh, H. D., Chang, Y. C.: Recent advances in modeling of well hydraulics, Adv. Water Resour. 51, 27 – 51, 2013.