Hydrology and Earth System Sciences Discussions

Interactive comment on "Improving confidence in deep drainage estimates, for arid and semi-arid areas using multiple linear regression with percent clay content and rainfall" *by* D. L. Wohling et al.

Anonymous Referee #3

Received and published: 12 January 2012

First of all I want to apologize for the late reply to the above stated manuscript. The authors present a kind of reevaluation of existing datasets from SE Australia concerning recharge in semi-arid to arid parts of Australia. To determine factors influencing potential recharge into the underground, the clustering of datasets (locations) according to annual, perennial and tree vegetation is a valuable approach. The influence of average clay content within the uppermost 2m in connection with annual rainfall amounts are assessed by different statistical parameters. Since it is a study, totally based on already existing datasets the authors were restricted to the locations investigated in the past. It would have been worthwhile to extend the databases by own investigations,

particularly for tree- and perennial vegetation sites. In comparison to sites with annual vegetation, sites with perennial vegetation are poor. It is somewhat delicate, that several of the latter ones are situated within humid areas with precipitation of more than 1000 mm/a. It is questionable how these locations fit to the titled "semi-arid to arid" conditions.

The approach, presented by the authors is worthwhile to be published in HESS since it gives an easy to handle tool for a general range of recharge estimation. I recommend it for publication with minor revisions.

However, I would like to ask the authors, whether effective field capacity does not amply describe the grain size distribution and texture of the substrate. It is a much more complex approach than only taking average clay content into account. Field capacity is a necessary parameter to calculate unsaturated flow (hydraulic conductivity of the substrate) for recharge calculation, as already stated by different authors (e.g. Morel-Seytoux H. J. (1989): Unsaturated Flow in Hydrologic Modeling. NATO ASI series. Series C : No. 275. Probably I misunderstood the aim of the study, is it aligned to give the possibility of recharge estimation just by the 2 parameters (1) av. clay content and (2) precipitation?

Since most of the comments done by C. Petheram and the 2nd reviewer fit to my and the authors already replied to them, I will not repeat. Additionally, I'm not a native speaker, hence I will not contribute to the topic of tense. However, some questions are still open and I would like to comment several points, given in detail below.

The most important point is the term "drainage". Even "deep drainage" is not a good wording for the process the authors describe. Infiltrating precipitation should either be termed as "potential recharge", "recharge" or "infiltration". "Drainage" is commonly used in different context.

Page 4536

Ln 5,6 What exactly do you mean by "providing regional estimates of drainage"? If this is meant as proposed outcome it should not be stated in your abstract since you did no areal survey neither of soil textures nor vegetation pattern.

Ln 15-19. I do not understand the meaning of the first sentence. Groundwater recharge is not interchangeably associated with drainage or potential recharge. Drainage should not be used for processes describing infiltration of precipitation into the underground or the flux of water through the unsaturated zone. Drainage may be used for diversion processes as used in agriculture to transport wetness out of crop areas etc. In Ln 19, if there are impeding layers they are either continuous – then it becomes a perched groundwater reservoir or they are inhomogeneous – then water percolates further downwards. The entire paragraph should be rephrased because it leads to misunderstanding out of the used terms.

Ln 22 In semiarid to arid environments, usually root-zones are not well developed due to the lack of vegetation. It may be of importance in areas of perennial scrub vegetation. However, in that context the authors are using "recharge" as right terminus for downwards percolating water through the unsaturated zone.

Page 4539

Ln 17: missing word: "…estimates that INCLUDE detailed rainfall …"

Ln 24 ff. What do you mean by "the use of impeding layers could improve the correlation"?

P 4540

Ln 10 What do you mean by "cleared annual vegetation sites" – does it mean during dry season? Or does it mean "cleared" in context of vegetation. Please specify.

Ln 11, 12 How do you explain using rainfall amounts of up to 1265 mm/a in the context of semiarid to arid? Please verify that Köppen-Geiger climate classification (BSh, BSk) fits to that area. It could be worthwhile to take Fig. 1 and colour Australia according to

C5700

that system. If one take Peel, M. C. and Finlayson, B. L. and McMahon, T. A. (2007). "Updated world map of the Köppen–Geiger climate classification". Hydrol. Earth Syst. Sci. 11: 1633–1644 into account, the locations of used datasets are within the range of group Cfa and Cfb, which state for humid subtropical climate.

P 4540-4541

Ln 14 to end of paragraph

The entire description is much to long. It would be worthwhile to extend the information given in fig. 1 by adding a table with methods, used by the different previous studies.

P. 4542

Eq. 1 – missing units (e.g. clay: % or g/g…) and please describe yo, b and a: what is fitted to what?

P 4543

Ln 4 If R2 is as low as 0.489, do you see a correlation at all?

Ln17 You state "arid" in your title, however all locations with precipitation less then 300 mm/a fall out of the 95%-interval. How does it comes?

Ln 20: missing word: "…that have very LOW drainage"

Ln21 Drainage under trees (pre-clearing): does it mean before defoliation or before clearing? If clearing is meant, all trees were removed and uprooted? What is the context?

P 4544

Ln 18 f. Entire sentence is not clear.

P 4545

Ln 3 How do you predict by that approach?

C5701

Ln 11 Again, what does "cleared" mean in context of annual vegetation, defoliated?

p 4546

Ln 8-16 That sounds like textbook. Please rephrase.

Fig. 1 Please enlarge the area of investigation and take entire Australia as insert or as small fig. for overview. Please insert Köppen-Geiger areas.

Figs. 3, 4: Legend is not clear. What do you mean by field data, are there also lab data? Please colour upper and lower pred. interval individually.

Pleas scale Y-axes to the relevant range (2-4 mm). That will improve figs for better readablity.