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Kinedyn: A New Modelling Technique to Simultaneous Restore and Forward Model Seismic Sections

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In this presentation we show a new modeling technique to simulate basement architecture, heat-flow, subsidence and sedimentation patterns along a given seismic profile. Our method gives, in effect, the same results as existing section restoration techniques (i.e. the potential history of faulting and thinning during extension) and forward modeling techniques (i.e. the likely history of sedimentation, heat flow and subsidence).

Our approach includes kinematic boundary condition for extension and slip on the faults in the upper crust, and dynamic description of lower crust and mantle as response to upper crustal deformations. While slip on the faults is kinematically prescribed the rest of the model is resolved in visco-elasto-plastic framework with rheological parameters from laboratory rock experiments. This allows us to accurately simulate how lower crust and mantle deform in response to different patterns of faulting in time and space.

Faulting geometries and timings must be interpreted from the seismic profile and input into the numerical model. For convenience purposes a user-friendly GUI interface was developed which allows fast adjustments of faulting geometries and timings preliminary obtained from the seismic profile. We have calibrated our models with fully dynamic numerical models to validate our solutions. Finally, we present a case study of modeling a seismic section on the magma-poor West Iberia extensional margin.