

**Author comment to Reviewer #2**

Manuscript no. hess-2014-268, "Estimation of temporal and spatial variations in groundwater recharge in unconfined sand aquifers using Scots pine inventories" by Ala-aho, P. et al.

Thank you for the several positive comments regarding our manuscript. All the comments and suggestions are valuable and highly appreciated. We have carefully addressed the reviewers' comments and suggestions in order to make changes in the manuscript. We hereby provide our point by point responses how each of the reviewer's comments will be addressed in the manuscript.

Sincerely,

Pertti Ala-aho

Detailed response to reviewer #2 comments:

**Moreover, I agree with Reviewer1 that the paper should be reduced in the text (the M&M section is rather long)**

We appreciate this comment to improve the readability of the paper and will shorten the manuscript in following ways:

- Results of the water flow at different depths (Fig. 7) and related discussion will be removed from the manuscript. We reconsidered that this result is not essential for the paper and can be removed in order to improve the focus of the paper.
- The comparison of measured stream baseflow to different simulated recharge will be simplified (Table 3).
- Materials and methods will be shortened by removing example of the spatial distribution of model results (page 12 lines 11-23) and not explaining the technicalities (page 14, 20-26).
- In materials and methods section, equations for different evaporation components could be presented as additional material / annex if this is in line with the journal formatting.
- some sections of the discussion will be removed (e.g. page 28 lines 2-6 and lines 10-16) or reorganized.

***There is a confusion about the use of the terms evaporation, transpiration, evapotranspiration. In my opinion evaporation is the process when water leave in gaseous form the bare soil. No plant or crop should be involved in this process. Transpiration is, obviously, the same type of process involving only crop/plant system. The process from the understorey depend if the soil is bare or covered (partially) by vegetation. If the latter applies, it is an evapotranspiration. If everywhere under the forest there are lichens, we can assume this floor as an evaporating surface, assuming no transpiration from the lichens. This is not a semantic question, because through the paper (i.e. in the M&M and Results section) it is not clear at which process the Authors refer.***

We appreciate this comment to clarify the different evaporation conceptualizations. The different evaporation and naming conventions are presented in Fig. 4. Their definition will be elaborated in the figure caption.

***2. The soils. This is a problem of the manuscript. It seems to me that the Authors mix soil with the rock/geological material underlying the soil. The Authors tend to call "soil" all the material between surface and groundwater. This isn't correct.***

The mineral geological material in manuscript is referred to as "soil" throughout the manuscript, which will be explicitly defined in the manuscript to avoid confusion. This naming convention is typically found in the literature. Lichen constituted and organic layer on top of the mineral soil, which is treated as an organic soil type, with specified Brooks and Corey parameter ranges.

***Moreover, just at the end of the discussion they speak about homogeneity of the simulation domain. They do not support this statement with any analysis/observation. So, I was not able to understand the reasons and evidence of homogeneity of the simulation domain. They should better clarify this.***

Homogeneity is assumed only in the vertical direction in the soil column for a given model run (page 31, line 21) justification of the assumption and the justification of the assumption is presented (page 31 lines 22-25). Spatially distributed heterogeneity in the model domain is introduced by hydraulic parameters (Section 2.1.3, table 2) varied in the Monte Carlo process.

***And what about the lichens? Till which depth they occur?***

Height of the lichen layer based on the samples will be added to section 2.1.2 The height is however mentioned when the model discretization is provided, (page 12 line 1)

***Summarizing, the Authors should review the simulation domain, reporting a scheme of it or at least they should clearly report in the text or in a table the different depths of the simulation domain.***

This will be improved by replacing Fig. 3 with a more informative cross-section describing the model domain. This will aid the understanding of the model domain, as already explained in section 2.2 and Fig. 1. Different thicknesses of the unsaturated zone are given in detail in Fig. 5.