We thank the reviewers for their insightful comments and suggestions to improve the manuscript. Below, we copy reviewer comments in black font and our answers in blue font.

The paper is a good example of how to use ICEsat-2 satellite altimetry data in a hydraulic model built without in situ topographic surveys of cross-sections. I found the paper interesting and adapt to the HESS journal. I think it deserves to be published after minor changes.

- In the analysis I have only one main concern that relates to the structure of the model without considering large tributaries. My main concern is the fact that you consider the boundary condition as uniformly distributed, but in fact from Figure 4 it is quite evident that there are at least two significant inflows from the two left tributaries (it is not clear whether the right tributary comes upstream or downstream of Jimay station). How did you simulate these significant inflows?

We do not assume a uniform inflow boundary in the HD model. We assume uniform runoff in the contributing area between the two stations. The uniform runoff is then distributed along the chainage according to the flow accumulation map derived from the MERIT DEM. The HD model uses a flow accumulation map along the river stretch to calculate the boundary inflow values at the different chainages in the river. Thus, boundary inflows will be high in chainage intervals that include major tributary junctions.

- Perhaps the organization of the article can be revised to avoid repetition and short paragraphs. In particular, the description of the ICEsat-2 dataset and the study area follow the method, but they are actually mentioned again and again to explain the different steps. Therefore, I think the best solution is to describe the material first (satellite and in situ dataset, study area) and then the method so that the reader is able to understand why the two satellite products and the hydraulic model scheme are used.

We will revise the manuscript accordingly and reduce redundancy in the description of the ICEsat-2 data.

SPECIFIC COMMENTS:

- Introduction: references on hydraulic simulations should include at least one of the studies conducted by Domeneghetti et al. (2014, 2015, 2020); references on altimetry densification should include the publication of one of the authors Nielsen et al. (2022).

  Suggested references will be added to the revised manuscript as appropriate.

- Lines 119-125: the numbers are rather arbitrary. Please, justify the reason for these thresholds in the main text (93% for the water occurrence; 15 m from the river center-line; 500 m distance between observations and less than 15 times…).

  The water occurrence threshold is selected to ensure consistency of the retained data. The threshold is conservative because we only accept data over very high water occurrence pixels. Water occurrence of 95% is only exceeded in very few pixels.

  The 15 m from the river centerline are taking into account the minimum river widths to be sure the points fall on the water surface (min river width is 80 m).

The 500 meters distance is selected taking into account the resolution of the HD model, which currently is 300 m and 100 meters for selected areas.

We will revise the manuscript to include an enhanced discussion of these aspects.

- Lines 132-138: I'm not sure I understand these lines. What is meant by "the reference water surface elevation of the cross-section changes "? If it is a reference, it should be fixed. And what is meant by "the change in flow rate is added to the corresponding depth of the cross section"? How can a flow discharge be added to a depth? Please, rephrase the sentences so that they are clear.

  The reference water surface is related to each cross-section. This water surface elevation corresponds to the WSE on the day the cross-section was acquired. As the acquisition dates are different so it is the discharge and we, therefore, have to correct the effect of different discharges on the different cross-sections. This will be rephrased In the revised manuscript to improve clarity.

- Line 141: it is not clear why the two products ATL03 and ATL13 are shifted of 41 cm. Is this explained somewhere in the manuscript? If not, please can the authors add the reason of this bias?
- This is because we use a different method to identify the water surface elevation to the one used in the ATL13 product. We will add a discussion of this issue to the revised manuscript.
- Lines 142-148: Please, explain the concept better. It is not clear why you are removing the red dots in Figure 3a that correspond to the zero change in discharge, or the dot at 400. In fact, I do not understand the logic of these analyses. Perhaps, they deserve more detail in the text.

  In this analysis, we look at the WSE observations from ATL13 and the extracted WSE from ATL03 from out method. We compare the ATL13 and the ATL03 values when they are closer than 300 meters. If the acquisition date for the compared ATL13 and ATL03 products are the same, we expect the WSE variation to be zero and the same with the variation of discharge, however, we observe a bias in some cases in the WSE variation, since we use a different method to extract the WSE from ATL03 as what is used in the ATL13 product. If the ATL13 and ATL03 products are from different acquisition dates, we check that the variation of WSE makes sense with respect to the variation of discharge. If we observe low variation of discharge we expect low variation in WSE and vice-versa.

  The analysis will be better explained in the revised manuscript.

- Line 212: remove “the”

  Will be changed.

- Looking at Figure 5 the shape of some cross-sections looks rather unrealistic (c,d,e,f). The river bottom looks high (shallow) and this could affect all the analysis. Do you have information on the topographic survey of some cross sections that could help to understand how much error is in the bottom estimate?

The data corresponds to the low flow season, where the depths in this portion of Yellow River vary between 1-2 meters. Unfortunately, we do not have access to in-situ surveys from the region.

- Please, define all acronyms: e.g. RHS, UPA, Obj

  The acronyms will be defined. The,y refer to Right-hand-side, upstream area and objective function.

- It is not clear why the paragraph 2.4.2 is described here and what is the role after. Try to explain why you are using the MIKE Hydro model.

  This is presented as one possible application of the presented cross-section retrieval workflow. The calibrated cross sections can be used in a full-hydrodynamic simulation. In our case, the hydrodynamic simulation is made with MIKE hydro using the cross-section and calibrated parameters. We will improve this discussion in the revised manuscript

- Line 290-294: For a reader who is not thoroughly familiar with the satellite product, this sentence is difficult to understand. Please try to explain what is the difference between weak and strong beam data. Also, since this is a product feature, I think it can be moved to a methods section.

  The sentence will be reformulated and moved to the methods section.

- Line 296-297: please, add the references for these distances (e.g. cross-section chainage and longitudinal distance.

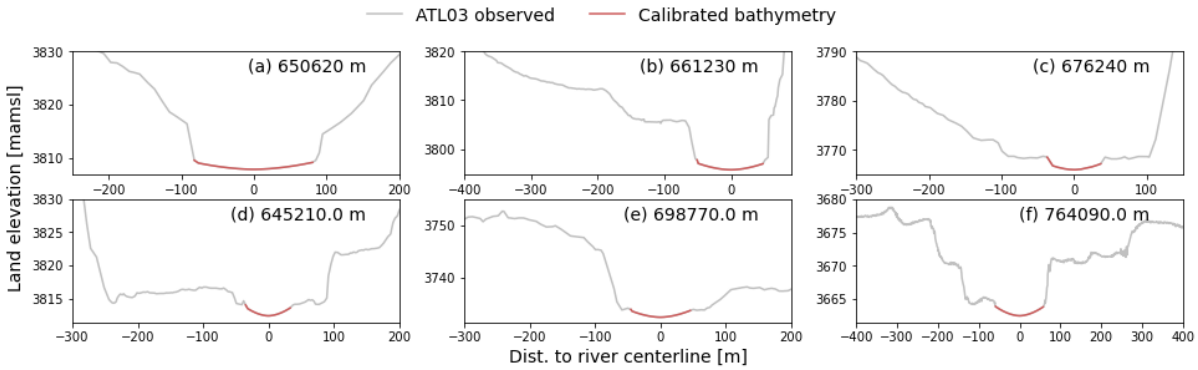
  References will be added.

- Line 320-321 the sentence is not clear. Please, reformulate it.

  The sentence will be reformulated.

- Line 333: the biggest errors are in the downstream sections because I think the estimated bottom of the river is too high. Can I see some cross-sections in the stretch from 65000 to 68000?

  I include cross-sections between chainage 65000 and 68000



The bottom of the river is higher in this stretch and might explain the underestimation in depth.

- Figure 13 a: please specify the Depth coming from Mike 11 and Depth coming from ATL13 in the x-axis and y-axis. Are you able to explain the differences between the simulated and satellite observed WSE in the July-August 2020?

  We will modify the figure accordingly and improve the discussion of the figure.

- Lines 384-385: do these studies refer to the same study areas? Please, specify.

  These studies refer to different study areas. The previous altimetry missions do not provide the resolution needed to study the narrow upstream Yellow River.

- Line 439: please clarify this sentence because the paper does not show any comparison with other satellite missions to be stated that it “performs better than previous altimetry missions”

  Other altimetry missions are limited in this area due to their resolution. The results will be compared with altimetry virtual stations in the area to justify this.