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The Gravitational Potential, Gravitational Acceleration, and Vertical Gravity Gradient of a Rising Thermal Mantle Plume: A Numerical Experiment JUAN H. HINOJOSA, Texas A&M International University — Thermal convection in the mantles of the terrestrial planets is an important mode of heat transfer from the planet's interior. Gravitational instabilities originating at hot, thermal boundary layers at depth, either at the core-mantle boundary or at an interface between the upper mantle and lower mantle, are responsible for a type of convection that gives rise to thermal mantle plumes. Since the inferred horizontal dimensions of mantle plumes as a whole are small compared with their vertical dimensions, it is difficult to observe mantle plumes directly. To better understand the mantle plume's gravitational expression at the surface, the gravitational potential, gravitational acceleration, and vertical gravity gradient of a rising mantle plume are calculated in a series of numerical experiments. An axially symmetric mantle plume is modeled using a composite of spheres and/or disks of various depths, radii, thicknesses, and density contrasts. The density contrast used in the numerical experiments is due to the temperature difference between an isothermal plume and the local geotherm for plumes at depths greater than the depth of pressure-release melt, and is due to the melt density contrast elsewhere. The resulting gravitational quantities for the spheres are obtained with straight-forward, analytical expressions, but those for the disks are obtained by numerical integration. The results of the numerical experiments will be presented.

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