Reply to Anonymous Referee #1 comments on
"Analysis of the drainage density of experimental and modelled tidal networks"

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The authors would like to thank the anonymous reviewer for the constructive comments which will definitely improve the quality of the manuscript. The reviewer's general comments and detailed suggestions/corrections (in the annotated PDF file) have been addressed below point by point *in italic fonts*.

General comments from the reviewer:

"I greatly enjoyed reading this manuscript, which contributes significantly to our understanding of tidal channel network dynamics through a unique mixture of field and lab observations and numerical modeling. The Authors show that the model can satisfactorily reproduce statistical characterizations of observed networks and the tool they develop will now allow the possibility for detailed and controlled studies, in space and time, of the phases through which tidal networks develop.

I provide some detailed comments in an annotated pdf, mainly concerning the use of the English language. My only general comment regards the Discussion and Conclusions sections, which I think repeat too much material from the Introduction and from the Results sections. I suggest the Authors revise these sections to streamline them and avoid excessive repetitions."

Our response to the general comments:

The reviewer mainly has two major suggestions: (1) improve the use of the English language; and (2) revise the Discussion and Conclusions sections and avoid excessive repetitions. To address suggestion (1), we will thoroughly reread the manuscript and rewrite all the unclear sentences, and moreover, we will invite a native British English speaker to check the entire manuscript. As for suggestion (2), we will rewrite and improve the Discussion and Conclusions sections following the comments of the reviewer. Meanwhile, the unnecessary repetitions will be removed.

Detailed suggestions/corrections from the reviewer annotated in the ESURFD manuscript (can be accessed via http://www.earth-surf-dynam-discuss.net/1/C429/2013/esurfd-1-C429-2013-supplement.pdf):

5   (1) Page 2, line 1-4. I suggest something like: "Based on a controlled laboratory experiment, we numerically simulate the initiation and long-term evolution of back-barrier tidal networks in micro-tidal and meso-tidal conditions."

The sentence will be rewritten following the advice of the reviewer.

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(2) Page 5, line 15-16. "Both the lagoon and shelf were filled with coarse low-density non-cohesive grains (medium size D_{50} = 0.8 mm and density ρ_s = 1041 kg/m^3) that were sufficient to prevent the erosion up to the non-erodible bottom." is

15   unclear, please explain.

The underlined sentence states that the initial sediments (put on the non-erodible concrete bottom) in the lagoon and shelf are sufficient for erosion (i.e. there are always sediments on the bed during laboratory experiments) so that there is no

20   *sediment shortage during simulations. Since the sentence may cause confusion, we rewrote it to "Initially, both the lagoon and shelf were filled with coarse low-density non-cohesive grains (medium size D_{50} = 0.8 mm and density ρ_s = 1041 kg/m^3) providing an erodible sediment layer thick enough to prevent the erosion down to the non-erodible concrete bottom."*

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(3) Page 6, line 13-15. "A grid mesh of 48 300 rectangular cells is adopted for both cases with different cell sizes (micro-tidal case: 22.5 m × 22.5 m, and meso-tidal case: 31 m × 31 m) and their input bathymetries are deduced by scaling up the

30   bottom perturbations of the initial measured experimental bathymetry with a multiplier factor of 100 and 200, respectively." How were these multiplier factors determined? Are the Authors preserving some governing non-dimensional number?

35   *We thank the reviewer for pointing out this unexplained model set-up which certainly requires more clarification. The multiplier factors 100 and 200 for micro-tidal and meso-tidal cases are chosen based on the scaling arguments of Stefanon et al. (2010, see full citation at the end of this reply). We have added the following sentences to explain why these numbers were chosen in the*

40   *manuscript as follows:*
"……and their input bathymetries are deduced by scaling up the bottom perturbations of the initial measured experimental bathymetry with proper multiplier factors. The values of the multiplier factors are chosen on the basis of the scaling analysis presented by Stefanon et al. (2010). In particular, the scaling

45   *ratios were derived based on the similarities of hydrodynamics (Froude similitude and the similitude of local inertia and advection) and sediment transport*

(similitude of Shields parameter and particle Reynolds number) between the prototype and physical model. In order to maintain those similarities, the vertical depth scaling factor for micro-tidal and meso-tidal cases is 100 and 200, respectively (Table 1)."

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(4) Page 7, line 3. Change 'formations of' to "configurations of the".

The phrase will be rewritten following the advice of the reviewer.

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(5) Page 7, line 8-9. Change "…… 1/3 area of the micro-tidal basin, while over 1/2 area of the……" to "…… 1/3 of the area of the micro-tidal basin and 1/2 of the area …..."

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The phrase will be rewritten following the advice of the reviewer.

(6) Page 10, line 1-2. "The drainage densities of both the micro-tidal and meso-tidal
20   simulated stable networks <u>are larger than those found in the laboratory experiment (represented by the marker "+" in Fig. 7b)</u>." Perhaps you could explain this difference with the wide differences observed when looking at the results obtained from different initial conditions, as explained below. Two single realizations can differ widely and are hard to compare.

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We agree with the reviewer that large differences in the results could be observed if the simulations (either laboratory or numerical) are carried out with different initial conditions. Stefanon et al. (2010) also demonstrated this point, see their Figure 13. Therefore, we have added a sentence to explain the main
30   *reason for the observed difference (see underlined sentences):*

"The drainage densities of both the micro-tidal and meso-tidal simulated stable networks are larger than those found in the laboratory experiment (represented by the marker "+" in Fig. 7b). <u>It is worth pointing out that different initial conditions
35   *can result in wide differences in either the experimental (see Fig. 13 of Stefanon et al., 2010) or the numerically simulated drainage systems (Fig. 7 and 9)."</u>*

(7) Page 10, line 7-9. "<u>The tidal network after 5 yr, obtained using the 1st bathymetry</u>
40   <u>as initial condition, showed less drained area than the one obtained using the</u> <u>2nd bathymetry as an initial condition</u>, which is in agreement with the larger slope of the exceedance probability distribution (in a semilog plot) 10 of the case with the 2nd bathymetry (Fig. 9)." You should state right here what the differences between the two initial bathymetries are.

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The only difference between these two starting bathymetries is the initial random bed perturbation. We have modified the sentences to:

"The evolved tidal network after 5 yr, obtained using the 1st bathymetry as initial condition, showed less drained area than the one obtained when considering the 2nd bathymetry (characterised by different randomly-generated bed perturbations with respect to the 1st bathymetry) as an initial condition, which is in agreement with the larger slope of the exceedance probability distribution (in a semilog plot) of the unchannelled flow lengths obtained starting from the 2nd bathymetry (Fig. 9)."

References cited in this reply:

Stefanon, L, Carniello, L., D'Alpaos, A., & Lanzoni, S. (2010). Experimental analysis of tidal network growth and development. Continental Shelf Research, 30(8), 950–962.