Earth Surf. Dynam. Discuss.,
doi:10.5194/esurf-2017-9-RC4, 2017

Earth Surface Dynamics Discussions

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.

J. A. Jiménez (Referee)

jose.jimenez@upc.edu

Received and published: 7 April 2017

General comment

This manuscript is a very interesting attempt to reconstruct (explore) the long-term evolution of the Ebro river-delta system by using (relative) simple models. The adopted approach based on using wave and river sediment supply scenarios permits to analyse the potential influence of each factor on delta development and, thus, to reconstruct dominant conditions controlling the Ebro delta development. This gives a great flexibility to the analysis since it permits to practically test any combination of forcings controlling deltaic formation and reduction processes. Although this is a great advantage, it also opens the question on how confident authors are on used (selected) conditions.

Printer-friendly version

Discussion paper

In addition to this, the proper selection of models' parameters will control obtained results (delta configuration). This may cause that different combinations of both factors (forcing conditions and parameters' selection) will produce a given response.

Specific comments:

[1] Authors use many times the term "delta" and in other places "delta plain". It will be great to clearly specify which is the target (that apparently it is the deltaic plain).

[2] When describing the suitability of the used models, authors mention that they were validated by comparing predictions of observed changes observed during the last century [page 3, lines 21-23]. However, it is not clear how a model "validated" for a period of few decades (for coastal changes) can be used to predict changes in a time frame of millennia.

[3] In different parts of the paper, authors mention the potential effects of deforestation on river sediment fluxes. However, it is not clear/justified in the text which is the magnitude of the deforestation or land-use changes in the river basin required to produce such increase in sediment load. Moreover, it is not justified if population and land use at the required time (1000 years BP) was enough to produce such deforestation.

[4] Authors make reference to a threshold of 860 m3/s to produce bedload transport in the river [page 5, lines 10-11]. However, previous estimations done in the area for 0.2 mm sediment give a threshold value of 400 m3/s. Is this affecting scenario development?

[5] When presenting the delta evolution model, authors mention that they propagate waves to breaking but the presented alongshore sediment transport formula is given as a function of deep water waves.

[6] The calibrated K value of Jiménez & S-Arcilla (1993) used by authors was obtained by comparing computed sediment transport rates with inferred ones from shoreline changes. To do this, several hypotheses were done, being the depth of closure one of

them (to be about 7 m) to convert shoreline to volume changes. Formally, this K value should be strictly valid to be used under the same conditions. Thus, if it is used with a different depth of closure (e.g. 10 m), same wave action should induce a smaller shoreline change.

[7] It is questionable to use a depth of closure of 10 m for very long-term runs (centennial or millennia time scales). This concept was designed to be used at yearly scales and, when time scale increases, it has been observed that it usually increases (e.g. Hinton & Nicholls, 1998). In the study area, non-published data show that beach profiles along the northern part of the Ebro delta taken 20 years later than the work of Jiménez and Sánchez-Arcilla (1993) presented significant bottom changes at locations deeper than 10 m. Moreover, if authors used the inner shelf bathymetry to identify the extension of ancient lobes (following Canicio and Ibañez, 1999), changes are observed down to 20 m water depth. If depth of closure is increased, deltaic plain growth rates will be smaller for given sediment supply and wave scenarios.

[8] How well wave conditions are correlated with NAO? Authors only mention how transport rates change with NAO positive and negative phases but not how significant (in statistical sense) variations are. This is important to support the hypothesis of no significant change in wave conditions during the period of simulation.

Interactive comment on Earth Surf. Dynam. Discuss., doi:10.5194/esurf-2017-9, 2017.