Dear Reviewer,

Thank you for the comprehensive and constructive review of our article. We understand that we should improve some aspects of this article and are willing to address most of your comments in a revised version, if the editor request us to do so. Please find below some answers to your questions and explanations on how we would address your comments. Our answers are in blue and your comments are in black.

Major comments:

1. Page 2, Line 42-44: "Furthermore, as noted by Cook (2015), it is unusual for two gauging stations to be located on the same river without intervening tributaries. Therefore, quantifying transmission losses from two existing gauging stations is rarely possible." I disagree. In reality, for large dryland rivers, where the most studies on channel transmission losses were undertaken, upstream river discharge is much larger than runoff produced between the streamgauges. Considering allogeneic dryland rivers, this runoff is practically null. Therefore, quantifying transmission losses from two or more existing gauging stations is perfectly possible in drylands.

Thank you for pointing that out, we will remove this sentence.

2. The described perceptual model of the surface-groundwater interaction of the study site (2 Study site) must be much better spatially presented, showing profiles along and across the main river and aquifer units.

We agree that this should be better presented in our paper and will make changes in this direction, including adding profiles (cross-sections) of the river and aquifer units, as suggested. Please also note that Larned et al. (2008) devoted a complete article to the presentation of the Selwyn River climate, geology, hydrology and geomorphology so we will try to keep it rather short in our article and refer to their work for further information.

3. As you described in the study site, is it correct to say that the water lost in the ephemeral losing reach is immediately available again downstream?

The water lost in the ephemeral losing reach is flowing underground to and then within the deeper regional aquifers before reaching the downstream gaining reach. The water in the gaining reach might also partly come from other sources (e.g. Waimakariri River, land surface recharge). Therefore the water lost in the ephemeral reach is not immediately available in the river downstream. This will be clarified by the profiles that will be added following your suggestions and by adding some text as well.

4. The ephemeral reach is always a losing one? Even during high floods?

We believe that the ephemeral losing reach is always losing overall, even during high flood, because of the flat topography, high soil permeability (gravel) and the absence of tributary around this section of the river. We will clarify that in the text if needed.

5. Page 6, Line 137: Why did you use five inflection points for the rating curve?

The rating curve is derived with concurrent discharge and stage data collected under various flow conditions. When plotting the stage and discharge data on a logarithmic scale, the correlation between discharge and stage becomes linear. Therefore, the rating curve (line) can be defined by inflection points.

The inflection points indicate where the stage-flow relationship changes within the cross-section. Therefore, the number and location of these inflection points of the rating curve depend on the channel slope, cross-sectional geometry, roughness of bed and bank materials, vegetation etc. In the case of the Selwyn River at our study site, there is one notable cross sectional widening above 1.12 m that caused a change in the linear correlation. An inflection point was drawn to indicate the rating change due to a cross-section widening above 1.12 m. The specific software we use for rating curve development requires an endpoint, a breakpoint, and a start point to change the slope. As a result, three points were drawn despite only one break of slope, which makes 5 inflection points in total.

This appears to be a bit of an over parameterization and 3 inflection points (so 1 change of slope) would have been enough to describe our data. If relevant, we can recalculate our results using only 3 inflection points in the revised version. This will change the results only very marginally because the rating curve will be virtually the same.

The details of the inflection points are not directly related to the uncertainties of the rating curve, rather the rating uncertainties are related to the gauged flow and discharge data. The sentence on page 6, line 137 might have added confusion.

In our text, we will revise the section that discusses the rating curve and the associated uncertainties to improve its clarity.

6. 3.2.1 Transmission losses derived from the river drying front locations: the main problem of this methodology is there are just five days of comparison between the GPS and satellite drying front positions, although daily satellite images were available. Therefore, more fieldwork should be done, in order to properly estimate the uncertainty on the satellite wetted river length estimation.

The method used to identify the river drying front locations on the satellite images is rather straightforward for the Selwyn River. The river drying front is simply identified visually on aerial photographs (see example below in Figure 1). Therefore, it seems to us that 5 days of validation is enough. Moreover, depending where the river fronts is located, it can be difficult to access. In this regard, we were lucky to have a dry season in summer 2020-2021, this allowed us to verify on the field the location of the drying front close to our study site. This would be much more difficult to do at the moment with the wetter weather. Five verification points might not seem much but we think that this is already a valuable and not easy to gather dataset. Furthermore, we adopted a rather conservative uncertainty of 100 m on the river drying front locations identified on satellite images.

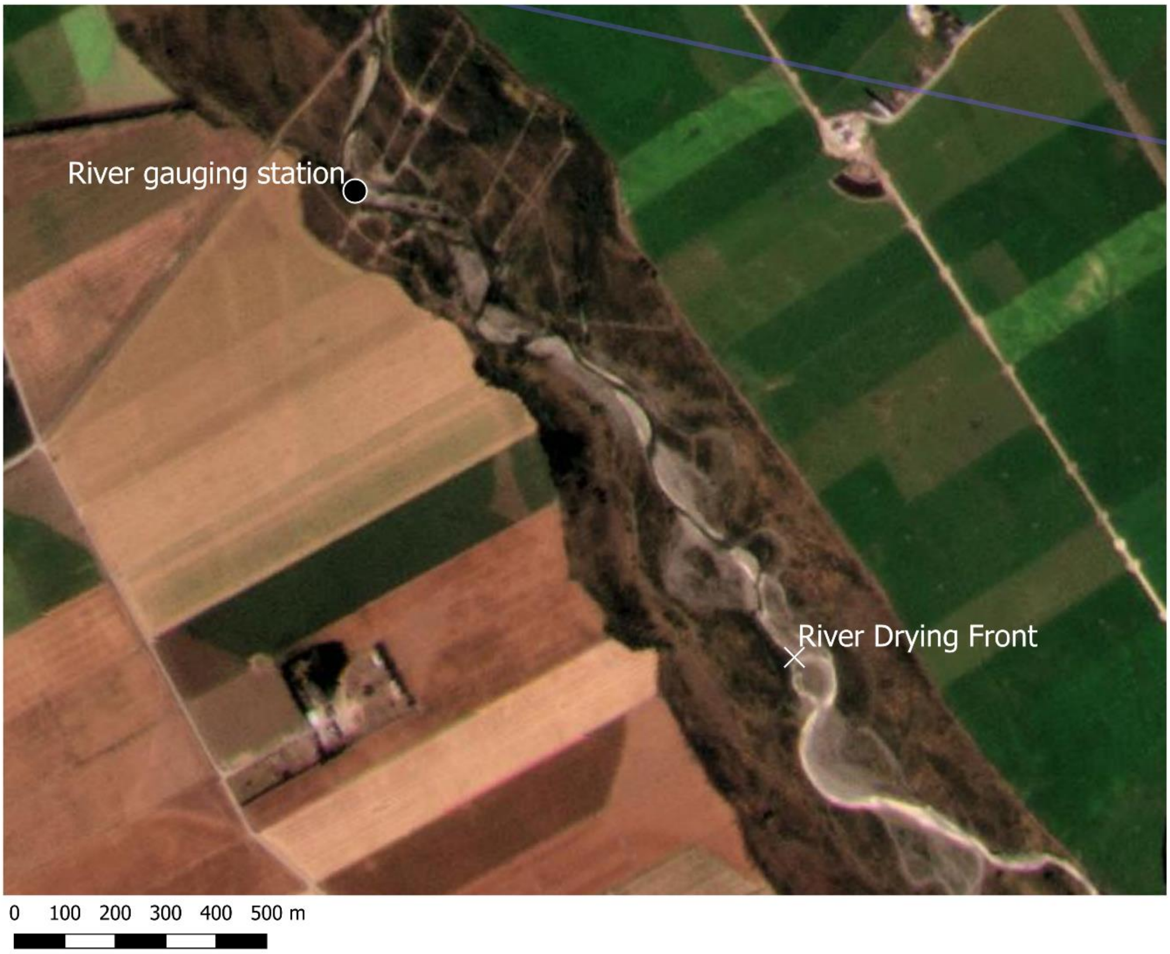

Figure 1: River drying front location identified on the satellite image taken on January 27, 2021.

7. Page 7, Line 180: you wrote that "the higher uncertainties are typically associated with shallow and low flow in the smaller braids." However, your fitted linear model showed a rather different result with higher uncertainties related to larger flows.

We meant the relative uncertainties, which are mentioned in the previous sentence. They represent the uncertainties on the flow measurements and are in general higher for lower flows. The linear models uncertainties, which represent the uncertainties on the transmission losses are indeed increasing with flow as discussed in section 5.3.

8. Page 13, Line 245: "... and the effect of the peaks becomes an important control" How?

Because of the amount of water lost at the drying front as discussed in section. 5.1. We will make clearer the link between this section of the text and the discussion in section 5.1.

9. 4.3 Reconstructed transmission loss time series: What did we learn about the transmission losses in the Selwyn River when the machine learning approach was applied? If there is nothing to add to our understanding of the process, I suggest either excluding it or to use another time series model.

The purpose of the machine learning 'reconstruction' was not to learn more about the processes but to produce a continuous hourly record. This record can be used first to investigate the exceedance probabilities and draw the duration curve as done in this study. Second, it is useful for further research work because it provides a continuous time series that can be used to evaluate physically-based models (work in progress). Third, there is some interest in predicting continuous records of both transmission losses and active river length for water management in this catchment. This is likely to be the case in other catchments as well. Therefore, we believe that this is an important part of the framework and that the random forest regressors are doing a good job at reproducing the estimations and propagating the uncertainties. We will add these explanations to the revised version of the manuscript.

10. You should compare your study with previous studies conducted on other ephemeral streams, including those from other climates. It is fundamental to place your findings in the context of transmission loss research.

Yes, we agree that not enough effort were made to compare our study with previous studies on other ephemeral streams in the submitted version of the manuscript. We will improve that in the revised version.

Minor comments:

1. I suggest moving the Figures A1, B1 and C1 from Appendix to the main text.

Yes, we will add these Figures to the main text.

2. Page 7, Lines 190-192: "In the course of the model development, more predictors (e.g. river flow, water temperature, groundwater level, date) have been tested but they appeared to not improve significantly the predictions." Have you tried any statistical criterion, such as AIC?

We used the RMSE to evaluate the different models as explain in section 3.3.

3. Please, reconsider the terminology of "reconstructed" transmission losses, because reconstruction of time series is a quite different topic. You should use just "predicted" transmission losses.

We will change to "predicted".

4. Page 12, Lines 235-236: "The estimated transmission losses range from 0.14 to 1.5m3/s/km. Most of the estimated losses (56%) are below 0.6m3/s/km and correspond mainly to baseflow periods and river drying phases." Please, provide a box-plot of the transmission losses, and add more statistical details.

We will add a better statistical description of the dataset, including the distribution or a box plot.

5. Conclusions: It is not necessary to use citations in the conclusion.

We will remove the citations in the conclusion.

Antoine Di Ciacca (on behalf of the co-authors)

References

Larned, S.T., Hicks, D.M., Schmidt, J., Davey, A.J.H., Dey, K., Scarsbrook, M., Arscott, D.B., Woods, R.A., 2008. The Selwyn River of New Zealand: a benchmark system for alluvial plain rivers. River Res. Appl. 24, 1–21. https://doi.org/https://doi.org/10.1002/rra.1054