

## ***Interactive comment on “Quantifying the impact of land cover changes on hydrological extremes in India” by Shaini Naha et al.***

**Anonymous Referee #2**

Received and published: 4 February 2021

General Comments:

The study investigates how the hydrological regime of the Mahanadi river basin would respond to the current and future land cover scenarios under a large-scale hydrological modelling framework. The recently released dataset LUH2, which has not yet extensively used in basin-scale hydrology, is firstly used in this study to provide current and future projected land cover scenarios. Although many studies have addressed the effects of future land cover changes on hydrological processes, I believe the novelty of the study lies with the consideration of parameter uncertainties of the physically-based model VIC, which are widely used by the hydrology community when evaluating LULC and climate changes. Valuable insights are provided into the sensitivity of the model parameters to the model outputs and the interactions among the model parameters in

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producing changes of the hydrological regime within different LULC scenarios.

To some point, I agree with RC1 that the parameter sensitivity tests are not properly designed and there lacks through analysis to link the sensitivity results with the LULC impacts. However, the authors agreed to re-conduct the sensitivity analysis and the calibration experiments with the involvement of more vegetation and soil-related parameters. I am looking forward to the new outcomes and modifications.

Specific comments:

1. Line 68, “results in an increase in surface runoff and decreases river discharge”, this trends seem to be contradictory between the surface runoff and the river discharge. Please check and confirm it.
2. Figure 2, please indicate in the figure title the time period of the LULC map and LAI data, and show the land use types in the legends rather than using abbreviations.
3. Line 198, explain what the exact meaning and the geographic scope of the “3 root zones”.
4. Line 251, should “Klein-Gupta Efficiency” be “Kling-Gupta Efficiency (KGE)”? It is better if the equations of NSE, lnNSE and KGE could be given.
5. Line 256-257, “Parameters which showed poor performance when tested across all the subcatchments and objective functions were discarded.” The sentence is unclear, please rewrite it to avoid misunderstanding.
6. Line 263-264, “the model was run, calibrated, and validated daily for each parameter set for the time period (1990-2000)”. I think the authors only mean “calibrated” here, since the validation period is found to be 2001-2010 in the following manuscript.
7. Line 330-331, “In all the six cases of model run, meteorological forcing is held constant. . .”, are the forcing data from the baseline scenario (2005) are used? Please give detail explanations.

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8. Line 379-380, "The grey lines in the parallel coordinate plot in Figure 6b shows. . .", the grey lines are nearly invisible in Fig. 6b.
9. Line 384, change the title of "4.2 Control case scenario performance" to "Baseline scenario performance" to keep consistency with the rest expressions in the manuscript.
10. Line 421, the time period 1990-2010 is used for analyzing the effects of different LULC scenarios on the streamflow in the study. However, this covers the calibration and validation periods used for generating the VIC model parameters. In normal case, data used for calibrating models should not be used again for further analysis.
11. Line 469-471, "Reduction in percent change in the F scenario is observed with a decrease in the surface runoff, baseflow and soil moisture content within a range of (1.5 to 12) % , (4.9 to 32) % and (-2.5 to 21) respectively followed by increase in ET within a range of -(1.8 to 3.5) %." Values in the first three brackets should be negative (representing decreases) while values in the last bracket should be positive (representing increases).
12. Line 503-520: this paragraph describes how the parameters influences the change of the streamflow as well as other water balance components. However, these descriptions seem to be deductive from the physical definitions of the parameters, rather than being concluded from Fig 8. The results showed in Fig 8 are not well analysed and the sensitivity of parameters should be given in a more quantitative way.
13. Line 531-532, "Give that the subcatchments are of conflicting catchment characteristics, there is no feasible point that optimizes all five parameter sets. . .", please explain what are the exact meaning of the "conflicting characteristics". I believe the rainfall-runoff characteristics of one subcatchment should not be so distinct from the others.
14. Line 635-636: "Perhaps, the most important implication of this study is that the changes that are likely to occur can have negligible to significant impacts on hydrology of Mahanadi river basin". The expression of the sentence is unclear, especially "negligible to significant impacts", which seems to lead the conclusion of the study to meaninglessness. Rewrite it to avoid misunderstanding.

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15. Line 669-670: "LULC changes that are likely to occur in the future can have negligible (2%) to significant impacts (20%) on the extreme flows of Mahanadi river basin." Again, I suggest not using words like "negligible" or "significant" when describing the percentage results.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-220>, 2020.

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