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Mantle Plumes and their gravity signals

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In the mantle, plumes are expected to develop as instabilities of core- mantle thermal boundary layer which carry hot masses and energy flux all over the earth mantle. Our knowledge about plumes in the earth is still so basic since it is too difficult to observe them and still, there are some contradictions on the most important questions concerning plume in the mantle, their deep, their morphology and even their existence.
However, gravity signals caused by such mantle plumes could be used as valuable observations which are measured and applied to better understanding of this geophysical phenomenon. Recent developments in gravity field determination from satellite missions, have improved the situation considerably and the long and medium wavelength of the earth gravity field are now determined with a global coverage. We used satellite derived gravity models (i.e. GRACE derived) in order to differentiate between plumes and their characteristics to classify them into different groups depending in their temporal state and the temperature-and pressure-dependence of the mantle rheology. On one hand we modeled plumes numerically in spherical axi-symmetric geometry and computed their gravitational effects and on the other hand the estimated contribution of plumes in the observed gravity field is extracted from a GRACE derived static geoid. A good agreement between these results could be regarded as a forwarding step in such studies especially in constraining plume numeric models.