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"Towards a nappe theory: Thermo-mechanical simulations of nappe detachment, transport and stacking in the Helvetic Nappe System, Switzerland" by Kiss and col- leagues is an interesting paper that investigate the thermo-mechanical processes of nappe formation. Overall, the paper is quite short, but well-written, pretty balanced, and the illustrations are to the point. It provides a modern and clear perspective on the topic. As soon as the authors consider the comments below, I will be happy to recommend this work for publication in EGU Solid Earth. I think with some improvements this review paper will be ready to have a big impact and long shelf-life.

GENERAL COMMENTS:

- I found the title "Towards a nappe theory" and the first part of the introduction a bit far from the aim of this study. This study is definitely a step towards a better theory of tectonic nappes; however, it is focused on a specific case (Helvetic Nappe System) and the model setup is also made for it. Based on my comment, I suggest to remove "Towards a nappe theory" from the title and rephrase the first part of the introduction (see my next comment).

We agree, therefore we modified the title accordingly.

- The introduction is very detailed. The authors provide a very broad overview. I would recommend to make it shorter. Also, the authors go back and forth between the general knowledge on the topic and what is addressed in the study. I suggest to separate this parts and improve the transition between the two; for examples, I would add some lines to highlight how numerical simulations can help to overcome the uncertainties from e.g., geological interpretation and/or typical limitation of analogue models.

We have shortened the introduction.

SPECIFIC COMMENTS:

Page 1:

#5: "of a thrust nappe and stacking of this thrust nappe" - remove "of this thrust nappe"?

We reformulated it.

#10: "and the resulting brittle-plastic shear band formation" - shear band (bands?) cutting through the cover layer?

We reformulated the sentence to make it clearer.

#10: "weak sediments" - décollement?

We extended the sentence to make it clearer.

Page 2: #5 ", for example, a basic definition" - ; for example. . .

We modified the sentence accordingly.

Page 5:

#15 "We assume slow, incompressible deformation" - please be more specific with the term "slow". Maybe long-term tectonic deformation?

We added the information that slow means here: no inertial forces.

#25 "With ongoing deformation, this marker chain needs to be locally remeshed which is achieved by adding marker points in the deficient chain segments." - The term remesh is odd, as it refers to the "Lagrangian" markers. Please specify whether this criterion assumes a minimum number of markers per cell. If so, please clarify how these markers are added and how the physical properties are interpolated from the nodes.

We reformulated the sentence. The marker chain is actually a contour line defined by marker points, and these marker points are different to the markers that carry information on material properties.

Page 6:

#20 "ambient pressure and temperature"?

We reformulated the sentence to make it clearer.

#25 "The top boundary is a free surface, using the algorithm of Duretz et al. (2016)". I recommend to spend a few more lines to specify how this algorithm works and that this is not "the usual" pseudo free-surface used in many geodynamic models.

The algorithm is explained in a bit more detail in the mathematical model section. p.5. #25

#25 I suppose the velocity discontinuity at the bottom right corner introduces a stress singularity - how do you treat this issue in the boundary conditions?

The velocity around the discontinuity is linearly decreased to zero within a small distance to minimize and smooth the effect of the discontinuity. The presented stress fields show that the stress perturbation around the discontinuity are minor.

Page 7:

#20 "deviatoric stresses reach ca 250 MPa". This values seems pretty high. In section 4.4 the authors discuss the effects of softening mechanisms - e.g., lower effective friction to mimic the presence of pore fluid-pressure. I was wondering what is level of deviatoric stresses when the model is under hydrostatic conditions.

Deviatoric stresses for hydrostatic conditions can also be around 200 to 250 MPa (see e.g. Kohlstedt et al., JGR, 1995; their figure 10). However, the maximal stress at the brittle-ductile transition in the cover units is not of first-order importance for our simulations, because the important deformation takes place around the basement-cover contact far below the brittle-ductile transition.

Figure 1: could you please add a small inset to locate the region of the cross-section?

We added a small inset.

I hope my comments contribute the authors to improve the manuscript.
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