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Solid Earth Discussions

Interactive comment on "Towards the application of Stokes flow equations to structural restoration simulations" *by* Melchior Schuh-Senlis et al.

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The article presents in a clear concise manner a new way of doing structural restoration using Stokes flow equations. The manuscript is well written and reads smoothly. The use of Stokes flow is clearly justified by the authors in the light of the geomechanical restoration problems (e.g., the non-physical constraint of flattening) but also when considering the difficulty of restoring structures with salt intrusions. I like publications that are based on simple ideas (here, the reverse time scheme used by the authors): Everything should be made as simple as possible, but not simpler. I think that the authors are paving the way for new ideas and developments in the domain of structural restoration, and we clearly see the potential for restoring more and more complex models, not only

in 2D but also in 3D.

Thank you for the very positive review and constructive feedback. Following are answers to your questions. The manuscript has also been changed according to those questions. In the following, for an easier reading, the reviewer comments are set in bold, and the answers follow in normal script.

âĂć **Even if faults are not yet included in the modeling, I do not see potential problems as the authors already deal with salt intrusion (interface between the rocks and the salt body). A specific viscosity for the faults can be used for the modeling, which was stated by the authors. So my first question is why the authors did not present a (synthetic) model with at least one faults, as all the ingredients are already here (coding)?**

* After considering the reviews and commentaries on the manuscript, in order to add more value and explain further the possible applications of the restoration idea, another simple example of a model containing two faults and a free surface was added and discussed in the manuscript.

âĂć **My second question (and suggestion) is related to rock properties, especially the poisson's ratio and the Young modulus. Is there a way to incorporate those properties in the process of restoration using Stoke flow equations? I think that this problem should be a little bit discuss by the authors as they can have an impact on the restoration process.**

* Incorporating elasticity in viscous flow has been done, for example by using an effective viscosity to account for the elastic part of the material while minimizing the modifications to the viscous flow code (e.g. Moresi et al., 2003). The problem is that those schemes, like every implementation of elasticity, use values of the stress and strain at previous time steps. This poses the problem of the stress state at the begining of the simulation, on which the elastic behaviour part depends completely and which is not available in restoration schemes. However, specific material properties

could still be taken into account in other ways in the restoration process. For example, the incompressibility constraint, which implies a Poisson's ratio of 0.5, can be relaxed (e.g. Thieulot, 2011 for the relaxation of the incompressibility), which could be used to account for lesser values of the Poisson's ratio. This discussion has also been added to the paper, in the discussion section.

âĂć **Another suggestion is to provide information about the computation time of the models (or at least for some of them).**

* The computation time was not added since the point is not set on code efficiency, and the code has not been parallelized, but it can be done.

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