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Intracontinental rifts and plate kinematic models - towards a global deforming plate model

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Basins are important natural repositories documenting both vertical and horizontal motions of the Earth's crust and the time-dependant generation of accommodation space during lithospheric deformation. Conversely, deciphering their evolution can also help to provide quantitative constraints on past relative plate motions. This is obviously the case for passive margins where continents have broken apart and separated, but it also holds true for intracontinental rifts. Lithospheric deformation from these rifts is often modeled and well constrained, particularly for those basins hosting significant hydrocarbon resources. However, this information has yet to be properly utilised in quantitative global plate kinematic models.

Here, we use an approach which provides a quantitative description of continental rifting at a range of scales from global to (sub-)basin scale. The approach connects low resolution global crustal data such as the global-scale CRUST2 and sediment thickness models in conjunction with a global rift basin compilation, using the interactive plate tectonic software "GPlates" to incorporate more detailed geological and geophysical datasets available for individual basins. Together, these datasets define a spatio-temporal description of the magnitude and timing for the various phases of rifting recorded within the world's sedimentary basins.

The methodology is used to build up a global deforming plates model which will ultimately also include deformation of passive margins as well as from compressive domains. First results indicate that retro-deformation of rift basin development increases the accuracy of how relative plate motion models are constructed and has potentially significant implications for absolute global plate kinematic models, fit reconstructions, and the spatio-temporal modeling of lithospheric deformation.