Journal: HESS
Title: Climatic controls on diffuse groundwater recharge across Australia
Author(s): O. V. Barron et al.
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Reviewer: O. Batelaan, Flinders University

Dear Editor,

I reviewed with pleasure manuscript hess-2012-92 from O.V. Barron et al. titled: 'Climatic controls on diffuse groundwater recharge across Australia'.

General comments:
The paper is well written and thoughtfully prepared. The topic of the paper is appropriate for HESS and treats an important scientific issue. The use of recharge elasticity values is an interesting and novel aspect of this paper. It helps in better getting grip on the importance of CC on groundwater.
The main problem which I do not understand in the paper and which should be resolved is the conclusion with respect to the comparison of R2pi and R2p (see comment -p6038, L13-16 and Fig 12). This is a very essential point as this conclusion with respect to the comparison is the central issue of the manuscript. There is also an important issue with respect to -p6038, L4-6: Fig 11a; it seems to me that the correlation is worse. But maybe there is an error in the graph? Some of the graphs and captions can be improved.
I hope the authors can resolve these issues because in that case the paper is a very interesting contribution for HESS.

Specific comments:
-The term 'diffuse' in the title and in the manuscript is not defined. As this term is not uniquely known it would be good that the authors define this term.
-p6027, L15: point and continental scale; why these scales and not e.g. regional?
-p6027, L17: is there an argument why these param's are selected and others not? Or is this made later explicit?
-p6028, L19: How are ranges in Table 1 determined? Spatial avg? of interpolated map? or avg of stations in climate zones?
-p6029, L7: potential: please explain. Is it used as in line 15?
-p6029, L16-18: The assumption: for which climate zones is it valid and for which not or less? The resulting errors from the assumption are expected for which percentage of the area?
-p6030, L16: SILO: explain meaning
-p6032, L4: Ri: not clear you should define and explain it better.
-p6033, L22: not clear; sum Ri for BSk is not 0.7; what do you mean; rephrase
-p6034, L25-26: for the most northern...for the most southern...: this cannot be deduced from fig 4.
-p6035, L3-5: I do not see this in fig 4. I think there is no increase for sure not for trees: K=1, delta Rip=0.6; K=0.01, delta Rip=0.4
-p6035, L5: not clear, reformulate; the point is what about the soil influence? Also valid for K=0.01?
-p6035, L14: Fig 5 is not referenced/discussed.
-p6036: fig 7 is not referenced (line 5 and further?)
-p6037, L17: 'often weaker': this is a misleading phrase; more often the correlation between annual rainfall-recharge is higher.
-p6038, L1-2: I do not see this better correlation from the fig.
-p6038, L4-6: Fig 11a yellow points many are below the bisectrix i.e. worse correlation. Hence, I do not understand this conclusion.
-p6038, L13-16: Hence for all combinations R2pi < R2p: so the exercise failed!
-p6038, L20: I do not see this from 13a, you mean 13b?
-p6038, L22: 13a?
-p6042, L14-16: I do not follow this conclusion, maybe I miss something but for me it should be opposite as it appears from the paper.
-Fig 2: modelled recharge: is that potential? What is the difference between the 3 sub figures, explain in the caption a, b, c.

-Fig 3: --> rich soils are not presented).
-Fig 4: caption is not correct. I see annuals and trees presented in the fig as well, as well as K 0.10 and 0.01. Correct caption.
-Fig 9: what is R2 for sub fig b and d?
-Fig 11: the dots are too small, the color is hardly visible.
-Fig 12: in caption: (a) K=0.001. Add also in the caption an explanation for AP, PP and TR.
Sub-fig b: So whatever aggregation method always R2p>R2pi: Hence aggregation is not successful; see also remark -p6038, L13-16.
-Fig 13: Caption is not good, describe sub figure a and b separately and not within one confusing sentence.

Technical corrections:
-p6024, L18: add a period after rainfall
-p6026, L9: add 'are' after recharge
-p6027, L21: add . after zones
-p6033, L19 and further: Bsk, Bsh, Bwh the 's' and 'w' is not consistent small or capital. Make it consistent throughout the manuscript
-p6036, L27: add . after d-1
-p6037, L3: remove 'also'
-p6037, L24-25: 11c-->11d and 11d-->11c, so mention first moving avg and then percentile
-p6042, L25: 'increase in'
-p6046: ref: Leterme et al. 2012 the final HESS version of the paper has been published; use that one.