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Hydrology and Earth System Sciences Discussions

Interactive comment on "Modelling the impact of prescribed global warming on water resources of headwater catchments of the Irrawaddy River and their implications for Loktak Lake, northeast India" *by* C. R. Singh et al.

Anonymous Referee #1

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Review of Singh et al., MS No.: hess-2010-99

This paper demonstrates the hydrological regimes modifications within sub-catchments of Loktak Lake, a Himalayan region catchment. This is achieved by running pattern-scaled GCM output through distributed hydrological model, MIKE SHE. The pattern-

scaled GCM projected outputs are associated with changes in the amount, state and season distribution of precipitation, and higher evaporation due to warmer temperatures. MIKE SHE takes account of the combined effects of these changes upon runoff.

Overall this is an interesting contribution that explores the uncertainty in accessing the dominating hydrological parameters like temperature, precipitation and discharge through the GCM projected climate change output. This research is an important contribution in the Himalayan region where the main source of natural resource is the hydropower. In the Himalayan region, dense network of rivers with steep topography stretches down to southern plain. Total annual rainfall concentrates relatively short period of about four months. These peculiar characteristics lead to a set of hazards, including frequent floods.

While I really like the foundational ideas proposed here, I ask for further clarification and references in how uncertainty in the GCM projected output may be reduced.

The title of the paper is: 'Modelling the impact of prescribed global warming on water resources of headwater catchments of the Irrawaddy River and their implications for Loktak Lake, northeast India'. The paper makes an analysis on the stage discharge modifications due to climate change scenario and does not explicitly explore the broader aspects of impacts on water resources, environment and socio-economy. Thus, I would suggest the title be more specific.

The study catchment is characterized by steep mountainous topography with the elevation extending from 800 m to over 2500 m. a.m.s.l (see page 2786, Line# 1). Two dominating hydro meteorological factors that the study takes into considerations are precipitation and temperature. How does the study take into account of the temperature lapse rate and elevation effect on the orographic precipitation?

Other comments Comment #1. Why is the computational grid scale in MIKE SHE 600 m X 600 m? Is there a relation between the grid scale and the model process time scale? It is not clear how the precipitation and temperature variability is accounted at

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this grid scale.

Comment #2. A climate changed scenario could significantly modify dominating hydrologic effective parametric values associated with landuse and soil moisture. This could be an important factor for the assessment of hydrological regimes modifications due to climate change.

Comment #3. For the ungaged sub-catchments the authors derive discharge in proportion to the area. Why not let the distributed hydrological model predict the discharge for the ungaged sub-catchments. Here is an example of transferring effective hydrological parameter, soil moisture parameter, in Himalayan catchment region: Pradhan N.R, F.L. Ogden, Y. Tachikawa, K. Takara, 2008, Scaling of slope, upslope area and soil water deficit: Implications for transferability and regionalization in topographic index modeling, Water Resour. Res., 44: W12421, doi:10.1029/2007WR006667.

Comment #4. The fragile rocks of the Himalayan Mountains (see page 2786, Line#2) make sediment discharge significant in the calculation of the lake volume-level relationship. How does Eqn. (1) take account of this sediment input output relationship in the analysis of the lake level?

Comment #5. Please use past tense. For example; Page 2792, line 25: Model performance is particularly good for high flows, although lower flows are underestimated . . ..

Page 2794, line#21. Use percent rather than %.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 2781, 2010.