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The thermochemical structure of central and southern Africa from multi-observable probabilistic inversion

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Central and southern Africa is a geologically intriguing region made up of several cratonic blocks separated by metamorphic belts or sedimentary basins and showing exceptional geophysical and geodynamic features (e.g. Bangui magnetic anomaly in central Africa, Beattie magnetic anomaly in south Africa, uplift of the Angolan passive margin and South Africa, shortening of the crust in East Africa).

Knowledge of the present-day thermochemical structure (temperature and major-element composition) of the lithosphere and sub-lithospheric upper mantle is key to understanding the relationships between internal Earth dynamics, surface observables (e.g. topography, gravity) and the location of mineral and energy resources (e.g. diamondiferous kimberlites) in this region. Here we apply a 3D multi-observable inversion method based on a probabilistic (Bayesian) formalism using high-quality geophysical, geochemical and geological datasets. This framework allows us to move beyond classic inversion schemes and jointly invert multiple seismic data (e.g. surface wave, receiver functions, etc) and non-seismic data (geothermal, topography, potential fields, etc) to retrieve estimates of the thermal, magnetic and lithological structures beneath Central and southern Africa at a resolution of 2°x2°.

In this presentation, we will discuss the benefits and limitations of our new model and a number of robust features that carry important implications for supporting or disproving current evolutionary models for this region.