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Comment on hess-2021-306

Anonymous Referee #2

Referee comment on "Quantifying the impact of land cover changes on hydrological responses in India" by Shaini Naha et al., Hydrol. Earth Syst. Sci. Discuss.,
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The manuscript "Quantifying the Impacts of Land Cover Changes on Hydrological Responses in India" predicts the future impacts of Land Use Land Cover (LULC) change on hydrological regime, with uncertainties, in Mahanadi river basin, India, using Variable Infiltration Capacity (VIC) model. The manuscript is well structured and the performed modelling experiment is theoretically sound.

The key contribution of the study is in quantifying the parameter uncertainty in predicting the impacts of LULC change on hydrological components. The impact on streamflow is the key focus in the study. My comments and questions on the manuscript are given below.

- I feel that inclusion of Basin name in the title would make it more appropriate.
- Results of the study indicate the importance of parameter uncertainty in assessing the hydrologic impacts of LULC change. In most of the sub-catchments the uncertainty is considerably large, highlighting the importance of considering uncertainty in such assessments. With uncertainty bounds, the quantified impacts are more realistic and useful to decision makers. However, in such studies the input uncertainty, due to uncertain land cover maps, is also important which is not included in the assessment. Categorical and positional uncertainties in LULC maps could increase the total uncertainty, and in some cases, the total uncertainty could be even higher than the net impacts.

- It is mentioned that the conversion from forest to agriculture reduces ET (line 26, and 462). However, there may not be very significant net change in ET due to forest-to-agriculture conversion. The additional moisture available during non-monsoon seasons due to irrigation could compensate the decreased LAI (due to conversion from forest to agriculture). The impact of such conversion will be only significant during monsoon season, when effect of irrigation is minimum. Since the irrigation was not considered in

this study, the impacts on ET due to forest-agriculture conversion may not be very useful. However, this may not affect the assessment of impacts on runoff.

- Authors mentioned that the recurrent flood events in the basin might be due to LULC change (line 31, 579). In my view, the LULC change has a little role in affecting the peak runoffs. With increased precipitation intensity the effect of LULC reduces, therefore during the episode of high precipitation which causes flood may not be affected by small scale LULC changes. Also, the precipitation is much more sensitive to affect runoff as compared to LULC. I believe that if the model is re-run with varying precipitation, instead of keeping it constant (line 337), the impact of LULC change may not be visible.

- The LULC proportions (%) mentioned in Table 3 are not summing to 100% in most of the cases, particularly for 'Salebhata'.
- If the uncertainty assessment is included, does the model calibration add any value to the performance? Generally, the model parameters are perturbed between the feasible lower-upper bounds by taking some probability distribution. In such case, is there any use of calibrated parameters?
- Please expand 'USGC' at line 194.
- The line 303 is not clear to me – 'The land cover maps from LUH2 are processed and converted to a LULC map of Mahanadi basin extent showing a single vegetation coverage at each grid cell of 0.25° and further converted to VIC grid size of 0.05 deg'. Does that mean each grid contains only one vegetation?
- What is 'behavioural model'? Please explain.
- Please correct line 462 'Removal of forests at the **expense** of cropland.....'.