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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Deforestation reduces the vegetation-accessible water storage in the unsaturated soil and affects catchment travel time distributions and young water fractions" *by* Markus Hrachowitz et al.

Anonymous Referee #3

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This manuscript presents a study on the effect of deforestation on catchment hydrology. In this manuscript mainly a modeling approach is used. Using this modeling approach, the authors find that runoff increases after deforestation and also catchment travel time distributions. While this is an interesting point, I have a number of concerns with the study as it is presented now.

1) While the study uses a valuable data set is not fully clear to me how exactly this paper goes beyond the studies that have already been published using this catchment and its data set. Conclusions 1 and 2 basically confirm earlier studies, and the other

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conclusions are based on modeling with a number of assumptions (as discussed below). In general, it would be important that the authors relate their findings more to the previous findings using the same catchment to show the added value of this study clearly.

2) An obvious limitation of this study is in the use of only one catchment. As valuable as the data set is results might not be generally valid unless they can be confirmed using a larger data set including several catchments.

3) The most obvious effect of deforestation on catchment hydrology obviously is the removed interception. Here the authors largely ignore interception by the use of so-called effective precipitation. It is important to note that effective precipitation was determined by modeling using a very simple approach with a constant interception storage. This means that the results might have been implicitly affected by the calculation of the effective precipitation.

4) The isotope data is used to parameterize the passive storage volume. As I understand, this passive volume is only used for groundwater storage. This makes me wonder whether any passive storage is also being considered for the unsaturated storage. Sorry in case I missed this, but I am feeling a bit confused here. It is also not clear to me how mixing between active and passive storage has been calculated.

5) Another crucial issue is the assumption that roots only take from the unsaturated zone. While this might be the case for the direct uptake, indirectly the uptake of water from the unsaturated zone will have the effect that an upward gradient is established which will cause groundwater to rise into the unsaturated zone. So, indirectly roots can access water from the saturated zone. This process seems to be ignored here.

6) Based on the points above, I would argue that the calibration parameter S_Umax is difficult to interpret. It sounds like it is the size of the unsaturated storage, but I would argue it is more a parameter describing catchment functioning.

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7) Overall, I am afraid that the results obtained in the study are both catchment- and model-dependent. The authors need to make a more convincing case why their results are generally valid.

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