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Role of kinematic thermomechanical modelling on constraining asymmetric continental break up

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For a long time, the complexity of the lithosphere was ignored by numerical modelling because the inherited structural and compositional complexity of the "real" lithosphere is indeed mainly unknown to geologists so modeler preferred to understand first order parameters such as rate of extension, lithospheric thickness, mechanical coupling or decoupling at the Moho. These models were not representative of any particular region but they were helpful. As a wider community of geologist became interested in numerical modelling, a growing number of numerical models have attempted to account for a major player in structural geology: inheritance. However, the complexity of "real" Earth has been simplified and "idealized" where inherited "anomalies" (e.g. fault, pluton, craton) or a combination of them has been added without really knowing the exact initial conditions which are the unknown of the problem. Yet another approach has been to add a lot of them in a more or less random mater or to replace them by initial noise in the parameters. None of these approaches actually fulfil the need for end-users community to have predictive models.

Realizing that structural inheritance is some kind of kinematic forcing in the solution of the models but also that it is not possible to anticipate and identify all the geological structures that can be inherited in rifted margin lithospheres, we have developed a new approach, through the integration of a new kinematic module to pTatin2D thermomechanical code, permitting to understand the kinematics of deformation of the continental lithosphere and asthenosphere through time leading to the establishment of rifted margins. The method is settled and validated by fitting the architecture (i.e. basement, Moho, LAB, Tmax) and by solving the kinematics of a random unknow 2D cross section extracted from 3D thermomechanical rifted margin model.

This new tool aims to help geologists to better constrain and draw on their 2D geological cross sections the position of the Moho, the Lithosphere-Asthenosphere boundary (LAB), the temperature isotherms and the heat flux.

Key words: Kinematic thermomechanical modelling, asymmetric rifted margin architecture, modelling method.