

Interactive comment on “Drainage reorganization and divide migration induced by the excavation of the Ebro basin (NE Spain)” by Arnaud Vacherat et al.

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We thank the anonymous referee #1 for his useful comments.

In this study, we prominently focus on captures in the vicinity of the Homino River because it is a place where magnificent river captures are well preserved in the landscape. It is consequently a select area for studying drainage reorganization and the induced divide migration, as already also recognized by Mikes (2010). Mikes (2010) already did substantial work in this area and we referred to his publication several times in the submitted ms. We did not know the report accompanying the Geological Map of Montorio, published by the IGME (1997) (now referred to as Pineda (1997) in the

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revised ms) and we are pleased to notice that the reconstruction that we proposed (independently) in our Figure 7 (steps 2 and 3) is consistent with what he actually proposed 20 years ago. We added the reference to this work in the revised ms. Note that in the submitted ms, this is not the only study that has mentioned some capture events in our studied area (Gutierrez-Santolalla et al., 1996).

Indeed, the Duero Basin is exorheic as it is opened toward the Atlantic Ocean. However, the upstream part of this hydrographic basin, west of the Iberian Massif is so well preserved, and recorded so low incision, that this domain appears at least to partially preserve the endorheic configuration of the basin. That is why we use the expression: “almost still endorheic”. We agree with the reviewer that this expression could be misleading and we use consequently the term “relict of the endorheic stage” in the revised ms. We clarify this in the main text.

L.647-650: The Ebro piracy led to important river capture at the expense of the Duero Basin. The Duero basin then recorded a loss of drainage area through time. This is not a question of absolute size of the Duero drainage basin but a question of decrease of its drainage area. We propose that the decrease of its area, estimated here to be of ~12% on the basis of existing markers, resulted in a decrease of its incision capacity. It is the reason why we consider that the Ebro piracy is responsible for the preservation of large relicts of the endorheic configuration of the Duero Basin. We rephrased the sentences mentioned by the reviewer:

“We then suggest that the decrease of drainage area of the Duero basin that we document here, partly due to divide migration induced by capture and incision in the Ebro basin, is responsible for an important decrease of the incision capacity in the Duero basin. Then, active exorheism in the Ebro basin is likely responsible for the current preservation of large relicts of the endorheic configuration of the Duero basin.”

We modified our Introduction to avoid redundancy with the Abstract. We also reorganized it to better highlight the objectives and the tools used in this study.

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We also modified the conclusions in order to be more relevant.

L.415-454: even if “redundant” with original derivations of the Stream Power Law, we think necessary to recall this theoretical background in the text to help readers that are not familiar with these methods. This is a very common practice in scientific papers to give some background, even if the authors are not those who developed it initially. We agree that the “Results” section is short compared to the Discussion. However, we consider here our objective results are not limited to the application of the Chi in our study area but also to its combination with geological and geomorphological observations, to finally highlight an original relation between the Ebro excavation and the Duero preservation, and this needed to be discussed.

L.46: We disagree. The reference to Bonnet (2009) is appropriate as this paper exactly deals with what is mentioned in this sentence. The suggested reference to Brocklehurst and Whipple (glacial erosion and relief production) or Perron and Royden (2013) (development of the integral approach (Khi plots) for the study of longitudinal profiles) are clearly off-topic. We also refer to Willet et al. (2014).

L.120: We specify the ages proposed for the Ebro opening for each reference.

L.123: Amended.

L.132-135: We replaced the term “opposed” by “facing”. Rivers are facing each other from one side of the divide to the other.

L.222: We deleted the term “dynamically”. We consider this area as stable in term of river mobility.

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