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Hydrology and Earth System Sciences Discussions

Interactive comment on "Impact of climate change on the stream flow of lower Brahmaputra: trends in high and low flows based on discharge-weighted ensemble modelling" *by* A. K. Gain et al.

Anonymous Referee #2

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Referee comment on: "Impact of climate change on the stream flow of lower Brahmaputra: trends in high and low flows based on discharge weighted ensemble modelling" A. K. Gain, W. W. Immerzeel, F. C. Sperna-Weiland, and M. F. P. Bierkens (doi:10.5194/hessd-8-365-2011)

General comment:

The paper addresses the issue of climate change impact in Lower Brahmaputra river basin (LBRB). It uses global hydrologic model PCR-GLOBWB under 12 different GCM and ensemble discharge predicted from it to study the trend in the high and low flows in LBRB. Undoubtedly Brahmaputra basin is one the hot-beds to study climate change

impact as is clear from many studies and physical evident. Since climate models often have ambiguous results, there is a strong need of ensemble based forecast. Hence the paper tries to addresses a very relevant and important issue which seems to fall pretty well in the scope of the current journal.

However the approach/methodology proposed in this study needs closer insight and can be still improved (see also specific comments):

1. Weighting factor (WF) for different GCM is calculated over entire period and same WF is applied for high and low flow. Why should WF be same over different flow regimes is not very clear from any analysis presented in the manuscript.

2. It is not convincing from the manuscript why 12 GCM been chosen and whether it is an improvement over previous studies (e.g. Mirza 2002 work). In fact result in the manuscript itself shows that 3 GCM simulations are non-significant in this approach. This point should be mentioned clearly in abstract.

3. Moreover the study relies heavily on one gauge station data. Is not there any other location in the basin which can be used as a cross-check point? Authors may put some words to describe the location sensitivity of the gauge station in terms of whether it's being influenced by any anthropogenic factors (e.g. artificial barriers upstream to it etc).

The authors give a good introduction to the problem and conclusion section is also good. Largely the paper is well structured and well written (with some exceptions. . .see next sections/specific comments). It may be further improved if authors consider following recommendations (see Specific comments). My rating for this paper for scientific contribution is: Good (not excellent). I will accept it provided following issues are addressed and modifications been done.

Specific comments:

1. Page 371 line 11-12: Explain why standard error of discharge observation is as-

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sumed 25% of the observed value in a sentence or two.

2. Page 372 line 20: “(trends) approximated as linear with time”. . ...why?? Is it a good assumption? Support it through some cross reference or strong argument.

3. Page 373 line 12: Should mention the equation number from which mean trend and variance is calculated, like . . ..using equation 2 and 3.

4. Page 373 line 19”: explain in a sentence or two why in table 2 (page 382) trend in month May is negative and why it has small correlation. . . no good explanation is given. Overall this section (section 4.1) is not very clearly written, try to rewrite.

5. Table 2, page 382: Can you also plot the observed trend??...are they close to the GCM trends?? Perhaps Fig. 2 can help in explaining it. May consider adding a sentence to mention this.

6. Table 1, page 381: Why other three GCM has very low weighting factor? Then why to take it at all?? Consider to put one/two sentence to explain/address it. Suggestion: Instead of using 12 GCM can take only the top 9 GCM in rest of the analysis.

7. Equation 5 and 6 (page 373, line 6-7): Cannot understand why these two equations are repeated...Instead can mention equation number 2, 3 in preceding discussion section (since essentially Equation 5 & 6 is repetition of Equation 2 & 3 respectively).

8. Page 373, line 2-3: Author himself mention “...Obviously, in case peak flows occur around the turning of the year, or for rivers with a very strong multi-year component, e.g. due to large groundwater reservoirs, such a construction would not work”. Then question will arise why should such construct be valid in lower Brahmaputra basin?? Can you dig-out some cross literature reference that shows in Brahmaputra that is not the case? It will then further strengthen the logic of employing ‘transient time series construct’ that they propose.

9. Page 373, line 11: Explain little bit how trend parameter is calculated. It is not very clear from reading the section.

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Interactive Comment

10. Page 373, line 13: R2 notation is generally used for correlation coefficient. Is it the correct notation to use here?

Technical corrections:

1. In title: change ‘modelling’ to ‘modeling’

2. Page 368 line 3: “..fore the years..” should be “for the year..”

3. Page 369 line 9: “projectsions”. . .should be “projections”

4. Page 369 line 20: “PCRGLOBWB” . . .should be “PCR-GLOBWB”

5. Page 370 line 5 and 6: “ground- water” should be “ground-water”?

6. Page 370 line 16: Missing comma after PCMDI. “. . .for Climate Model Diagnosis and Inter comparison (PCMDI) https://esg.llnl.gov:8443/index.jsp” should be “. . .for Climate Model Diagnosis and Inter comparison (PCMDI), https://esg.llnl.gov:8443/index.jsp”

7. Page 371 line 2: “GCM-PCRGLOB-WB” should not it be “GCM-PCR-GLOBWB”?

8. Figure 1: Suggestion: May consider to use other color to show lower Brahmaputra basin (instead of white can use yellow or some other light color). As Country boundary is also in white, proper contrast is not coming out well.

9. Figure 2: Suggestion: May consider to plot Jan from x=0 coordinate. Can avoid gridline and moreover color combinations are not good. . .can be improved.

10. Page 372 line18: “. . . .Using this approach both statistical properties (year to year variability) as well are preserved in the constructed...” should be like: “. . .Using this approach both statistical properties as well as year to year variability are preserved in the constructed. . .”

11. Fig. 4 and Fig. 5 (page 386-387): Fix y axis max to 10,000 to bring out extremes values more clearly. And also can avoid gridline here too.

12. Page 374 line 13: ‘LBRB’ introduce this short term once before using it in rest of

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the section.

13. Fig. 7 and Fig. 8: May consider adjusting the y-axis lower bound to bring out extreme value prominently.

14. Page 377 line 3: "...Extreme downstream discharge"...Change it to "extreme discharge at downstream"

References:

Mirza, M. M. Q.: Global warming and changes in the probability of occurrence of floods in Bangladesh and implications, Glob. Env. Change, 12, 127–138, 2002.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 365, 2011.