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Interactive comment on "Large-scale coastal and fluvial models constrain the late Holocene evolution of the Ebro delta, Spain" *by* Jaap H. Nienhuis et al.

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General comment: This is a "bold" manuscript exploring how the evaluation of the sediment budget in a coastal system during long-term periods (thousands of years) is suitable for the interpretation of past sedimentary processes, their timing and their morphological evolution (and presumably be applied to future projections). I like this aspect of the work. However, I suspect that the necessary assumptions required to simplify natural processes in the model make the results merely conjectures without firm evidence and that different test proposed by authors are just a sensitivity analysis of considered parameters. In fact, the application of this methodology to the Ebro delta evolution during the late Holocene mainly adjusts model results to previously known

data (or interpretations derived from it). This provides the opportunity to authors to discuss several issues of the Ebro delta recent evolution that are interesting but quite speculative.

Specific comments: Sometimes I'm a little confusing with the use of the term "delta" in the manuscript. The Ebro delta (understood as delta plain, prodelta and associated fluvial and lagoon environments) developed during the Holocene (Díaz et al., 1996), but previous "delta" deposits are recognized before since the Messinian (Farrán and Maldonado, 1990; Urgelés et al., 2011). Sentences as "the delta was already formed -6000 years BP" (p. 4, l 10) or "…the effect of fluvial sediment supply on Ebro delta morphology…" (p. 12, l15) suggest that delta and delta plain are used indistinctly along the text. In fact, a question what comes to my mind is if we can properly reconstruct the Holocene sedimentary history of a deltaic area and their fluvial inputs just using the shoreline variations and almost ignoring the submerged delta (the present-day delta plain area is about 325 km2 and the prodelta area is one order of magnitude larger, about 2300 km2). I realize that the 1-D model of shoreline evolution assume that shoreline variability is proportional to the shoreface translation considering a constant shape of the profile (and the shallowest submerged delta is included in this way). However, previous studies show that the depth of closure varies along the delta and, probably, there were important changes in the littoral profile during progradational and erosional periods of the shoreface. This is corroborated by the distinct morphology and sediment distribution on previously abandoned deltaic lobes areas (Guillén and Palanques, 1997). I am afraid that values obtained from these approximations are very close to the error range of the method because these uncertainties. For instance, it sounds reasonable to expect values of subsidence in the Ebro delta area of a few mm per year. During 2000 years this implies changes of several meters in the level of emerged and submerged delta. Apparently this should be a significant parameter for long-term evolution that probably change the sediment budgets inferred from shoreline data but which is ignored in the manuscript.

Estimation of sedimentary fluvial inputs and fluvial model: Here there is a mesh of data from different sources. To choose a grain size of 0.2 mm for the fluvial profile model seems unrealistic. This sediment grain size characterizes deltaic beaches but the sediment in the river (including in the delta plain) is coarser. Upstream of the deltaic area most of fluvial bed sediment is gravel. The assumption that this sediment (0.2 mm grain size) is mostly transported during floods of 900 m3/s is also inaccurate. Batalla et al (2004) refers this value for bedload of gravel beds upstream of delta plain. The bedload transport in the river at the delta plain (which determines the sediment supplied to the coastal zone) begins with water discharges of about 400 m3/s and progressively increases with water discharge (flow velocity). There is an inflection point in this relation with water discharges around of 800-900 m3/s. This means that the potential bedload transport is "most effective" with that water discharges, but total bedload transport depends of the duration of flow conditions. Finally, the estimated sediment supply of 70 Kg/s-1 during Riet Vell formation and used in model simulations, which is equivalent to the pre-dam bedload flux (71 kg s-1) by Syvitski and Saito (2007), should be considered as a feasible number that could give an order of magnitude of sedimentary inputs but whose variation would significantly change the results of the model.

I found the analysis of section 4.3 about wave climate change during the Holocene really weak. The evaluation of storminess during the Holocene is a complex issue and the approximation carried out in this section is too simplistic to prove any trend.

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