

## ***Interactive comment on “HESS Opinions “Integration of groundwater and surface water research: an interdisciplinary problem?”” by R. Barthel***

### **Anonymous Referee #2**

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Reading the paper at times reminded me of the popular book "Men are from Mars Women are from Venus". The author effectively demonstrated that while both surface water hydrologists and groundwater hydrologists are nominally hydrologists, they might as well be seen as coming from different/opposite ends of the spectrum. The author is right - his point is that instead of trying to force them to fit into the same straitjacket, we might as well accept the reality and treat them as two different fields altogether - and bring them together within an inter-disciplinary context, just as we bring hydrologists and ecologists or hydrologists and economists together. Accepting the inter-disciplinarity from the outset (instead of a forced/artificial uni-disciplinary ap-

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proach) may lead to better success. This is a controversial position, but nevertheless I do not see any problem supporting this as a considered opinion paper. I am saying this also because, as the author himself states, all other approaches to a forced marriage has not worked well, except in a few cases: the two communities are still far apart.

The main reasons for the separation of the two fields, and here I am paraphrasing the author's own arguments, is the difference in time and space scales of interest. Surface water hydrologists study well defined, compact catchments (small to large) and focus on processes operating at timescales of hours to days to months, and rarely higher. Groundwater hydrologists study much larger, regional scale, deep aquifers, and study processes that operate on much longer timescales (years to decades that are needed to recharge them and discharge them). For this reason, it is easy to draw a boundary/line between them and study them separately. Even though both of them involve flow through porous/fractured media, surface hydrology is highly affected by complex near surface processes and interactions with the atmosphere, groundwater hydrology has none of these issues to deal with but has to deal with other geological processes and patterns.

The only time when they can come together in equal terms is when we are studying regional scale problems of water extraction, climate change, land use and land cover changes. This is the author's argument - I partially agree - I would argue that one has to bring in longer timescales. The problem of interest must involve longer timescales, which the author failed to emphasize. Once we are on a problem like this, then to bring the two (and more) parties together in an inter-disciplinary manner using the principles the author enunciated may lead to a fruitful collaboration. Even then, a lot of give and take is required, each side must jettison age-old traditional/standard practices and have the courage to frame the problem in ways that bring balance and equality to the disciplines involved will make for faster progress. The approaches that surface hydrologists might use at hillslope or small catchment scales may be over-kill for a regional scale problem, whereas groundwater hydrologists must adapt their traditional methods

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towards the small time/space scale process variability and the interactions between the different systems. Overall, the paper would benefit a lot if the author manages to illustrate this through a real example of a regional scale/long-term problem and explain how this might work. One may be able to build a perceptual/conceptual model of the system, highlight processes and process interactions that occur at similar time and space scales and how they can be modeled in a commensurate way.

Finally, I would challenge the author's viewpoint that surface water hydrology and groundwater hydrology can never be brought together in an integrated way. Instead of accepting the inevitability of this separation, I would argue that we use these regional scale problems to bring the two communities together, and enable them slowly make the connection and overcome the barriers. That is good for the science, and that is also good for the applications of the science to society, as it is at these large space scales and long time scales that most of society's water and environmental problems lie.

I also found quite a few English language problems with the manuscript - I will leave it to the author and the language editor of Copernicus to sort out these problems. Overall, the paper can eventually be published in HESS if the author can sharpen the message, bring out the scientific issues more than the societal and human issues (they are sufficient to support his argument), and if possible include an illustration of how the two disciplines can come together at regional/long time scales. Of course, being an opinion paper I do not insist on it.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 2011, 2014.

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