Author Comments

We would like to thank all the anonymous reviewers for their constructive reviews. Both the reviewers' comments are valid and we are happy to address them all, as follows (referee comments are marked in blue color).

Anonymous Referee #1

1. One assumption being made in the model is that the relationship between streamflow and snowmelt is stationary in time. It is good that some consideration was given to where this was not true (step change). However, the manuscript would benefit from a more in-depth discussion of this assumption and how it may affect the model accuracy and/or prediction intervals. While step changes caused by the construction of a dam may be obvious, more subtle changes such as changes in land use or timing of snowmelt due to climate vari- ability/change may also significantly change the relationship between lagged snowmelt and streamflow. For example, this may explain why the models perform better during certain periods as compared to others such as Figure 7, setting 1, a and b pre 1995 versus post 1995.

This is a very valid question and we considered this issue before commencing the prediction work. We carried out a trend analysis of all the hydro-climatic variables considered in this paper and found that the spatially averaged data from 1978-2004 (the study period) did not have any significant trend and therefore not shown. This was partly consistent with the previous findings where some researchers noticed that Western Himalaya responded to global warming differently as compared to the other parts (Fowler and Archer, 2006).

In addition, to our surprise, we didn't find an increasing trend in Satluj River basin average diurnal temperature range (DTR) that was reported by Yadav et al. (2004). However, the best hypothesis for this mismatch might be due to the reason that we aggregated all the station/gridded data to have a spatial basin average, which might have eventually smoothed out not showing the trends. Individual station data might have had inconsistent precipitation trends, as published recently by Dimri and Dash (2012) while reporting the Western Himalayan climatic trend analysis, but this was not within the scope of our study.

2. p8140 lines 5-8 sentence is awkward please rewrite

- Will be considered and rewritten

3. p8140 line 20 insert "the" in between "In" and "Iberian"

- Will insert 'the'

4. p8141 line 8 remove s from exhibits and line 9 remove s from skills

- Will remove 's' 2 times

5. p8141 line 17 insert and before locally and line 18 remove "etc."

- Will do

6. p8148 lines 1 to 5 do you need this detail even though you don't use this criteria?

- Will do

7. p8148 line 7 change "the table" to Table 3.

- Will do

8. p8149 line 15 change "were done in" to "was done using"

- Will change

9. p8150 lines 4 to 7 sentence is awkward pkease rewrite

- Will rewrite

10. p8153 line 13 change "as was also" to "and is"

- Will change

11. Figure 1 the points indicating snow and rain stations are exactly the same? The small map of India is hard to read text the plot label size needs to be increased. Figure 5 titles too small and the caption is very long, could this be incorperated into a table which can be referred to in the text and figure caption?

The points showing snow and rain stations are nearly accurate. Some of the station location information wasn't available and we relied upon different website sources. We'll increase the Figs 1 and 5-label size and make a table for Fig 5 caption to make it shorter.

Anonymous Referee #2

1. As far as I can see, the main output of this paper is in Table 4, which presents a number of regression based empirical equations for predicting MAMJ flow to the Bhakra reservoir. The main problem in this table is that the units of the predictors/predictand are missing. The units must be specified to allow more sensible evaluation of these equations.

- The units will be specified in the table

2. In a number of equations (Table 4), the same predictor appears a number of times in the same equation. E.g. J(R) appears twice in Setting 1 (1 Feb), M(Q) appears three times in Setting 1 (1 Apr) and so on. I would recommend to keep one predictor only once (bringing them together) as long as they are explicit. This way makes it

easier to assess the relative contribution of each predictor. Example (Setting 1, 1 Feb): Q(MAMJ) = 16324 + 135*ND(R) + 80*J(R).

- This change will be incorporated and all the equations will be rewritten

3. In the equation for Setting 1 (1 Apr), interestingly the sum of all the terms with tem- perature is zero! Therefore, no need to include the temperature terms in this equation. This can be verified by substituting Tavg = (Tmax – Tmin)/2 and DRT = Tmax – Tmin.

- We'll delete the temperature terms there

4. The authors should also discuss in the manuscript relative importance and/or sensitivity of the predictors on the predicted flow.

- We'll do a sensitivity analysis and discuss this in the manuscript

5. Pg 8145, Line 19: In Setting 1, I wonder whether the IMD rainfall also includes snowfall? If that is the case, the snowfall is used twice as input to the model.

- We are not explicitly aware about this since nothing regarding the snow is discussed in the paper where the data is described (Rajeevan et al, 2005). We guess the data is all rainfall.

6. Although the paper is mostly well written, the use of many abbreviations is hindering its readability. The use of abbreviations should be reduced as much as possible and a list of abbreviations should be provided.

- We'll provide a list of abbreviations

7. In Fig. 1 the location of the Bhakra reservoir, particularly the outflow (control) point and the main inflow points, e.g. the Satluj river flow and BSL (pg. 8239, lines 5-8) should be shown.

- We'll show these important components of this river system in Fig 1

8. The letters used in Fig 5 are too small to read.

- We'll increase the font of the letters used in Fig 5.

References

Dimri AP and Dash SK. 2012. Wintertime climatic trends in the western Himalayas. Climatic Change 111:775-800.

Fowler HJ and Archer DR. 2006. Conflicting Signals of Climatic Change in the Upper Indus Basin. Journal of Climate 19:4276–4293.

Rajeevan M, Bhate J, Kale JD and Lal B, 2005: Development of a high resolution daily gridded rainfall data for the Indian region. India Meteorological Department, Met. Monograph Climatology No. 22/2005, 26 pp.

Yadav RR, Park WK, Singh J and Dubey B. 2004. Do the western Himalayas defy global warming? Geophysical Research Letters *31*:L17201. doi:10.1029/2004GL020201.