Authors' response to short comment by G. Sun

The authors thank G. Sun for his/her interest in our work and for offering very useful comments.

C1: 'A simple testing of the model does not offer much insights and contribute much to our understanding the individual effects of land use or climate on hydrology.'

AR: The main aim of the paper is not about testing the model over a catchment, but rather it is about understanding and isolating the individual effects of land use and climate on hydrology which is achieved using a rigorously calibrated and validated (tested) hydrologic model over the basin.

C2: 'Has the hydrology changed over the period 1970-2011? Has climate changed? It is unclear from the write-up to me. If the hydrology has changed (I assume so given the large change is LU), can the VIC model explained it based on your study.'

AR: Based on the Mann-Kendall trend test conducted on climate variables and observed streamflow, it is noticed that climate variables such as rainfall and maximum temperature did not change significantly (95% confidence level) from 1971-2005. However, minimum temperature is observed to show an increasing trend during the same period. Observed streamflow for upstream (1987-2005) and midstream (1977-2005) regions did not show any trend. The corresponding results are presented as time series plots in Fig. 1. This observation can be directly related to the results shown in the paper where climate change (not LU) is observed to be predominant factor affecting the hydrologic response. It is observed that even though LU has changed significantly during the baseline time period, its influence on hydrologic response is not very dominant. This could be due to low spatial extent of the sensitive LU category (urban area) in the region (Pg. 2220 (24-27) and Pg. 2221 (1-11).

C3: 'The authors could provide a quantitative assessment the contribution of climate or LU to the observed flow change.'

AR: Results pertaining to the quantitative assessment of the contribution of climate or LU to the streamflow are provided in Section 3.3.4 (Pg. 2220 – 2221) and Table 6.

C4: 'Modeling the future is useful for water resource planners, but modeling the past may give more confidence of the modeling tool.'

AR: Yes, the authors agree to this comment. The hydrologic model in the present work has been rigorously calibrated and validated using the historic/observed streamflow data. These results are presented in a summary form in Table 2, Fig. 3 and Fig. 4. Such validation gives confidence in the modelling tool.

C5: 'In addition, I was puzzled why the hydrologic response to forests change have two signs in Table 4.'

AR: Sign associated with Runoff-LU (RL) ratio across different LU categories for upstream, midstream and downstream regions (Table 4) indicates the direction of change. In the upstream region it has been observed that dense forest has increased in the last decade (Pg. 2212, Line 19-20). It is well established in the literature that increase in forest cover leads to reduction in runoff and vice-versa (Bosch and Hewlett, 1982). Thus, the negative sign of RL ratio for upstream region indicates this effect. Midstream and downstream regions in the UGB are dominated by scrub forest, area under which has decreased over the time period. Thus a positive sign (for midstream and downstream regions) indicates an increase in streamflow due to decline in scrub forest cover.

Reference

Bosch, J.M., and Hewlett, J.D.: A review of catchment experiments to determine the effect of vegetation changes on water yield and evapotranspiration, J. Hydrol., 55, 3-23, doi:10.1016/0022-1694(82)90117-2, 1982.

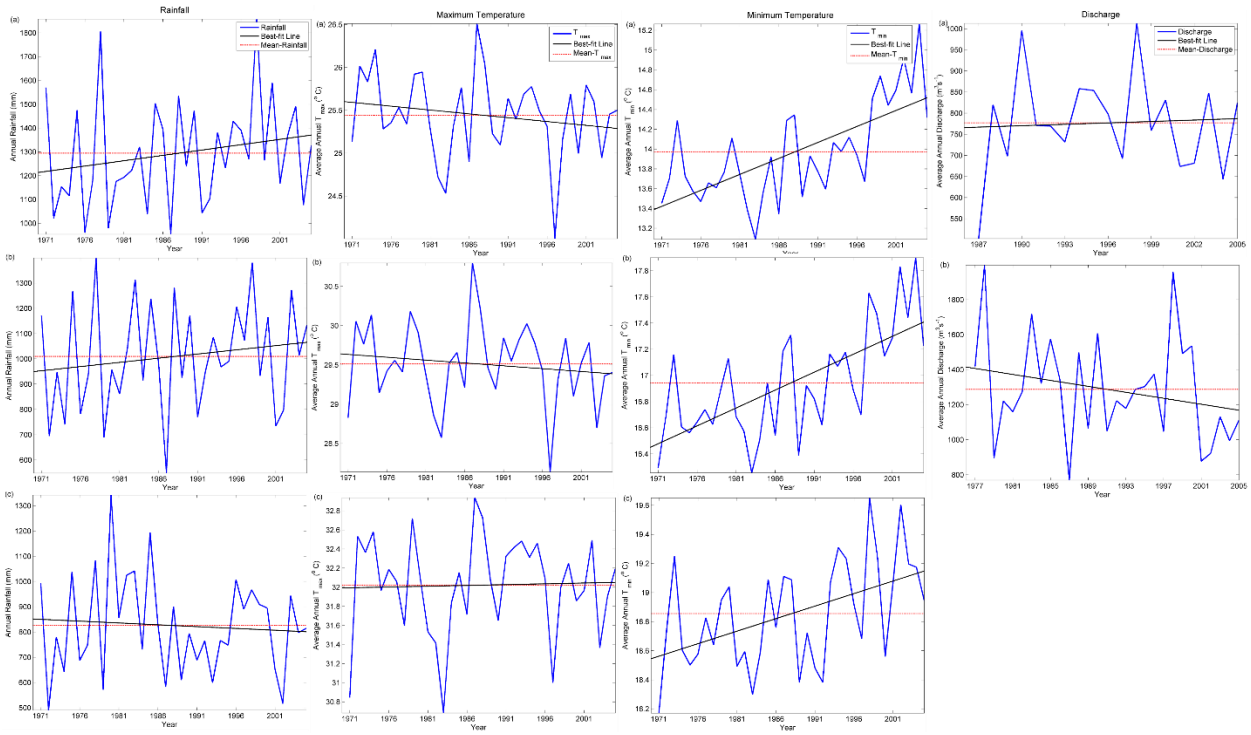

Figure 1. Time series plots of (left to right) rainfall, maximum temperature, minimum temperature and observed streamflow with associated trend line for (a) Upstream, (b) Midstream and (c) Downstream regions of the UGB