Solid Earth Discuss.,
https://doi.org/10.5194/se-2018-122-AC2, 2019
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Solid Earth
Discussions

Interactive comment on "Control of increased sedimentation on orogenic fold-and-thrust belt structure ndash; Insights into the evolution of the Western Alps" *by* Zoltán Erdős et al.

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Received and published: 25 January 2019

This manuscript investigates the relationship between rapid synorogenic sediment filling and the development of foreland fold-and-thrust belts. It focuses in particular on the temporary slowing of thrust-front propagation, as observed in the North Alpine Foreland Basin. The results of this study are also compared to predictions of the critical taper theory. The manuscript is concise, well written and illustrated. However, I have two main questions that I would like to address:

1) The initial configuration of the numerical model is not specified. Could you please comment on why you have chosen this specific setup? And could you, if possible, give

references to the Alps, i.e. extension/convergence rate, sedimentation rates, erosion rates, crustal geometry, etc.. Changes in model parameters are likely to alter the model results. It would be therefore useful to know why you have chosen them in the first place.

Response: The initial parameters (crustal setup, convergence velocity) have been chosen to match the circumstances likely applicable for the Pyrenean-Alpine orogenic systems. The major differences are that there is no ocean and no lag between break-up and onset of inversion, but these differences are due to computational limitations. The sedimentation/erosion algorithms are rather simplistic and have been parametrized to represent moderate rates for both processes. Based on the reviewer's comment we will clarify this in the text.

2) Are the timescales observed in the models comparable to those observed in the Alpine Foreland Basin? Please elaborate.

Response: The shortening rates, timing of orogenesis and of transition from an under- to an over-filled basin are based on observations in the Alps and the timescales of thrust/basin evolution are comparable. The jump in thrust-front position is in the order of a 100 km in both cases, but the stagnation in the Alps lasted about twice as long as what we observe in the models. Based on the reviewer's comment we will clarify this in the text.

Other comments: Introduction Line 7-11: What effect does synorogenic sedimentation have on the development of thin- and thick-skinned foreland thrust sheets. Please elaborate.

Response: we will expand the topic based on the reviewer's comment.

Numerical method: Details on the crustal thickness, extension/compression velocities, thermal gradient and the position of the weak seed and are all shown in Fig. 2, but are not mentioned in the text. Is extension instantaneously followed by compression?

Response: We will expand the text based on the reviewer's comment but some of the above-mentioned details are covered in the supplementary materials. The extension is instantaneously followed by compression (i.e. there is no thermal relaxation phase). This limitation is covered in the discussion.

Model 1: I think it could be useful to give a brief definition of pro- and retro-side.

Response: We will expand the text based on the reviewer's comment.

Model 2: What are the corresponding erosion rates?

Response: This information is covered in Supplement 1. The elevation dependent erosion algorithm is scaled so that a 2-km high topography erodes by 1 km in 1 Myr.

Critical taper theory: This section appears a bit unconnected to the rest of the text. I suggest to rearrange parts of it., i.e. models described in this section could be moved to the result section.

Response: since both reviewers made this point, we will restructure the text so that the critical taper theory part will become its own section between the results and the discussion sections as we think it would be difficult and possibly counterproductive to separate the results from the interpretation.

Interactive comment on Solid Earth Discuss., https://doi.org/10.5194/se-2018-122, 2018.