

Interactive comment on “The influence of subducting slab advance and erosion on overriding plate deformation in orogen syntaxes” by Matthias Nettesheim et al.

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We would like to thank the A. Replumaz for her critical review of our work and her constructive comments. In the following, we will address her concerns point by point. For better readability and because of the extensive modification of this manuscript, we provide references to the differenced document (see response to reviewer 1) rather than showing differences directly in this response letter.

Reviewer Point P 2.1 - In this paper the authors show a fully coupled thermo-mechanical numerical model to investigate the effect of a curved slab advancing on overriding plate deformation and they test different erosion scenarios on the result-

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ing topography. This coupling between 3D thermo-mechanical models and erosion is ambitious, the subject could be very interesting as it is dealing with an emblematic problem, the curved subduction zones and the syntaxes. But as it is presented now it is a bit disappointing, as the setup is presented as global, corresponding to all the observations of figure 1, with no specific case study proposed, and I find the conclusions of the paper hard to compare with a natural case. The authors said that their setup is similar to the Cascadia subduction zone or the Alaskan plate corner (p2, line2), in that case they have to show a map of the plates boundary and of the slab geometry in these regions, so that the reader is able to compare with the model. Having worked upon the India/Asia collision zone, for me the models presented in this paper could not be compared with the Indian slab corners in the Himalayas or with the Indonesian trench smooth curvature.

Reply: We thank A. Replumaz for her assessment of and constructive suggestions to improve our work. We understand her main concern lies in the limited transfer to natural settings. We have edited our discussion section to include more references to natural systems and added Figure 10 on page 25 to illustrate the relation of our results to nature. Figure 1 (page 3) now shows the geometry of Cascadia subduction zone. As discussed above (see figure R1), we are convinced that our results are also transferable to asymmetric cusp-like geometries. We agree that detailed adjustment of initial and boundary conditions is required before conclusions about a specific subduction setting can be drawn.

Reviewer Point P 2.2 - I suggest 1/ to better analyze the case studies, to properly differentiate different cases as trench curvature (Andes), slab corner (Himalayas), but also sense of curvature (convex for Himalayas versus concave for Andes or Alps), see below analogue modeling Bajolet et al., 2013. I suggest [...] 2/ to choose 2 very different cases to model, for example trench curvature / slab corner or concave / convex curvature.

Reply: This point is closely linked to concerns expressed by the first reviewer. We

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intentionally limit ourselves to convex plate corners, where flexural stiffening of the downgoing plate (see Mahadevan et al., 2010) is thought to occur, in order to specifically investigate a possible focusing effect on upper plate deformation as proposed by Bendick and Ehlers (2014). We agree with both reviewers that additional models will be very helpful to illustrate this effect. We have added three models with a straight trench well as two more models with a narrower and a wider indenter. Results are shown in figures 3 (page 14), 4 (page 15), and 8 (page 19) in sections 3.1 and 3.2 on pages 9 ff. and 17. See also discussion in sections 4.3 on page 21 f.

Reviewer Point P 2.3 - Remove the low convergence case (half slab advance name is not clear at all) which is of low interest according to me.

Reply: Perhaps we were unclear in the manuscript as it seems the half advance case may have been misunderstood. For example, the half-advance scenario is quite similar to the convergence between India and Eurasia in the Himalaya, where India moves into Eurasia at around 45-50 mm/a, but only about 40-50% of that convergence is shortening in the Himalaya (e.g. Ader et al., 2012). In addition, we note that the convergence rate is the same in all models presented in this study. To ensure readers are not misled, we have edited the description of our boundary conditions (see section 2.2.4 on page 2.2.4) and expanded table 1 (page 9) in the revised version in order to provide a clearer explanation of the different boundary conditions and their geodynamic implication.

Reviewer Point P 2.4 - I suggest [...] 3/ show the erosion pattern for each case (as figure 9a), as it is an important issue of your work.

Reply: We have added the requested models to our study, results are shown in figure S3.

Reviewer Point P 2.5 - figures should be bigger, and better focus. Show the plates boundaries and find a way to represent slab geometry on figure 1. It will be better for the reader as it will be possible to see what you are talking about, and it will help to

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differentiate the kind of curvature/slab corner.

Reply: Figures 1 (page 3), 3 (page 14) and 4 (page 15) have been replaced in the revised version. Additionally, we have added four figures to the supplement for a more detailed understanding of the reader. We will request large figure sizes in the final publication for best perception.

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