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Heat flow from the core and the thermal evolution of the Earth

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The role of heat flow coming from the Earth's core has long been overlooked or underestimated in simple models of Earth's thermal evolution. Throughout most of Earth's history, the mantle must have been extracting from the core at least the amount of heat that is required to operate the geodynamo. In view of recent laboratory measurements and theoretical calculations indicating a higher thermal conductivity of iron than previously thought, the above constraint has important implications for the thermal history of the Earth's mantle. In this paper we construct a paramaterized mantle convection model that treats both the top and the core-mantle thermal boundary according to the boundary layer theory, and employs the model of Labrosse (2015) to compute the thermal evolution of the Earth's core. We show that the core is likely to provide all the missing heat that is necessary in order to avoid the so-called "thermal catastrophe" of the mantle. Moreover, we analyze the mutual feedback between the core and the mantle, providing the necessary ingredients for obtaining thermal histories that are consistent with the petrological record and have reasonable initial conditions.

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