

We would like to thank Prof. Savenije for the valuable and constructive feedback on our manuscript. We take the opportunity provided by this forum to address the main concerns raised in this review and offer suggestions for improving the manuscript in the next iteration.

Some of the points have been raised by both reviewers 1 and 2. We address the issues regarding the article structure, thematic focus and research goals/questions mainly in our response to review #1, and concerns regarding sensitivity and uncertainty mainly in our response to review #2.

Thematic focus and research objective/questions

One major point of the review concerns the focus of the article. We submitted this manuscript with the intention to test whether Guswa's model yields sensible estimates of S_r in temperate and boreal forests, at the spatial scale of e.g. a forest plot. The aim is to assess whether this parameterization can be implemented in a hydrological or ecohydrological model. As discussed in the Introduction, measurements of rooting depth are scarce and probably not very informative at the spatial scale that we are considering. Therefore, instead of comparing the results of Guswa's model against measurements, we chose to use values obtained by calibration as a reference. As a way to assess the reliability of the calibrated values, a validation of the local water balance model was performed at the stations where the data record was long enough.

One of our main conclusions was that Guswa's model agrees relatively well with the calibrated values in temperate, lowland forests, while mismatches occur e.g. at Mediterranean sites, and at pine sites on coarse soils. However, the review suggests that these are not the most interesting outcomes of the manuscript. Instead, the reviewer sees the value of the paper in the opportunity to gain knowledge on the drivers and processes that influence rooting depth at a given location.

We believe that this point can be reconciled quite well with our initial research goal. Also, one of the main points of criticism of reviewer #2 was the lack of a clear research goal statement. We therefore suggest a reformulation of the research objective as follows:

The aim of this paper is to assess the suitability of Guswa's model (G10) for implementation in a dynamic hydrological or ecohydrological model. A dynamic S_r parameterization in a hydrological model is suitable if (1) it gives sensible estimates of S_r (or rooting depth) for a given combination of climate, soil and above-ground vegetation, (2) its variations across different climates, soil conditions and vegetation types are physiologically and ecologically justifiable, and (3) the associated uncertainty remains within reasonable bounds. We therefore ask:

- *How well do the predictions of G10 agree with calibrated values?*
- *How does the sensitivity of G10 to its various inputs vary across sites? Can these variations be explained with physiological and ecological theory?*
- *Given the uncertainty of the inputs to G10, how large is the uncertainty of estimated S_r under different climate/soil/vegetation type combinations?*

The first question is already addressed in the current version of the manuscript. However, as pointed out by reviewers 1 and 2, it is necessary to assess the uncertainty

of the G10 estimates, as well as the FORHYTM results and the calibrated values. We refer to our response to Reviewer #2 for an outline of the sensitivity and uncertainty analyses that we propose, and a brief discussion of preliminary results.

The second question relates to the suggestion of reviewer #1 on the focus of the paper. The different sensitivities of G10 under different conditions can provide insight into the processes that influence rooting depth.

The third question relates directly to the research goal formulated above by assessing (1) whether the uncertainty of G10 is acceptable, and (2) which inputs of G10 are particularly sensitive and should be considered particularly carefully in a dynamic model.

Discussion of model properties and comparison with alternative approaches

The answer to these three questions will then form the basis for a discussion of the properties of G10, and how they compare to alternative methods. The water supply-and-demand scheme of Gao et al. and subsequent papers is another candidate for implementation in hydrological models (see e.g. Nijzink et al.), and this is an interesting opportunity to discuss the difference between both approaches. Discussion points include the implied objectives of organisms and/or ecosystems (optimization of C budget vs. resistance to dry spells), the various processes considered in either approach (e.g. seasonal and inter-annual climate variability, role of above-ground vegetation and of soil WHC), and possibly more technical aspects of either approach.

The current manuscript includes a discussion of other possible factors that influence rooting depth (e.g. low soil temperature and oxygen stress). We suggest to include this paragraph in the same subsection as the discussion outlined above.