Dear Editor,

On behalf of my co-authors, we thank you very much for giving us the opportunity to revise the manuscript (Manuscript ID: **hess-2022-196**). We appreciate the comments on our manuscript entitled "*Attributing trend in naturalized streamflow to temporally explicit vegetation change and climate variation in the Yellow River Basin of China*" by Zhihui Wang, Qiuhong Tang, Daoxi Wang, Peiqing Xiao, Runliang Xia, Pengcheng Sun, Feng Feng.

Great thanks to the reviewers and editors, we have revised the manuscript carefully according to the comments. All the changes were high-lighted in the revised manuscript and the point-by-point response to the comments of the reviewers is also listed below. Please let me know if you require any additional information on our paper.

Looking forward to hearing from you soon.

Best regards,

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Response to Comments from Reviewer 3

General comments:

Attributing hydrological variation to climate and surface feature is a hot topic under global warming in Anthropocene and the Yellow River basin is a typical case where eco-hydrological processes have changed severely during recent decades, so it's critical to quantify the contributions of land use/cover and climate changes to streamflow reduction in the YRB, China. Many previous studies have already focused on this topic using various methods and have got some interesting findings. But as authors of this MS mentioned, those studies analyzed the contributions of inter-annual change of driving factors to hydrological processes, while effects of the intra-annual change of climate and vegetation have not been examined. To solve it, this MS improved the VIC model by coupling time-series land cover and LAI remote sensing data to capture the cumulative effect of dynamic vegetation on the hydrological cycle, and designed six scenario simulation experiments to separate impacts of intra-annual changes of climate and vegetation from those of inter-annual changes and the interactive effects. Since topic of this MS is meaningful and innovative, methods are convincing, and results & discussions are reasonable, I recommend it to be published with revisions. Some specific comments are as follows:

Response: Great thanks for your encouragement and recognition to our manuscript.

Specific comments:

Point 1: Line 187-188, the optimization algorithm named MOCOM-UA is inconsistent with SCE-UA in fig. 2.

Response: Great thanks for this great comment. Here is an obvious mistake when we draw this flowchart. Corresponding figure has been revised, and the details are show below.

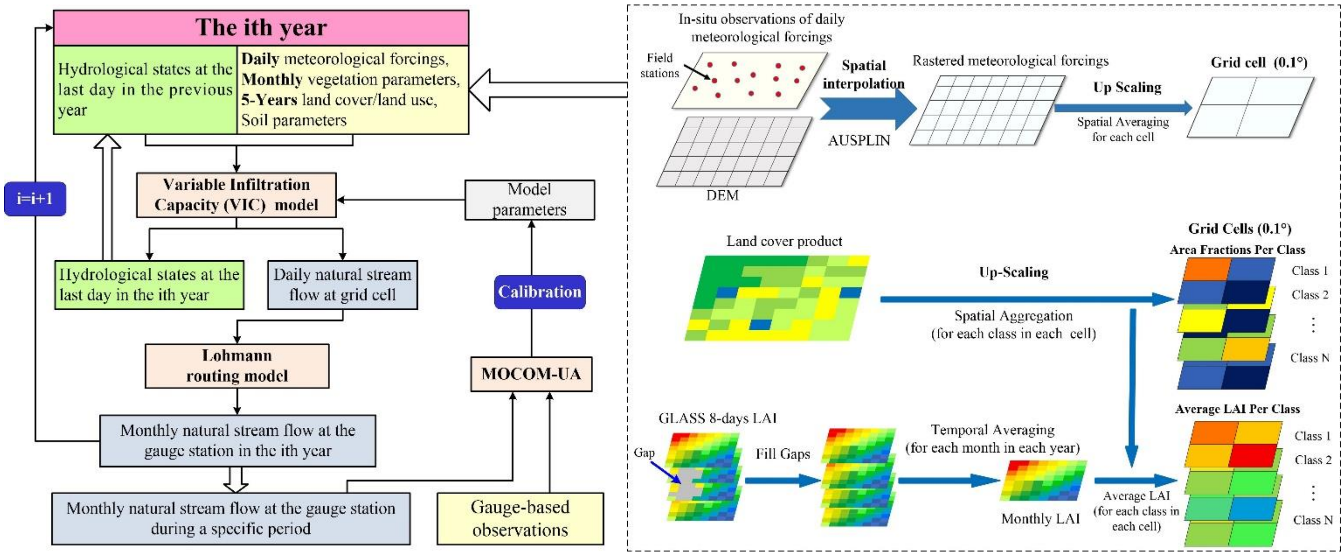
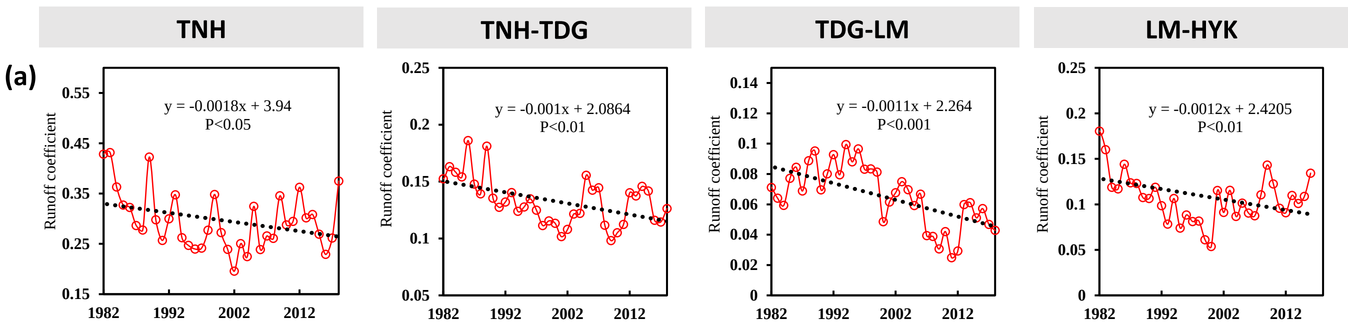


Figure 2. The flowchart of VIC model setup considering temporally explicit vegetation change

Point 2: Line 313, unit of runoff coefficient is wrong in Fig. 7a.

Response: Great thanks for this great comment. Here is a mistake when we draw this figure. We have revised according to your suggestion, and the details are shown below.



Point 3: Line 365, as Fig. 9 shows, temperature has negative impact on streamflow in the source regions. This is inconsistent with my understanding of this region that higher temperature contributes to an increase in runoff due to its role in promoting glacier melting, although the authors discussed the negative impact in Section 5.4 and attributed it to permafrost degradation.

Response: Great thanks for this great comment. In this study, glacier melting and permafrost degradation were not considered during VIC simulation, hence the negative impact of temperature on streamflow in the Figure 9 represents its direct impact caused by ET increase driven by temperature increase, and the indirect impact of temperature increase by altering glacier and permafrost condition on the annual runoff are not further discussed in this study because of the topic of this paper is to figure out the impacts of temporally explicit vegetation changes on runoff reduction. According to previous studies, glacier and snow melting indeed contribute to an increase in runoff in the Qinghai-Tibet plateau region, whereas the area ratio of glaciers in the source region of YRB is relatively low, and the negative effect from permafrost degradation probably offset the slight positive effect from glaciers melting, which is a very interesting scientific problem worthy of study in the future. Therefore, we added some discussion about this aspect in the section of “Uncertainties”,

Due to the lack of water consumption data of coal mining and the effects of glaciers melting and permafrost degradation on the runoff generation were not considered during VIC simulation in this study, the impacts from coal mining, glacier and permafrost in analysing the relationship between non-vegetation underlying surface change and river runoff were not further clarified.

Point 4: Line 390 It's confusing to use rainfall and precipitation concurrently because they have different meanings and precipitation includes rainfall, snow, hail, etc.

Response: Great thanks for this great comment. We have revised all descriptions of “rainfall” into “precipitation” according to your suggestion, and the details are shown below.

Due to runoff yield in excess of infiltration is the dominant runoff mechanism where precipitation intensity is the crucial driving force over the most of YRB (Jin et al., 2020), we then focused on the impacts of interannual precipitation and intra-annual monthly to annual precipitation ratio on the precipitation intensity.

Precipitation frequency caused by temporal pattern change of precipitation possibly influence the hydrological process over the YRB.

Point 5: Line 435-439 There are some grammatical errors in these sentences such as vegetation phenology rather than phenological.

Response: Great thanks for this great comment. According to your suggestion, corresponding description has been revised, and the details are shown below.

Therefore, the massive vegetation type conversion from cropland into forest-grass vegetation could significantly alter the vegetation phenology, which could lead to the interannual trend of intra-annual monthly to annual LAI ratio increased in the spring and decreased in the summer (Figure 6).

Point 6: Line 455 Error in name of y-axis, annual instead of anuual.

Response: Great thanks for this great comment. According to your suggestion, corresponding figure has been revised, and the details are shown below.

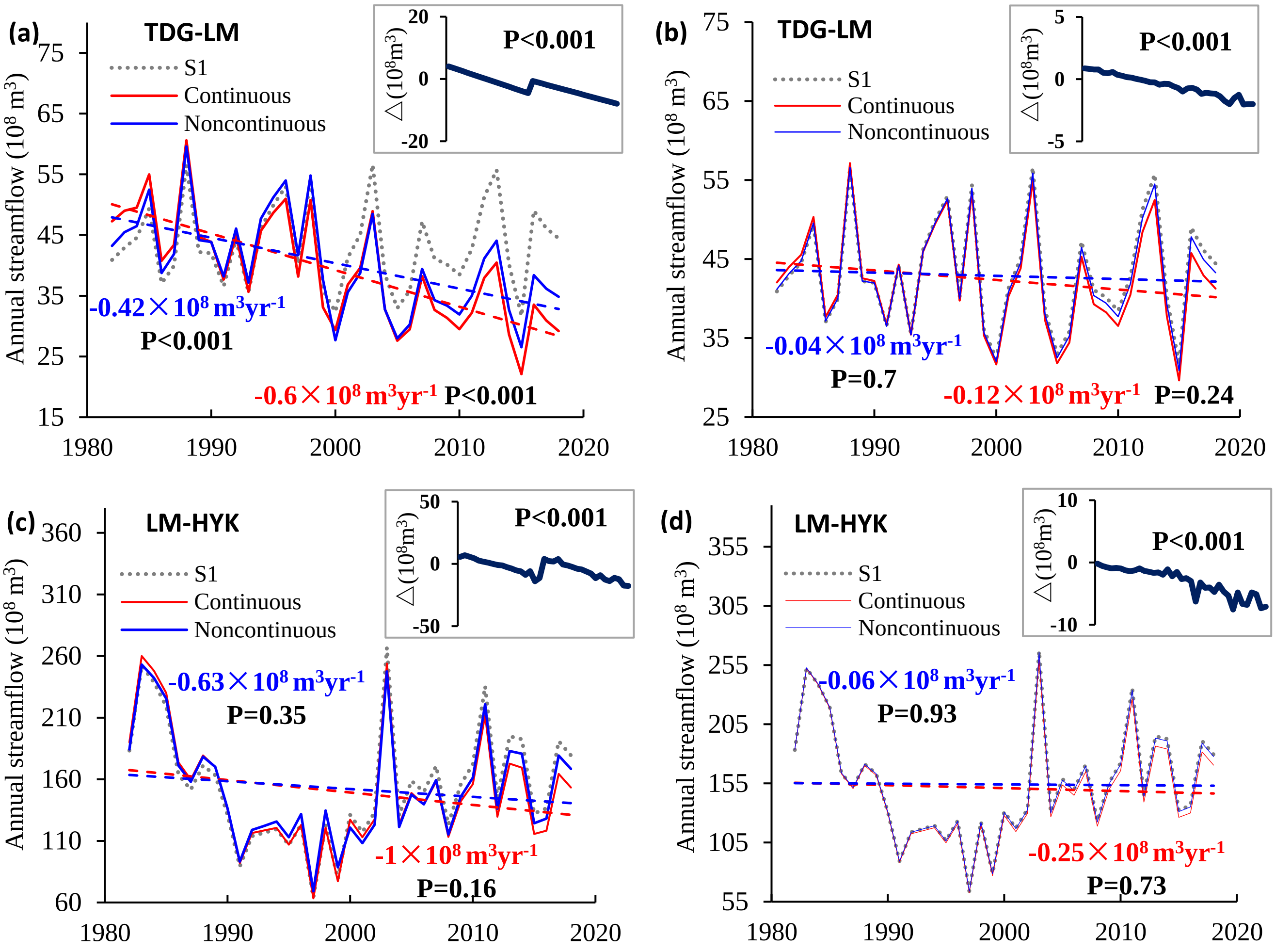


Figure 12. The comparison of simulated annual streamflow trend using VIC considering and without considering continuous dynamics of interannual LAI (a and c) and intra-annual temporal pattern of LAI (b and d) in the TDG-LM and LM-HYK. The insets show the time-series of difference between simulated annual streamflow with VIC considering and without considering continuous LAI dynamics, and its significance level of change trend.

Point 7: Line 455 Differences between trends of annual streamflow with continuous and noncontinuous LAI changes is little visually, especially for Figs. 12b, c, and d, so adding significant level of these trends may be more convincing.

Response: Great thanks for this comment. Due to original interannual fluctuations of annual streamflow were reserved in the scenario simulations, the change trends of simulated annual streamflow (Figure 12(b)(c)(d)) are insignificant. It is also shown from the Figure 12 that the range of fluctuation of original annual streamflow is relatively large, hence differences between trends of annual streamflow with continuous and noncontinuous LAI changes is little visually. However, it should be noted that time-series of difference between simulated annual streamflow with VIC considering and without considering LAI dynamics actually shows extremely significant change trend ($P<0.001$), and this insert plots has been added into the Figure 12 to demonstrate obvious differences. To make the figures more clear, understandable and scientific, the significance level of the trend of time-series of difference in the Figure 12 was added in the original figures, and the details are shown below.

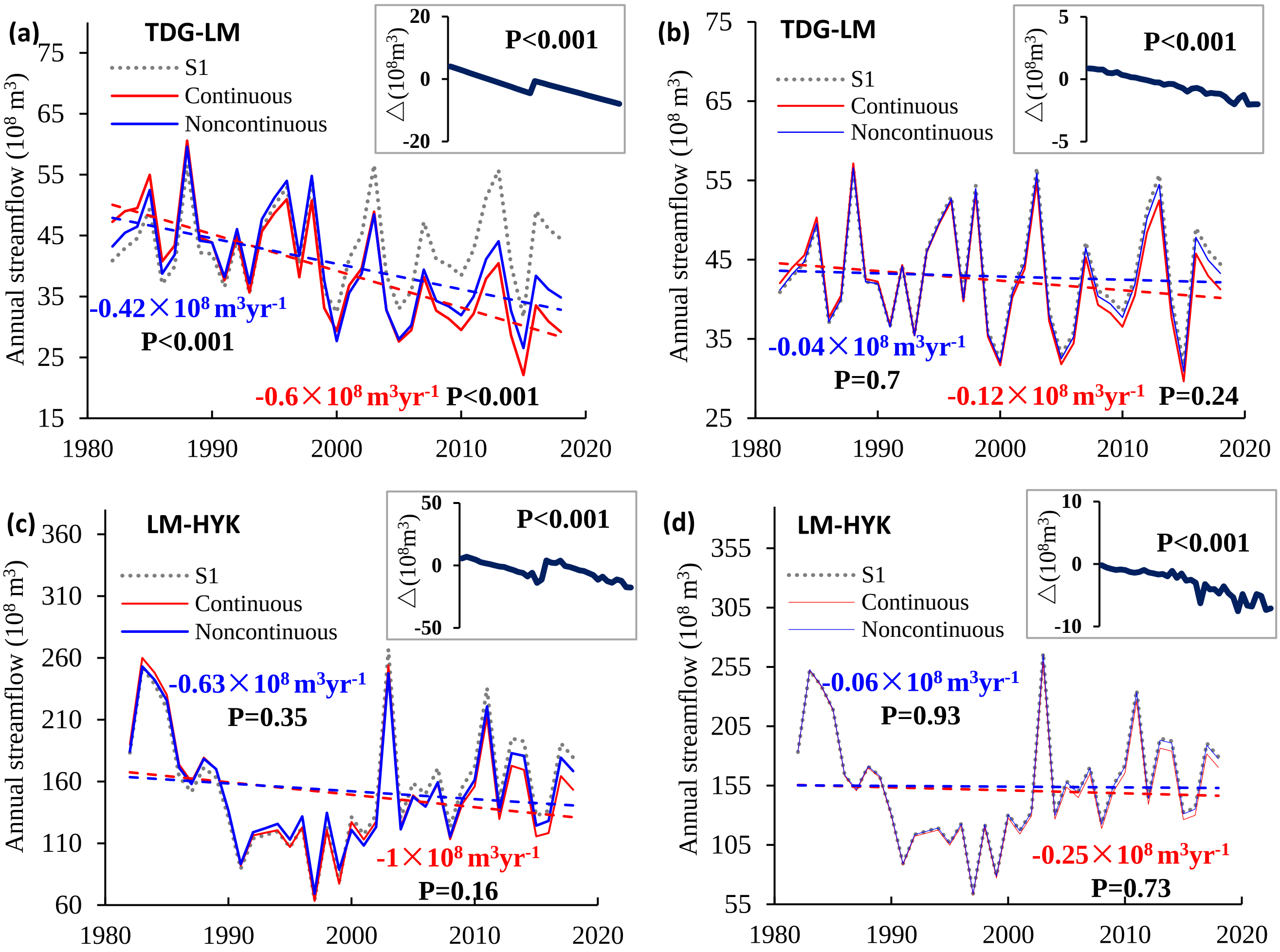


Figure 12. The comparison of simulated annual streamflow trend using VIC considering and without considering continuous dynamics of interannual LAI (a and c) and intra-annual temporal pattern of LAI (b and d) in the TDG-LM and LM-HYK. The insets show the time-series of difference between simulated annual streamflow with VIC considering and without considering continuous LAI dynamics, and its significance level of change trend.

Point 8: Line 458 Error in figure name; Figs. 12c and 12d are for LM-HYK instead of LM-TDG.

Response: Great thanks for this great comment. According to your suggestion, corresponding description has been revised, and the details are shown below.

Figure 12. The comparison of simulated annual streamflow trend using VIC considering and without considering continuous dynamics of interannual LAI (a and c) and intra-annual temporal pattern of LAI (b and d) in the TDG-LM and LM-HYK. The insets show the time-series of difference between simulated annual streamflow with VIC considering and without

considering continuous LAI dynamics, and its significance level of change trend.

Point 9: Line 486-491 This paragraph should move to Section 5.2 to build a direct connection with streamflow change, so that take Section 5.3 as an additional methodological analysis to highlight the role of vegetation dynamics in streamflow trend.

Response: Great thanks for this great comment. According to your suggestion, corresponding paragraph has been moved to the end of the Section 5.2, and the details are shown below.

Recent studies have increasingly focused on the effect of vegetation phenology and growth on runoff. It is found that earlier spring phenology and delayed autumn phenology promote a longer growing season and can increase the period for plant transpiration, potentially resulting in larger transpiration and might reduce the river runoff (Piao et al., 2019; Geng et al., 2020; Wu et al., 2021; Chen et al., 2022). These results were consistent with the negative effect of intra-annual temporal pattern of LAI associated with phenology change on runoff simulated by VIC model considering explicit vegetation dynamics in this study.

Point 10: Line 544 Usage of due to is wrong, please check it throughout this MS.

Response: Great thanks for this great comment. According to your suggestion, corresponding description has been revised, and the details are shown below.

The LAI increase is always associated with land cover change as a result of restoration projects, hence the vegetation's hydrological effect was considered as the total impact from LAI and land cover changes in this study.

Point 11: Line 547 Grammatical error, accounts instead of account.

Response: Great thanks for this great comment. According to your suggestion, corresponding description has been revised, and the details are shown below.

This inevitably involves the impacts of non-vegetated land cover conversion (e.g., urbanization), nevertheless this land cover change type only accounts for a very small proportion of YRB.

Point 12: Line 555-557 Usage of disentangle is wrong, rewritten it, please.

Response: Great thanks for this great comment. According to your suggestion, corresponding description has been revised, and the details are shown below.

Here, daily meteorological, monthly LAI and yearly land use/cover time-series data were coupled in the VIC hydrological model to clarify the contributions from temporally explicit changes of climate variables and vegetation on the natural streamflow trend during 1982-2018.