Recommendation: Accept for publication with minor revision

The manuscript, " Control of increased sedimentation on orogenic fold-and-thrust belt structure –Insights into the evolution of the Western Alps" by Erdős et al., presents an innovative numerical study investigating the evolution of orogenic fold-thrust belt structures with control of intensified surface process, i.e. sedimentation coupled with erosion. Their presented models show all detailed structures of thin-skinned and thick-skinned fold-thrust belts similar to that observed in natural examples, which is further used to investigate in high detail the development of basement thrusts and topography.

I enjoyed reading this paper, which I think is a useful reference work for the literature on fundamental thrust belt mechanics in various tectonic settings. The text is very well-written and easy to follow, I recommend only minor modifications.

Abstracts:

Page 2, Line 3-4: change "where a sudden increase in foreland sedimentation rate is well documented during the mid-Oligocene" to "where a sudden increase in foreland sedimentation rate during the mid-Oligocene is well documented"

Page 2, Line 5: "the basement thrust" should be "the frontal/outermost basement thrust". The study is focused on the frontal basement thrust development and propagation, so it is better to state this clear in the abstract. Otherwise it might be confusing with the early basement thrusts that may also remain minor active or be reactivated during the onset of increasing sedimentation.

Page 2, Line 10: "thrust-front propagation rate", here I assume the authors refer to "basement thrust front rate" not the "thin-skinned thrust front rate". So better to make the description precise and clear by adding basement in front of this phrase.

Introduction:

Page 3, Line 29: "model". The Critical Taper Theory is not just a model, but a widely accepted theory as the authors also described. So replace "model" by "theory".

Discussion;

Page 6, Line 23: "One of these basement thrusts", here needs further explanation on the particular basement thrust that then becomes the locus of subduction, such as its angle, displacement or position. Because the locus of subduction is of particular importance to the subsequent formation of new basement thrust in the subducting pro-wedge lithosphere.

Page 7: line 6-7: "a new thrust", "deformation front". Both need the "basement" to be added to make the definition more specific. In the thin-skinned and thick skinned coupled

deformational system, the single description of a new thrust and deformation front can represent structural features at either thin-skinned or thick skinned belt.

Page 7, line 33 “new thrust”, line 35 “thrust front”, similar problem as raised above.

Page 8, line 6 “thrust front propagation”, similar problem as raised above.

Page 9, line15-16: in this first sentence, the initiation behaviour of the new thin-skinned front thrusts between the reference Model 1 of no sedimentation and Model 2 and Model 3 of significant sedimentation is not comparable as the new thin-skinned thrust in the Figure 8a is missing. Add the new thin-skinned thrust in figure 8a and make the comparison.

Page 9: line 34: “This suggests that $\alpha \approx 10^{\circ}$ can locally be seen as a critical value”, the critical taper theory has provided robust equations to calculate the critical taper angle with given wedge material properties. Here the theory predicted value is needed and further discussion should be followed.

Figures captions:

Page 15: line 12: “The material coloring scheme is identical to that used in Figure 1”. Figure 1 does not include colour scheme about the different modelling mechanical layers, so it should be Figure 2.

Page 15, line 26, same problem. Replace “Figure 1” by “Figure 2”.

Page 15, line 34, please define “over-steeped”, or just state “steepened”.

Page 15: line 37: “Figure 1” to be replaced by “Figure 2”.

Page 16: line 2: “Figure 3” to be replaced by “Figure 4”.

Page 16: line 6: again either define “gradually steepening” or just use “steepening”.

Figures:

Page 18 Figure 1, Jura Frontal t. needs to be clarified as “Jura Frontal thrust”

Page 20 Figure 3, figures a, d, g are missing horizontal distance. Figure b and c show an increasing distance from foreland to retro-side of orogen while the figure h shows the opposite distance trend. Please make the distance direction determined consistently across different model examples.

Page 23 Figure 6, after the onset of sedimentation, distal edge of foreland becomes more complex with some slightly retreat marked by concave line, i.e. 16-18 Ma and 100 km in figure b and 13-15 Ma and 100-105 km in figure c. These needs some explanation or discussion.

Page 25 Figure 8, each sub figure needs to project the predicted critical taper angle by Critical Taper Theory and make further discussion. Figure 8a needs the initiation of new thin-skinned thrusts within the pre-deformation sediments. The figure 8c shows two successive thick-skinned thrusts that form very closely in time, i.e. 41 My and 42 My respectively, which seems to contradict the statement that the frontal basement thrust becomes stationary after the onset of sedimentation. Please make some explanation on this. The unit at the horizontal axis should be consistent as that in the text “Myr”.

Overall suggestions:

The study involves the structural behaviour of both foreland thin-skinned fold-thrust belt and basement fold-thrust belt, but there are many occasions where the description of thrust front, frontal thrust, deformation front are not confusing. All these need to be clarified, such as distal edge of foreland basin, basement deformation front, new thin-skinned thrust fault, new thick-skinned thrust fault, basement thrust fault, outermost/ frontal basement thrust fault.

A significant portion of texts associated with Figures 7 and 8 belongs to the result section, but they are completely described and discussed in the discussion section. I would suggest a separated result section on the taper angle of modelled fold-thrust belts and initiation of new think-skinned and thin skinned thrust faults.

The authors claims that the results presented in this study have broad implications for orogenic belts other than the Western Alps. It will be useful to add a schematic diagram to generalize the major conclusions of this study, which will help to gain a better and more direct application of this study to other tectonic settings.

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