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CONTROL ID: 1194157

TITLE: 3D multi-observable probabilistic inversion for the compositional and thermal structure of the lithosphere and sublithospheric upper mantle

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

CURRENT SECTION/FOCUS GROUP: Study of Earth's Deep Interior (DI)

CURRENT SESSION: DI03. An Interdisciplinary View of Earth's Mantle: Combining Geophysics and Mineral Physics

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ABSTRACT BODY: High-resolution imaging and characterization of the thermal and compositional structure of the lithospheric and sublithospheric upper mantle are the basis for understanding the formation and evolution of the lithosphere and the interaction between the crust-mantle and lithosphere-asthenosphere systems. Unfortunately, such imaging and characterization using available geophysical-geochemical methods still present unsolved and technically challenging problems.
In this contribution we present a new full-3D multi-observable inversion method particularly designed for high-resolution (regional) thermal and compositional mapping of the lithosphere and sublithospheric upper mantle. Ambient noise tomography, multiple plane wave earthquake tomography, magnetotelluric, thermal, thermodynamic, and potential field modelling are all combined in a single thermodynamic-geophysical framework and appraised within a general probabilistic (Bayesian) formulation. This circumvents the problems of strong non-linearity involved in traditional inversions, provides highly refined seismic information, minimizes the problem of trade-off between temperature and composition in wave speeds, offers critical insights into incompatibilities between traditional stand-alone methods, and takes advantage of a priori local geochemical information. Both synthetic models and preliminary results in real-case examples will be used to discuss the benefits, robustness, and limitations of this method.

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INDEX TERMS: [1212] GEODESY AND GRAVITY / Earth's interior: composition and state, [7218] SEISMOLOGY / Lithosphere, [7208] SEISMOLOGY / Mantle, [3939] MINERAL PHYSICS / Physical thermodynamics.