The manuscript presents a study on tide-influenced bifurcations based on morphodynamic modelling. The modelling is carried out for a schematized bifurcation and aims to understand tides influence the morphological development of bifurcations. This is an important subject and the conclusions are relevant for understanding the morphological development of tide-influenced deltas. I support publication of the manuscript after moderate revision.

We thank the Referee for his time to read the paper. It helped us to improve the manuscript.

1. **Comment from referee:**

I think that the manuscript can be improved by presenting more thorough analysis of the model results. The additional analysis should take away the vagueness in the conclusions, like those formulated in the abstract:

• Line 18-19.

"…our results show that bedload tends to divide less asymmetrical compared to suspended load, showing a possible stabilizing effect of lateral bed slopes on morphological evolution." The word "possible" suggest that the authors are not sure about this. Better analysis of the model results should clarify this.

Author's response:

We agree that "possible" is too weakly formulated. We already know that a lateral bed slope has a stabilizing effect for a bifurcation (Bolla Pittaluga et al., 2003). They showed that the lateral bed slope only affects the bedload transport, causing additional transport of sediment towards the deeper channel. Such a compensating mechanism is not present for suspended load transport. Bedload tend to divide less asymmetric than suspended load as we have shown in the manuscript in Figure 11a below, also because suspended load has a stronger dependence on flow velocity than bed load transport.

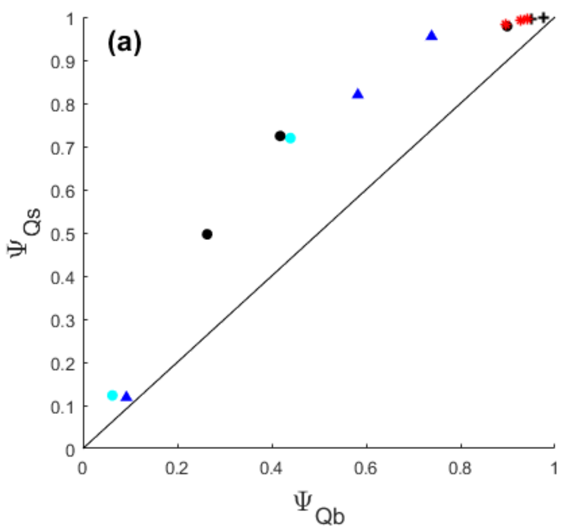

Figure 11a from the manuscript. Comparison of suspended load asymmetry ($\Psi_{susp\ load}$) against bedload asymmetry ($\Psi_{bedload}$) overlaid by the line of equality (black line),

Author's changes in manuscript:

In the abstract of the new version we will remove the word “possible” to be more clear. The old statement:

“…our results show that bedload tends to divide less asymmetrical compared to suspended load, showing a possible stabilizing effect of lateral bed slopes on morphological evolution.”

Our improvement will be:

“…our results show that bedload tends to divide less asymmetrical compared to suspended load and confirm the stabilizing effect of lateral bed slopes on morphological evolution as was also found in previous studies.”

2. **Comment from referee:**

• Line 19-20. “In our simulations, the more tide-dominated systems tend to have a larger ratio of bedload and suspended load transport.” How should I read this? Is this a general conclusion, or is it just because of some special feature in your simulations? In the last case it is not worthy to mention in the abstract, unless it gives explanation to the other conclusions. Otherwise you need to give the physical mechanisms explaining it.

Author’s response:

According to our simulations with different asymmetry in geometry and tides, we have a consistent behaviour where a larger ratio of bedload and suspended load transport occurs in the more tide-dominated condition as given in Fig. 11c below. This is because the tide-river interaction causes a long period of weak flows in one tidal cycle, the strongest flow occurs during ebb tides at which the suspended load transport is the highest. Since river discharge dampens the tides, the low sediment mobility condition which favour bedload transport occurs for a relatively long period, which is during flood and during transition between ebb and flood tides.

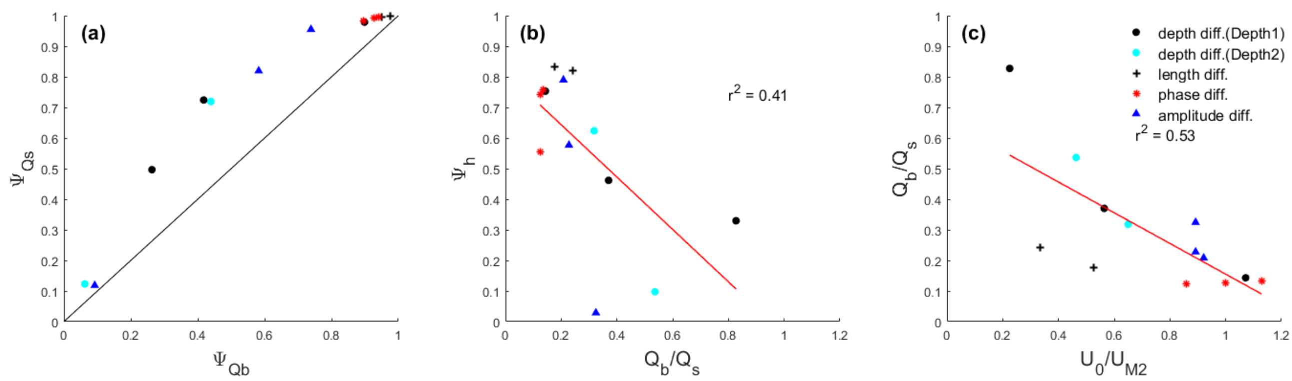

Figure 11 from the manuscript. Comparison of: (a) Suspended load asymmetry ($\Psi_{susp\ load}$) against bedload asymmetry ($\Psi_{bedload}$) overlaid by the line of equality (black line), (b) Scatter plot of morphology asymmetry (Ψ_h) against ratio of bedload and suspended load transport in the upstream channel, and (c) Scatter plot ratio of bedload and suspended load transport in the upstream channel against the dominance of river flow over tidal flows in the upstream channels. The legend for all panels is provided in panel c.

Author's changes in manuscript:

We will add additional explanation in the abstract of the new version to clarify this as follows:

“In our simulations, the more tide-dominated systems tend to have a larger ratio of bedload and suspended load transport due to periodical low sediment mobility conditions during a transition between ebb and flood. “

3. Comment from referee:

In the model set-up some of the parameters have been given a fixed value without sufficient motivation: “horizontal eddy viscosity was set to 10 m2s-1”, “value of 10 for αbn”, “αbs =1” (Line 102-106). Especially αbn is a key parameter influencing the distribution of sediment transport to the two downstream branches. Also the horizontal eddy viscosity may be important for the local flow pattern around the bifurcation. Therefore, I expected some sensitivity analysis on these parameters, or at least some motivation why fixed values for them can be used in the study without influencing the conclusions.

Author’s response:

For horizontal eddy viscosity, the chosen value (10 m^2s^{-1}) was chosen because a small value can cause numerical instability in the model near the bifurcation because flow magnitudes and direction quickly change. It does not influence the final results.

Transverse bed slope effects for bedload transport were accounted for by the approach of Ikeda (1982) and we used a value of 10 for α_{bn}. This value is much higher than the default value (1.5) and values suggested by Bolla Pittaluga et al. (2003) (0.3-1) because a small value of this parameter in Delft3D leads to unrealistic and grid size-dependent channel incision (Baar et al., 2019). This is kind of a model artefact. The model ‘needs’ a diffusive process. Near the mouth of an estuary this can come from waves (Ridderinkhof et al. (2016) used realistic values of α_{bn}). Note that although the value is large, it is well within the range of what others used (e.g. Dissanayake et al., 2009; van der Wegen and Roelvink, 2012; Van Der Wegen and Roelvink, 2008). However, we agree that it is an important parameter and that sensitivity should be studied.

For streamwise bed slope effects the Bagnold (1966) approach was used with a Delft3D default value of α_{bs} =1. In general, this does not have a large impact on modelled bed evolution.

Author's changes in manuscript:

The reasoning for the chosen horizontal eddy viscosity will be added in Section 2.1 (model set-up) in the new version. For the transverse bedslope effect, additional reasoning mentioned in the Author’s response will be added in Section 2.1 (model set-up) in the new version. To strengthen the argument, we ran an additional simulation that apply the α_{bn} of 1.5 (Delft3D default value) and compare it with the one we use for all simulations (α_{bn} = 10). Compared simulations will have the same settings except for α_{bn} to clearly see the effect of the chosen parameter. The results are shown in the plot of final morphology for the two simulations below. The difference between the results from these simulations will be discussed in the discussion section (Section 4) in the new version of the manuscript. For streamwise bedslope, we will mention that we used the default value from Delft3D.

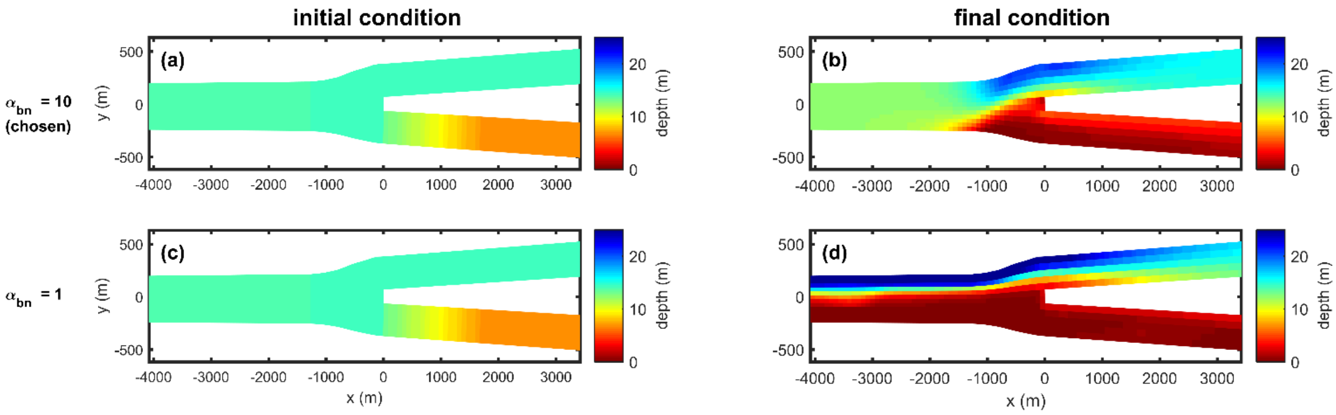

Figure: Initial (left panels) and final (right panels) depth near the bifurcation for different α_{bn}. The same initial and boundary conditions were prescribed as the simulations for the sensitivity of grain size.

4. **Comment from referee:**

Line 134. "to have Courant Number smaller than 1", why is this needed? I thought that Delft3D uses an implicit scheme.

Author's response:

According to Lesser et al. (2004), Delft3D applies an alternating direction implicit (ADI) to solve the continuity and momentum balance in hydrodynamic simulations. In this scheme one direction is solved implicitly, the other one explicitly. This alternates between time steps. This approach requires a certain courant number for the numerical stability reason (Lesser et al., 2004). Though it has been stated in several papers (e.g. Long et al., 2008; Reyns et al., 2014) that best results are obtained for Courant <1, especially for morphodynamic simulations and system with steep bends, in the Delft3D manual (Version: 3.15.29178, 17 July 2013), it is stated that using ADI scheme the maximum Courant number to fulfil the numerical stability is 4√2 while our model has the maximum Courant number below 1 which fulfil this requirement.

Author's changes in manuscript:

In Section 2.1 (model set-up) in the new version, we will mention the numerical scheme to solve the shallow water equations and the maximum Courant number to fulfil the numerical stability is 4√2.

5. **Comment from referee:**

Line 143 & Section 2.2. How about the morphological boundary conditions? What was prescribed at the e.g. the upstream boundary, sediment transport rate or fixed bed?

Author's response:

At inflow condition, the equilibrium sediment transport was prescribed. Thus, the morphology at the open boundaries does not change. During outflow, no boundary condition was needed at the open boundaries and the bed was free to evolve.

Author's changes in manuscript:

We will explain morphological boundary condition in Section 2.1 in the new version as mentioned in the Author's response.

6. **Comment from referee:**

   Line 153. Note that even for the largest discharge (2800 m3/s) the velocity at the upstream boundary is only about 0.5 m/s.

   Author's response:

   Because we built a typical setting for a tidal delta we prescribed a channel with gentle slope ($3x10^{-5}$). This drives a small river flow. Besides, we also need to prescribe this small river flow to let the tides propagate to the upstream channel and to have conditions in which tidal flows are larger than river flows.

   Author's changes in manuscript:

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7. **Comment from referee:**

   Line 178. I do not understand immediately why the first 2 km determines the morphological development of the entire downstream channel.

   Author's response:

   From our simulations, we found that the development of the downstream channels starts from upstream and develops downstream. Therefore, analysing the most upstream end of the downstream channel is sufficient to determine the growth in asymmetry between them. Based on our simulations, a distance shorter than 2 km cannot be representative to determine the behaviour of the downstream channel (whether they are silting up or deepening) due to the presence of local morphological features near the bifurcation such as bar formation or small incisions in the downstream channel that is silting up. However, a longer distance cannot be representative to determine the downstream channel asymmetry or avulsion because even though one downstream channel almost avulses upstream, tides can cause a deepening near the downstream boundary as shown in length difference scenario as shown in Figure 5c and f and phase difference scenario in figure 7e and h provided below. Hence, we decided to use the average bed level first 2 km as a representative depth.

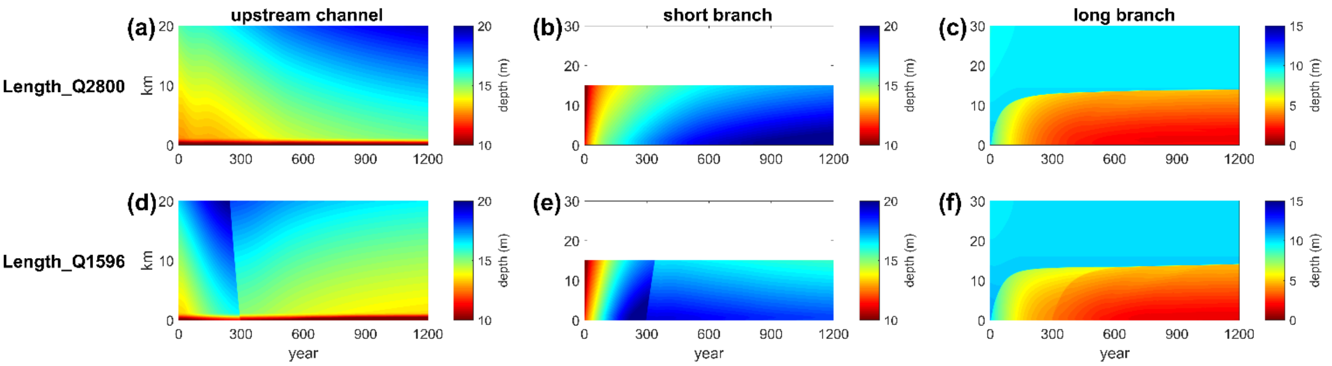

Figure 5 from the manuscript. Time-stack diagram of width- and tide-averaged depth as a function of space for the simulations in Length difference scenario with the same order as Figure 4 but with short (panel (b) and (e)) and long (panel (c) and (f)) downstream branch.

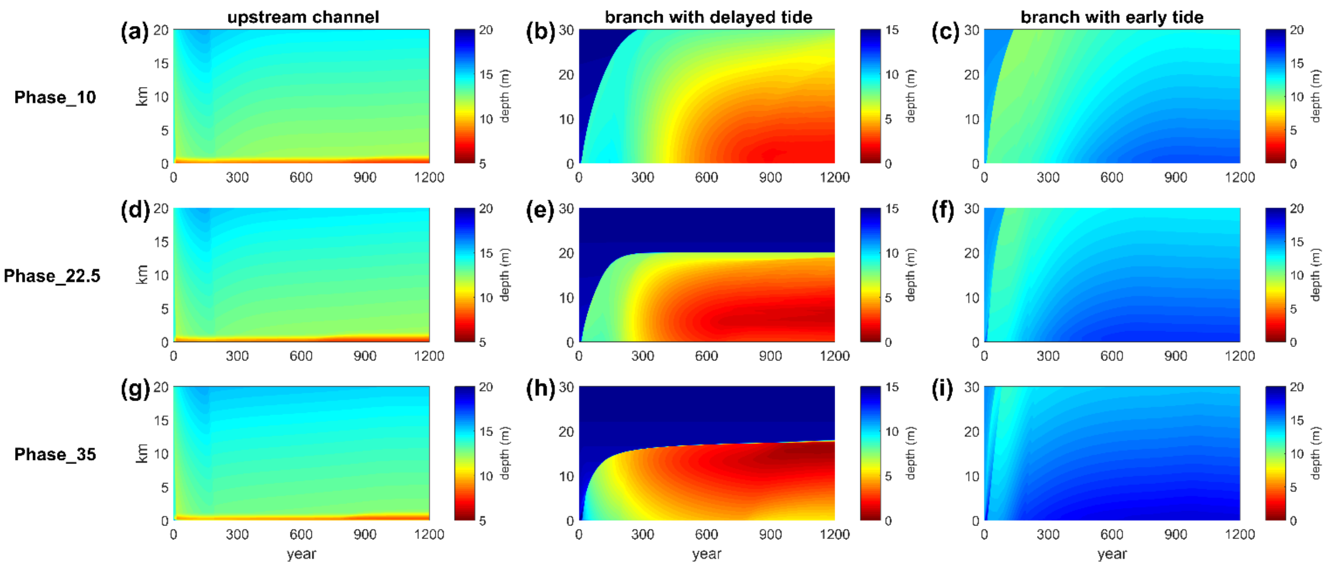

Figure 7 from the manuscript. Time-stack diagram of width- and tide-averaged depth as a function of space for Phase difference scenario.

Author's changes in manuscript:

We will explain our motivation to use the first 2 km in Section 2.3 (Methods to evaluate model simulations) in the new manuscript.

8. **Comment from referee:**

Line 211. "but the depth of the two downstream channels does not depend on the discharge", this is remarkable. I wonder if this is not because of the short simulation time. Influence of the upstream boundary not yet reached to the downstream branches?

Author's response:

The statement in line 211 is describing the depth of the two control simulations namely Control_Q2800 and Control_Q1596 which is named according on the prescribed discharge upstream and are with 1 m tidal amplitude at the downstream boundaries. The morphology of the two downstream channels still depends on the prescribed discharge. However, the difference between those simulations is small as shown in time-stack figure below

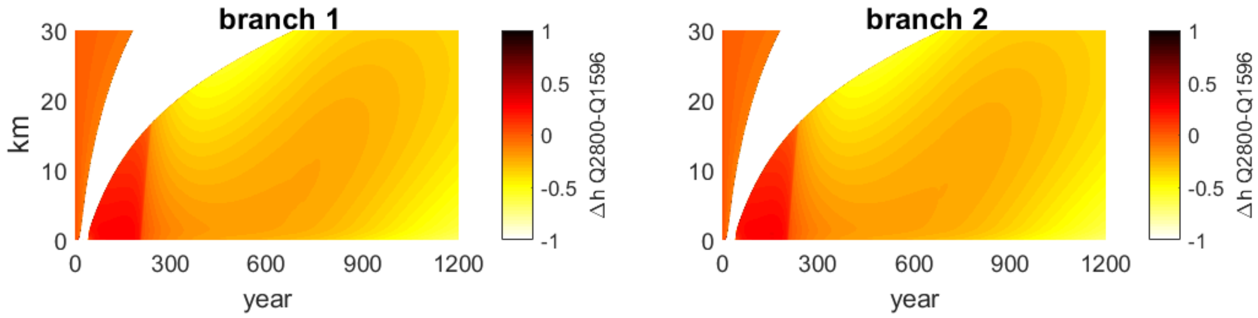

Figure above is time-stack figure of the difference between the depth of simulation Control_Q2800 and Control_Q1596 in branch 1 (left) and branch 2 (right). Negative value means simulation Control_Q1596 is deeper than Control_Q2800. The depth from simulation Control_Q1596 at the end of the simulation is slightly deeper at the end of the simulation period. Here I also provide Figure 3 (the depth from the two compared simulations) from the manuscript.

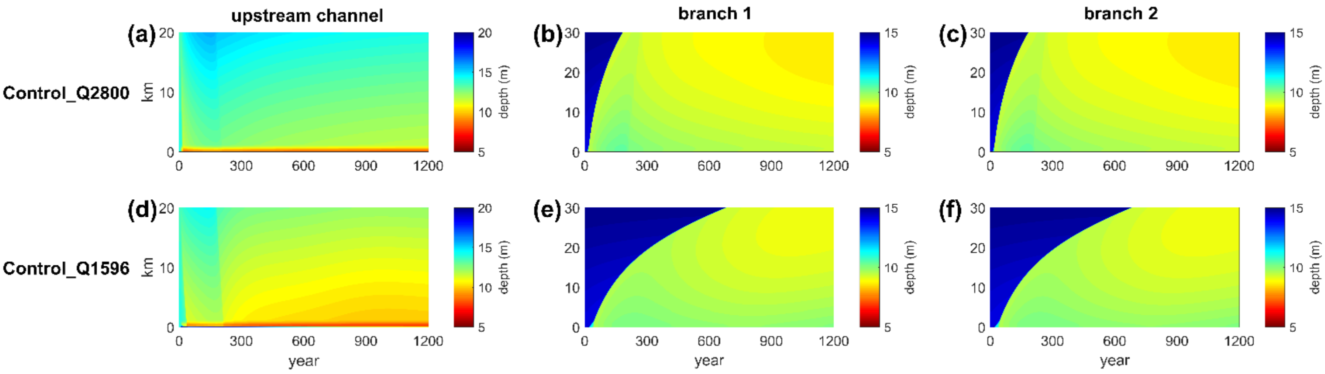

Figure 3 from the manuscript. Time-stack diagram of width- and tide-averaged depth (colour) of the upstream channel (left panels; km 0 is junction, km 20 upstream) and downstream channels (middle and right panels; km 0 is junction, km 30 near sea) as a function of distance from the bifurcation (vertical axis) for the two control simulations. The top panels ((a), (b), and (c)) are the result from the high discharge simulation (Control_Q2800) while the bottom panels ((d), (e), and (f)) are for the low discharge simulation (Control_Q1596).

This small difference in the downstream channel between the two control simulations is because a strong influence of tides in the downstream channels in controlling the morphology. Though river discharge dampens the tides, the widening channel aids to maintain the tidal flow upstream in both downstream channels and causes river-induced flow velocities to become small. Since the two simulations are imposed by the same tidal amplitude, a similar morphology occurs in the downstream channels for both simulations

Author's changes in manuscript:

In the previous version we stated: “but the depth of the two downstream channels does not depend on the discharge”.

In Section 3.1 (Evolution of control runs) in the new version we will clarify it:

"but the change in the prescribed discharge does not significantly affect the depth of the two downstream channels. This is because both control simulations were imposed by the same tidal forcings and the morphology of the downstream channels is mainly controlled by the tides".

Details:

9. **Comment from referee:**

Line 183. Change "duration of simulations" to "simulated period"?

Line 192. "m3" should be "m-3".

Author's response and changes in manuscript:

We will improve them in the new version based on these comments