I. Introduction

- Higher core thermal conductivity requires a CMB heat flow of at least 12 TW (early estimates are around 3.4 TW). What is the impact of basal heating on mantle dynamics with continents and self-consistent plate tectonics?
- How does the combination of basal and internal heating affect mantle convection?
- Do mantle plumes prefer to develop under continents [1-3]?
- Is there any correlation between continents and elevated temperatures in the subcontinental mantle?

II. Numerical modeling using StagYY

- Boussinesq, incompressible thermochemical convection in 2D spherical annulus geometry using StagYY [4].
- Self-consistent plate tectonics with continents [5] which are a compositionally distinct field tracked in time using the tracer ratio method.

III. Results

- Continents are near-surface (300 K CMB temperature) when basal heating is applied, and internal heating is applied.
- Rectangular degree 1 and 2 structures form.
- Basal heating + internal heating, 3000 K CMB temperature:
  - Rayleigh number:
    - Ra = 1e6
    - Ra = 5e6
    - Ra = 1e7

IV. Conclusions

- Irrespective of variations in basal heating or continental size (except for very small continents), correlation between continents and elevated temperatures in the subcontinental mantle is observed. With increasing Ra, continents become very mobile and an episodicity can be seen between correlation-anticorrelation.
- Anticorrelation is observed for cases with multi-layered convection. In most cases, plumes focus under continents.
- With increase in CMB temperature, plumes form much quicker. They are short-lived and larger in number (higher Ra) degrees.
- With internal heating, convection is more vigorous and continents move faster.

V. Future directions

- Moving to compressible mantle convection models
- Run cases with different continental yield stress values
- Combine free surface boundary condition
- Self-consistent evolution of continents

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