We thank the two reviewers and the editor for their comments, which helped improve the manuscript. We address all of their comments in blue below.

Editor: by Pieter van der Zaag

This paper addresses an interesting and important topic. If it succeeds in better quantifying the impact of small reservoirs on the hydrology (rather than the modelled hydrology, as in the title) than it is also a salient paper. But I am yet to be convinced what new knowledge this paper adds, despite of the use of the word "novel" in the abstract.
We believe that the main novelty of the study is the integration of a top-down data-driven remote sensing-based algorithm and resulting data products on dynamically quantifying the OFR area with the SWAT+ physically-based model. However, we are not among the developers of SWAT+, and modifying the model is beyond the scope of our work.

My main worry concerns my doubts whether the method that the authors adopt is suited to achieve their objective, that is to assess the cumulative impact of on-farm reservoirs that "store water from precipitation and runoff during the rainy season to irrigate … crops during the dry season" (lines 18-19).

These reservoirs (OFRs) are meant to displace water in time in order to provide water for irrigated lands during the dry season. But the model the authors employed cannot or does not model water abstractions from these reservoirs to the farm lands. The only thing the model apparently does is follow "the model default rule, which sets the OFRs to release water when the spillway volume is reached – 80% of the OFRs capacity" (lines 276-277). So the model cannot model the actual use of the OFRs, the impact of which the authors want to assess. It is also not clear how irrigation water fluxes are or are not included in the SWAT+ model.
Considering the rule—releasing at 80% of the OFR capacity—is a reasonable assumption, as the remaining capacity provides freeboard or accounts for uncontrolled spills from the reservoir. Since most of our results are presented on monthly and annual time scales, this approach captures the cumulative impact of OFRs, particularly during critical low-storage months (June–September), when their effect on storage and downstream flows is most significant.

Data on irrigation fluxes are challenging to obtain, as water is appropriated from channels along the river. To address this, we assume that water appropriated for irrigation returns to the channels after a fraction is lost as consumptive use, which we account for based on typical seasonal patterns, particularly the higher consumptive losses in July. While the SWAT+ model does not explicitly simulate field-level water abstractions from OFRs, the approach used effectively represents the broader hydrological impacts of OFRs on storage, flows, and irrigation at the watershed scale.

An alternative way of assessing the impact of OFRs on the hydrology is to measure the change in one of the most important fluxes of the water balance, namely evaporation from the irrigated crops (transpiration or evapotranspiration), whereby it could be assumed that with each OFR there are associated irrigated fields, i.e. more OFRs imply more irrigated fields and more evapotranspiration. The added evaporation will obviously impact the surface hydrology. But the paper does not even discuss this, let alone model it.
We added a note on the importance of ET in the discussion, please see next comment below.

The point is that the reservoirs themselves have a limited impact on the hydrology, compared to their capacity to divert water in time and place in order for it to (largely) evaporate. So statements such as “the presence of OFRs in the watershed decreased annual flow” (lines 27-28) are suggestive and strictly speaking incorrect. A more correct statement would be “the presence of OFRs in the watershed is associated with a decreased annual flow”. The OFRs themselves are unlikely to significantly decrease these annual flows, as the study region is not very arid, and the additional evaporation losses directly from the open-water reservoirs is probably limited. The impact largely comes from increased irrigation, and this is of course nothing new. A PhD student of mine ten years ago used actual evaporation estimates derived from remote sensing to force a hydrological model, which could adequately model an intensely (irrigated) cropped catchment in Africa (Kiptala et al., 2014). Nowadays there are better products, even and in particular from Planet Inc. (!), for estimating actual evapotranspiration.
We have rephrased the statement on lines 27–28 to now read: “the presence of OFRs in the watershed is associated with a decreased annual flow”, as per your suggestion.

We appreciate your suggestion to explore advanced ET products to estimate actual evapotranspiration. We have included a note in the discussion section acknowledging it as a valuable next step for refining hydrological models. The sentence reads: “Future work should integrate data on actual evapotranspiration, ET (Kiptala et al., 2014) to quantify as the balance between water availability and ET determines in large part the irrigation system efficiency and crop productivity in the watersheds where OFRs occur”.

We agree that the primary impact of OFRs in our study region arises from their ability to redistribute water for irrigation rather than direct evaporation losses. While integrating additional ET data, such as those from Kiptala et al. (2014), could enhance our modeling, this lies beyond the current study’s scope, which focuses on broader hydrological trends associated with OFR presence.

The above concerns need to be addressed in the revised paper. The revised paper should obviously also adequately address the issues raised by the two reviewers.
We addressed those in detail below.

Reference

Kiptala, J.K., M.L. Mul, Y. Mohamed and P. van der Zaag, 2014. Modelling stream flow and quantifying blue water using modified STREAM model for a heterogeneous, highly utilized and data-scarce river basin in Africa. Hydrol. Earth Syst. Sci. 18, 2287–2303 [doi:10.5194/hess-10-18-2287-2014]

Reviewer 1

General comments

The article deals on an important issue, the impact of on-farm reservoirs on the hydrology.

The article propose an interesting application, with an innovation that consist in imposing surface and hence volume of the reservoirs in the model as derived from satellite data.

The application is in Arkansas, USA, with about 300 OFRs on a basin of 530km2, known for the importance of irrigation.

One issue with such reservoirs is the lack of data on their management.

From what I understood, the study tries to retrieve some parts of the management of the OFRs by imposing the extension of surface water of the OFRs which is very interesting

However, some elements of the methods are not clear, and I couldn't understand how the model really works, and how the OFRs are managed.

My main comments is that the way OFRs are models and their management should be clarified

Details questions

Introduction : Peak flow is mentioned in the introduction and analysed in the study, but never defined... In the study, it seems to be maximal annual monthly flow, which is quite far to what can expect as peak flow, ie, flood... Can you define ?

Peak flow is defined on lines 382-384 as follows:

"For this analysis, peak flow is defined as equal to or higher than the 99th flow percentile calculated using the entire flow time series (Equation 3)."

Section 2.1: It is stated that there are with about 330 OFRs. The size of the basin, given later in the text is 7107 km2. Thus, the density of the OFRs is lower than 0.05 OFRs/km^2. This corresponds to a small density, especially considering large annual precipitation (1300mm/year) when compared to previous studies review by Habets et al., 2018 refered in the article. It is stated that 95 % of the OFR are smallest than 50ha, and Fig 4, it is shown than only about 10 aggragated OFRs are smaller than 10ha. According to the hypothesis used in the study of an average depth of 10m, 10ha corresponds to a capacity of 1 million cubic meter, which is quite large.

So is there only 330 OFRs because there are actually rather large OFRs. Or Is it possible that smaller OFRs are missing ?

The average depth of these OFRs is shallower than 10 meters, ranging from 2 to 4 meters. These man-made reservoirs do not follow a consistent construction pattern, making the acquisition of accurate depth data challenging. The total capacity of these OFRs is estimated to be at least half of what the reviewer estimates.

There are many additional OFRs in the basin, but most remain unmapped with the current resolution of satellite data (3m Planet Scope, 10m Sentinel). This study focuses on 330 OFRs previously mapped by Yaeger et al. (2017). Capturing all OFRs is only feasible with a ground inventory, and some OFRs are intermittent, meaning they may not be full in a given year.

To clarify the points above, we added information on Lines 153-156:

"This study only accounts for a fraction of the total OFRs in the study region, given that there is no comprehensive and up-to-date inventory of all OFRs in the basin. This limitation is partly due to the fact that many of these man-made structures are located on private properties, making them difficult to document."

Line 274 « For each of the aggregated OFR, the water volume was calculated using SWAT+ default rule, which is a simple multiplication of the OFR surface area by a factor of 10 » : Do you mean that the maximum volume capacity of the OFRs is the maximum surface area multiplied by 10m ? Or do you mean that the water level within the OFR is constant and fixed to 10 ? This is unclear...

Yes, the first statement is accurate. For a given situation where the OFR has a surface area of 1 ha (10,000 m^2), the corresponding initial maximum volume would be 100,000 m^3. This assumption reflects one of the main limitations of our study, given that depth information is not available for all OFRs.

Added information to make it clearer on lines 292:295:

"For a scenario where the OFR has a surface area of 1 hectare (10,000 m^2), the corresponding volume would be 100,000 m^3—this is an important limitation of our study, as the assumption was necessary due to the absence of available bathymetry data."

Line 282 : I find it weird to have details on how the river channel are divided in 4 classes, while, no details on the way the OFRs impacts the water balance are given...

You need to provide the water balance of the OFRs:

what are the inputs and ouptuts of the OFRs ?

Is there water abstraction from the OFRs ? How much ? How is it computed ? What are the temporal variations ?
Is there evaporation from the OFRs ?
Does the water level vary ? Is the water level affect the outflow ?, due to the spillway
The surface of the OFRs is changing. But is it the only way to have a change on the volume of the OFRs ?
What's happening if the surface of the OFRs is decreasing ? Does it lead to an outflow of water downstream ? Does the associated volume is expected to be abstracted for irrigation ? How this volume is estimated ? What happens when the surface area increase ? Does the inflow feels the reservoir ? Again how the corresponding volume is estimated ? What if the inflow is not large enough to fill the OFRs ?

I'd like to have a detail explanation of how it works.

We did not have access to abstraction data from the OFRs, so all abstractions are modeled according to Equation 3, which accounts for water flowing out of the OFR and losses through evaporation and seepage.

The water level varies according to surface area variability, which is also affected by evaporation losses and spillway. An increase or decrease in surface area would impact the OFR water volume accordingly.

If the surface area decreases, the water volume is expected to decrease. If the inflow is not sufficient to fill the OFR, the water is expected to be routed to the following water channel. The OFRs are located on the watershed's channel network. They receive loadings from upstream channels and potentially from surrounding routing units and usually discharge into one downstream channel.

Added information on Lines 281-324:

2.4 OFRs water balance

"We did not have access to water abstraction data from the OFRs, so all abstractions were modeled using Equation 3, which accounts for water flowing out of the OFR, as well as losses from evaporation and seepage. The total volume of water in the OFR fluctuates with changes in surface area and is also influenced by evaporation losses and the spillway. A reduction in surface area (Equation 4) typically leads to a corresponding decrease in water volume. If inflows are insufficient to fill the OFR, water will not be routed to the downstream channel.

$$V = V_{stored} + V_{flowin} - V_{flowout} + V_{pcp} - V_{evap} - V_{seep} \quad (3)$$

Where V is the volume of water in the OFR at the end of the day (m^3), V_{stored} is the volume of water stored at the beginning of the day (m^3), V_{flowin} is the volume of water entering the OFR during the day (m^3), $V_{flowout}$ is the volume of water flowing out of the OFR (m^3), V_{pcp} is the volume of precipitation falling on the water body (m^3), V_{evap} is the volume of water removed from the OFR due to evaporation, and V_{seep} is the volume of water lost by seepage (m^3).

The OFR surface area is used to calculate the amount of precipitation falling on the water body, and the amount of water lost through evaporation and seepage. Given the initial OFR surface area obtained from one of the three modeling scenarios, the OFR surface area was modeled daily. The surface area varied according to the volume of water stored in the reservoir. Equation 4 is used to estimate the surface area:

$$Surface\ area\ (ha) = \beta_{sa} * V^{\,expsa} \tag{4}$$

$$expsa = \frac{log10\,(Vem) - log10(Vpr)}{log10\,(Surface\ areaem) - log10\,(Surface\ Areapr)} \tag{5}$$

$$\beta_{sa} = \left(\frac{Vem}{Surface\ areaem}\right)^{expsa} \tag{6}$$

Where β_{sa} is a surface area coefficient, V_{em} is the volume of water (m^3) at the emergency spillway, V_{pr} is the volume of water (m^3) at the principal spillway, $Surface\ area_{em}$ is the surface area (ha) at the emergency spillway, and $Surface\ area_{pr}$ is the surface area at the principal spillway.

The volume of precipitation falling into the OFR is calculated using Equation 7:

$$V_{pcp} = 10 * R_{day} * Surface\ Area\ (ha) \tag{7}$$

Where R_{day} is the amount of precipitation falling into the OFR on a given day (mm).

Evaporation losses are calculated using Equation 8:

$$V_{evap} = 10 * \eta * E_0 * Surface\ Area\ (ha) \tag{8}$$

Where η is an evaporation coefficient (0.6), and E_0 is the potential evapotranspiration for a given day (mm).

Seepage losses are calculated using Equation 9:

$$V_{seep} = 240 * K_{sat} * Surface\ Area\ (ha) \tag{9}$$

Where K_{sat} is the effective saturated hydraulic conductivity of the reservoir bottom (mm/hr).

Section 2.4 Scenario Analysis

line 297 ; "The daily surface area time series of each OFR was used to simulate three scenarios (i.e., lower, mean, and upper) representing the OFRs' capacity in terms of surface area." Sorry, but, again, this part is not clear. Figure 2 is not very 3 helpfull to understand what is done...

Hopefully Figure 2 is clearer with the extra explanations.

Added more information to lines 357:362 to clarify this issue:

“Therefore, a single surface area value was assigned to each scenario and OFR, with lower, mean, and upper values used as starting points for the model's water balance simulations. This initial surface area reflects the OFR’s maximum surface area at full capacity for each scenario. For example, in the lower scenario, an initial surface area of 1.2 ha represents the maximum area for this OFR. As model iterations proceed, the surface area is recalculated based on Equation 4.”

It is stated that the « daily OFRs’ surface area change between 2017 and 2020 » is derived,, and then that (line 300) « The mean scenario represents the regular condition of the OFRs, and it is the mean of the daily surface area time series derived from the Kalman filter , The lower and upper scenarios represent the lowest and highest capacities of the OFRs, and they are based on the surface area 95% confidence interval limits, calculated using the daily time series. »

So there is 4 value for each day of the year, how do you compute a 95 % confidence ?

The 95% confidence is calculated using the outputs from the Kalman filter presented in Perin et al., 2022. This is done by estimating the state and covariance matrix to assess uncertainty in the state estimate. The standard error is derived from the covariance matrix, which reflects the error variance in the estimation. By multiplying the standard error by 1.96 (the critical value for a 95% confidence level), the resulting interval provides a range where the true state is likely to fall within 95% certainty, offering a probabilistic measure of the estimate's accuracy.

Added information on Lines 350-351 to clarify this issue:

“Please refer to Perin et al., 2022 for more details on how the 95% confidence interval was calculated”.

Line 304 : » For each scenario, the OFRs were simulated at full capacity (i.e., maximum storage at the lower, mean and upper scenarios), and this capacity was kept constant during the simulation period »

Indeed, this is confusing. We improved this section by modifying lines 352:370 See the comments below for more details.

⇒ this seems to be in contradiction with the previous sentence... Do you mean that the maximum capacity is set constant ? That the volume is set constant... ? Please, make it clearer...

Moreover, this part is the innovative part of the article. And only the distribution of the area of the aggregated OFRs is given Figure 4, and no details are given on the annual cycle of the OFRs … I strongly suggest that the daily evolution of the surface area of the OFRs be presented, for the 3 scenarios.

And again, please explain how the evolution of the surface impact the evolution of the volume….

Does this surface change gives indication on the volume of water used for irrigation ? If yes, please, provide the estimated values…

By simulating the three scenarios, we aimed to model the behavior of the OFRs at different capacities. We agree with the reviewer that a more realistic approach would involve directly inputting the daily surface area time series into the model. However, since the surface area is modeled based on Equation 4 for daily model simulations, this information was not an input. Instead, for each scenario, we provided a single surface area value for each OFR, which then served as a starting point for variations according to the reservoir water balance equation (Equation 3)—that's what we meant when the OFR was modeled at full capacity. In other words, surface area and volume were not kept constant, however, unfortunately, the model does not allow the direct input of the daily surface area time series generated by the Kalman filter—outputs from Perin et al., 2022. Considering this limitation, we proposed the three scenarios described in section "2.4 Scenario Analysis.

Added information to lines 352:370:

"The SWOT+ model does not allow for direct incorporation of a daily surface area time series because it calculates surface area dynamically (Equation 4) based on changes in water volume through the reservoir water balance equation (Equation 3). It is structured to accept a single surface area value per scenario, which then varies internally. Incorporating time-varying surface area data, such as from the Kalman filter, would require modifications to the model that are currently not supported."

Line 360 : The impact of the OFRs on monthly flow varied throughout the year…. Ok, but here, the reason of this impact is not clear : there is no information on the management of the OFRs, so, no idea of when they are filled, when the water is used/ abstracted, the condition for the water to spill out… So, again, please provide an description of the water balance and describe the hypotheses… the dynamic of the storage is clearly missing….

All this part is difficult to follow since key informations are missing…

Information regarding the water balance was added in "Section 2.4 OFRs water balance" (see lines 280:324). Yes, the reviewer is correct, there is no information on the OFRs management, and that is because this information was not available.

Section 3.3 : impact on peak flow... You have to define what you consider as peak flow...

Peak flow is defined on lines 382-384 as follows:

"For this analysis, peak flow is defined as equal to or higher than the 99th flow percentile calculated using the entire flow time series (Equation 3)."

Section 3.4 Again, difficult to understand as the hypotheses on the functioning of the OFRs are not clear. You should present the evolution of the OFRs volume and surface in this section, as well as the evolution of the abstracted water....

Hopefully, this section is clearer now, given the additional information on water balance.

Section 4 : Discussion

line 512 : « our validation and calibration was done using the flow measurements, and the OFRs surface area scenarios were based on an algorithm that was validated with an independent higher spatial resolution dataset (Perin et al., 2022). »

==> This sentence is not clear : OFRs surface area is an input data, not an output to be validated....

True. We used the OFR surface area as an input in this study. However, the surface area derived from satellite data in a previous study was manually validated in the previous study cited.

line 515 : « Furthermore, differently from previous research, our results showed that the OFRs may have a positive (< 9%) impact on flow (Fig. 5, classes 3 and 4) »

⇒ This is true only for some months...But you don't explain why. This can occur only if OFRs release some water. But the management of the OFRs is not presented at all...

Yes, this is true for some months, and the main cause of that is related to how the water balance was calculated, i.e., an increase in the reservoir outflow, given other aspects of the modeling that are not related to irrigation activities or water management—information that is not available. Our analyses on the OFRs impact were carried out at the channel level, which differs from previous studies that mostly reported the annual impact on flows.

line 527 : « This could be explained by the level of details in our analyses. »

Clarified this issue by adding information to lines 603:613:

“When evaluating flow changes at the channel scale, it’s important to note that flow at this level is several orders of magnitude smaller than at the main basin outlet. Consequently, this scale often exhibits more significant percentage changes, both increases and decreases. This likely explains how OFRs can enhance channel flow, primarily due to the additional water contributed by OFRs, influenced by periods of increased precipitation in certain channels during specific months and years. While we calculated the monthly impact on flow at the channel scale by aggregating the OFRs to the closest channel, previous studies have mostly reported the annual impact on flows (Habets et al., 2018), and they performed their analysis at the subwatershed scale by aggregating the OFRs to a single point at the outlet of each subwatershed in SWAT (Evenson et al., 2018; Kim & Parajuli, 2014; Perrin, 2012; Zhang et al., 2012), or they used different modeling approaches (see Habet et al., (2018))”

⇒Well to achieve this, it is necessary to know how much of the water in the OFRs is used, directly in the OFRs, but also, if the OFRs releases water in the river, to have a clear idea of the pumping directly in the river.

That is true. This is a clear limitation of our study.

This was highlighted in lines 384:386:

“However, the impact of the OFRs in this analysis is solely based on modeling scenarios and does not account for OFR management practices, which represents a key limitation of this simulation study.”

Moreover, it is not clear that this increase of riverflow with OFRs improves the model results, thus, correct a bias of the model without OFRs.

line 542 « For instance, during January and May the mean monthly percent change ranged between -35.8 ± 6% and -32.0 ± 7%, and during June and December it varied between -8.8 ± 5% and -5.4 ± 6% for the three surface area scenarios »

⇒ Do these values refer to the evolution of the surface of the OFRs ? Such info is needed earlier to understand the method and the results

Yes, that is mostly driven by changes in the OFRs' surface area (Equation 4) and the water balance output.

Added more information to lines 669:673 to clarify this point:

“The changes in the OFRs impacts along the year, and between different years, are directly related to the OFRs water balance (Equation 3). The variations are primarily driven by the volume of water stored by the OFRs, which is modeled at a daily scale, and it varies according to total daily precipitation, evaporation, and seepage losses.”

line 559 : « Our findings highlight that the impacts of the OFRs on flow and peak flow have a significant intra- and inter-annual variability (Figs. 5, 6, and 7) »

⇒ Fig 5 only present monthly flow. So, again, it depends on what you call peak flow...

Peak flow is defined on lines 382-384 as follows:

"For this analysis, peak flow is defined as equal to or higher than the 99th flow percentile calculated using the entire flow time series (Equation 3)."

line 593 « Our results indicate that OFRs do not have an equally distributed impact on mean and peak flow across the watershed. Hence, assessing the OFRs location as well as their numbers across the watershed is important when aiming to manage the construction of new OFRs. »

⇒ I don't understand how you can reach such statement... 1st, because no indication is given on the OFRs management, 2nd, the density of the OFRs varies in space....

Even though we do not have information on OFR management, we can still show the variability of their impact, which in this case is mostly related to their size, their variations in water volume, and their number, i.e., their presence.

Added extra information to lines 677:680 to clarify this statement:

"Our results indicate that OFRs do not have an equally distributed impact on mean and peak flow across the watershed. This variability is primarily influenced by differences in their size, water storage capacity, and their spatial distribution (i.e., their presence)".

line 620 : « there is no bathymetrie » Does it means that the water level in the OFR is constant !

We do not have bathymetry information—that would be the most important information needed to estimate the OFRs water volume. However, for the modeling scenarios, the OFRs water volume changes according to their surface area, and therefore, it is not kept constant, and modeled according to Equation 3.

Reference

Yaeger et al : Trends in the construction of on-farm irrigation reservoirs in response to aquifer decline in eastern is not well referenced

Correct Reference:

Yaeger, M. A., Massey, J. H., Reba, M. L., and Adviento-Borbe, M. A. A.: Trends in the construction of on-farm irrigation reservoirs in response to aquifer decline in eastern, Agric. Water Manag., 208, 373–383, https://doi.org/10.1016/j.agwat.2018.06.040, 2018.

#Reviewer2

Dear Authors,

The study innovatively assessed the spatial and temporal variability of the cumulative impact of OFRs at the watershed and subwatersheds levels, quantifying the annual impacts of the OFRs on flow and peak flow at the channel scale. Although the manuscript presents relevant novelty, there are some issues, which must be addressed or clarified by the Authors, prior to the study's publication, in my point of view. Please, see below my comments and suggestions.

Major comments:

1. The influence of OFRs on surface hydrology and their mathematical representation could not be adequately evaluated, because there is no streamflow monitoring in the areas with the presence of the OFRs (see Fig. 1).

   Hopefully, this issue is clarified with the information added in "Section 2.4 OFRs water balance (see lines 281-324)".

2. Very simple considerations were assumed for the water volume and water releases of OFRs (see Lines 273-278). This is a critical issue of the study, which should be addressed by fieldwork or at least by a sensitivity analysis.

   True, and an important limitation. We added a few more lines describing this limitation.

   See added lines 291:294:

   "This is a significant limitation of our study, as the assumption was necessary due to the absence of available bathymetry data."

   This was already discussed in lines 708:718:

   "Future improvements should focus on how to better represent the OFRs water management (i.e., OFRs inflows and outflows) in SWAT+. Given that each OFR has an independent water balance, accounting for the OFR water volume change would be a more realistic representation of the OFRs when compared to the three surface area scenarios tested in this study. Estimating the OFRs volume change can be done by combining the OFRs surface area time series with area-elevation equations—these equations describe the bathymetry of the OFRs, and allow volume estimation by inputting the OFRs' surface area (Liebe et al., 2005; Meigh, 1995; Sawunyama et al., 2006). After carefully assessing different methods to derive these equations (Arvor et al., 2018; Avisse et al., 2017; Li et al., 2021; Meigh, 1995; Sawunyama et al., 2006; Vanthof & Kelly, 2019; Yao et al., 2018; Zhang et al., 2016), we decided that measured ground-data of the OFRs' depth—which is not available—is required to estimate the equations with an acceptable uncertainty"

3. Please, explain in detail how hydrologically the OFRs could positively impact streamflow, as you found.

   This is related to the analysis being carried out at the channel level, and it was observed for a few months of the year, based on how the water balance is calculated.

   Clarified this issue by adding information to lines 603:613:

   "When evaluating flow changes at the channel scale, it's important to note that flow at this level is several orders of magnitude smaller than at the main basin outlet. Consequently, this scale often exhibits more significant percentage changes, both increases and decreases. This likely explains how OFRs can enhance channel flow, primarily due to the additional water contributed by OFRs, influenced by periods of increased precipitation in certain channels during specific months and years. While we calculated the monthly impact on flow at the channel scale by aggregating the OFRs to the closest channel, previous studies have mostly reported the annual impact on flows (Habets et al., 2018), and they performed their analysis at the subwatershed scale by aggregating the OFRs to a single point at the outlet of each subwatershed in SWAT (Evenson et al., 2018; Kim & Parajuli, 2014; Perrin, 2012; Zhang et al., 2012), or they used different modeling approaches (see Habet et al., (2018))"

4. I did not fully understand what kind of results you would like to explore in section 3.5 Overall impact of OFRs. Please, improve this section.

   The spatial variability of the impact of the OFRs. We changed the section name.

   "Section 3.5 Spatial variability of the OFRs impact on annual flow".

   Added extra information to lines 677:680 to clarify this statement:

   "Our results indicate that OFRs do not have an equally distributed impact on mean and peak flow across the watershed. This variability is primarily influenced by differences in their size, water storage capacity, and their spatial distribution (i.e., their presence)".

5. In the beginning of the manuscript, you mentioned that one of your focuses is the analysis of the interannual flow variability. However, I could not find such an analysis. An example of simulated time series (section 3.4) is not enough. For example, what are the impacts of OFRs on low-flow and high-low years?

Figure 5 highlights monthly changes and during all simulated years. For example, for the month of January, we analyzed how the OFRs contributed to changes in channel flow, using data from January between 1990 and 2020 for all OFRs. This variability, which also includes years with low and high flows, is shown by the size of the bars for each month.

To clarify this issue, we added an extra sentence to the Figure 5 caption:

“This analysis included data from all simulated years (1990–2020).”

comments:

1. Lines 385-386: “In general, the OFRs contributed to decreased monthly flow. However, the OFRs' impact on flow had a significant intra- and inter-annual variability…” Figure 5 is only on intra-annual variability or, also called, seasonal variability.

   A close examination of Figure 5 reveals its various components. The channels are categorized into four classes, and for each class, we assess how the flow fluctuated over the course of the year, represented along the x-axis by each month. The three bar colors indicate three distinct scenarios, while the bar heights reflect differences among channels as well as variations across years. For example, when examining the bars for January, they encompass all January data from 1990 to 2020.

   Added extra information to lines 425:429:

   “Figure 5 breaks down the channels into four distinct categories, with each category showing variations in flow throughout the year, displayed along the x-axis by month. The three bar colors represent different scenarios, while bar heights illustrate variations across channels and years. For example, the bars for January include all January data spanning from 1990 to 2020, enabling a thorough comparison of seasonal and year-to-year flow changes.”