Response to Editor

Thank your for submitting a revised version of your work. While I agree with the arguments presented in your rebuttal, I cannot see how the contents of the manuscript was changed to account for the main comment (R1). Since the reviewer's view likely reflects the view of the average reader, please account for the comment in your revised manuscript by including some of the argumentation presented in the rebuttal in the manuscript. Please also consider using Fig. R1 in the manuscript (can be supplied as a supplementary figure). I hope including these changes won't take much time, since the text is effectively already there. Since the other comments seem adequately addressed, I should be able to accept a revised version without much delay.

Response: Thanks very much for your great efforts to assess our manuscript. We have made corrections/revisions as suggested in the revised manuscript. The Fig. R1 has been supplied as a supplementary figure in the supplement file (Fig. S1).

Relevant text reads (Line 366-378): "The treated catchment (afforestation) experienced four different periods: (I) 1990–1996 pre-drought and untreated, (II) 1997–2001 pre-drought and treated, (III) 2002–2009 in-drought and treated, and (IV) 2010–2015 post-drought and treated. During the period (I), runoff of the threated catchment has not been significantly affected, it can be considered as the calibration period for evaluating the impact of vegetation change on runoff. During the period (II), the treated catchment was affected by both vegetation change and climate variability. During the periods (III) and (IV), the treated catchment was affected by multiyear drought, vegetation change and climate variability, because the rainfall-runoff relationship after multiyear drought may not recover to that before multiyear drought (Fig. 4) yet and may persist such state for a long time (Peterson et al., 2021). When separating impacts of vegetation change and multiyear drought on runoff, the data of the control and treated catchments need to be used at the same period, that is to say, the same period needed to be applied to these two catchments. The (II), (III) and (IV) periods of the treated catchment were combined into one period as the prediction period. Thus, Table 2 and Fig. 6 essentially compared runoff between the untreated (1990–1996) and treated (1997–2015) periods. Runoff difference between the untreated and treated periods in the treated catchment was caused by vegetation change, climate variability and multiyear drought, and runoff difference in the control catchment was caused by climate variability and multiyear drought."

(Line 384-394): "Estimated changes between the period (I) (i.e., 1990–1996, pre-drought and untreated) and the period (II) (i.e., 1997–2001, pre-drought and treated) as well as between the period (I) (i.e., 1990–1996, pre-drought and untreated) and the period (III) & (IV) (i.e., 2002–2015, in- & post-drought and treated) can be seen in the supplementary Fig. S1. Impacts of afforestation on runoff were 34.3%, 65.9% and 41.5% of the total runoff changes during the period of 1997–2001 by the PCM, TTM and SBM, respectively. Impacts of afforestation on runoff were 32.4%, 100.8% and 68.4% of the total runoff changes during the period of 2002–2015. It can be seen that results of the

TTM and SBM during the period of 2002–2015 were significantly higher than those during the period of 1997–2001, while the results of PCM were close. Because multiyear drought happened in 2002–2009 and caused persistent effects in 2010–2015 had a great impact on the rainfall-runoff relationship of the Red Hill catchment, which made the TTM and SBM overestimated the impact of vegetation change on runoff remarkedly. That is to say, errors of the impact of vegetation change on runoff estimated by the TTM and SBM will be larger as effects caused by multiyear drought are imposed on the paired catchments."

(Line 432-445): "There are missing values in both rainfall and runoff data. Both runoff and rainfall observations are missing from November 1999 to November 2000 and from October 2006 to October 2007. In order to minimize the influences of missing values on the annual total values, annual total is regarded as missing value if more than one month is missing. Thus, there are four missing data points in annual time series of rainfall (Fig.7). Two periods with missing data are just at the beginning and end of multiyear drought. Missing rainfall values should not differ significantly from the annual rainfall values during multiyear drought period. The overall trend or segmented trend during drought will not change much due to the lack of rainfall data. It is also true for annual runoff. In addition, the change point of annual runoff calculated with data including missing values was consistent with that by Zhao et al. (2010), both appeared in 1996. Based on data including missing data, estimated afforestation impacts were 31.4%, 84.7% and 64.9% of the total runoff changes during the period of 1990–2005 by the PCM, TTM and SBM, respectively. Results of Zhao et al. (2010) were 27.0%, 71.0% and 57% by the PCM, TTM and SBM, respectively. They were very close. Furthermore, same analysis was conducted based on the gridded rainfall data from SILO. Estimated afforestation impacts were 32.8%, 93.5% and 73.0% of the total runoff changes during the period of 1990–2015 by the PCM, TTM and SBM, respectively. The results were very close to results using in situ observed rainfall as presented in this study. Therefore, we believe processing of missing data has little influences on the estimated changes."

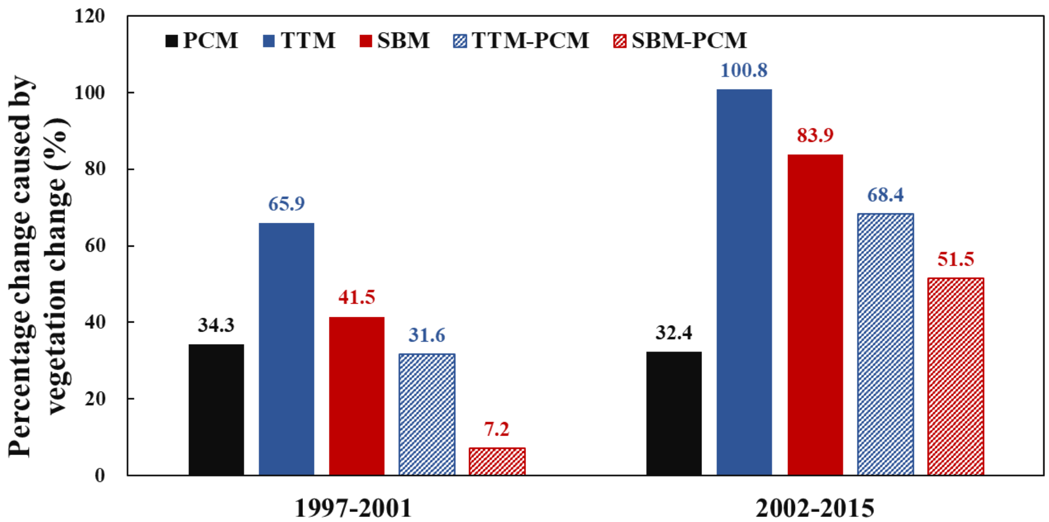

Figure S1: The contribution of vegetation changes to the total runoff changes of the Red Hill catchment estimated traditionally using all three methods during the periods of 1997–2001 and 2002–2015.