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Interactive comment on "Long-term Morphodynamics of a Schematic River Analysed with a Zero-dimensional, Two-reach, Two-grainsize Model" *by* Mariateresa Franzoia et al.

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We are sincerely grateful to Reviewers #1 for the valuable comments on our work and the rich literature suggested on this topic. Following such comments we revise the entire manuscript, and an additional discussion is reported here.

page 2, line 14-20: As specified in the revised Introduction of our manuscript, in our study we consider an alluvial river having a constant long-term flow and sediment input, and we search for its final morphological state. p. 5, l. 17: The model uses two diverse widths for the valley and the river. The different widths (BU and BD) of the river valley (excluding the constant active river-width B) are not imposed constraints, but are possible descriptors of the considered river system, basically controlled by external conditions (including geology), assumed here to remain constant during the profile and grainsize evolution. p. 8, l. 2: As visible in Eq. (10), setting equal to zero the time derivatives (equilibrium conditions), grainsize and slope, as well as sediment transport and transport composition, result equal for both reaches and compatible with the (constant) water and sediment input. p. 11, l. 27-29: One of the main hypothesis of the model is that a river network may be aggregated in a single watercourse, similar to a water- and sediment-fed flume. The water and sediment input is concentrated at the upstream end and the 'active' width of the river is constant. With the assumed initial conditions, the model develops an increasing concavity (and fining) that initially persists and later tends to disappear as the profile approaches the asymptotic equilibrium conditions ($t \to \infty$). This is what occurs also in the Guerit et al. (2014) experiments, carried out with a constant width of the flume. In the case of a 2-D alluvial cone, the geometrical widening of the cone circumference in the downstream direction would have very likely permitted a concave profile also at the asymptotic equilibrium conditions. It should be noted, however, that a progressively wider 'active' width along the cone is hardly realistic, as the stream will tend to wander all over the cone surface, keeping a relatively constant active width. p. 11, l. 31: The filling time Tfill is the time required by the sediment input G to fill the space comprised between the river bottom in equilibrium conditions and the base elevation. As there is always a considerable output from the river, the time to reach the equilibrium condition is necessarily very much longer than Tfill. In Fig. 3 of the present paper is shown that this occurs, in fact, for t* about 10, namely after a time near ten times Tfill, with some variations depending on the morphometric characteristics of the river basin. Comparable values of t* to reach the equilibrium conditions have been obtained with the 0-D one-reach, one-grainsize model (Di Silvio and Nones, 2014). However, what results most important is that – well before reaching the final equilibrium conditions – the model attains the maximum values for both the concavity and the fining. The high values of these parameters are quite persistent (quasi-stationary or quasi-equilibrium conditions), and may reasonably represent the present configuration of real rivers. Note that, while Tfill is still a fundamental parameter inasmuch as it scales the morphodynamic time of the river evolution, other morphometric parameters (listed in Table 2) are also relevant, especially as far as the quasi-equilibrium configuration is concerned.

References: Di Silvio, G., and Nones, M.: Morphodynamic reaction of a schematic river to sediment input changes: Analytical approaches. Geomorphology, 215, 74-82, doi: 10.1016/j.geomorph.2013.05.021, 2014. Guerit, L., Métivier, F., Devauchelle, O., Lajeunesse, E. and Barrier, L.: Laboratory alluvial fans in one dimension, Phys. Rev. E, 90(2), 22203, doi:10.1103/PhysRevE.90.022203, 2014.

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