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Phase transitions in numerical models of crustal deformation

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During lithospheric deformation rocks experience a large range of pressure and temperature (P-T) conditions. Within this P-T range, metamorphic rocks recrystallize and this leads to significant changes in their physical properties. Incorporating phase transitions in numerical geodynamic models is then required in order to investigate the effect that phase transitions have in lithospheric processes. Phase transitions that occur in the lithosphere during deformation can greatly affect the pressure and temperature fields. In addition, mechanical deformation, via shear heating phenomena, may contribute to the development of transient P-T anomalies. In this work, we develop a non-Boussinesq approach to investigate geodynamic scenarios where phase transitions are important. In such an approach, shear heating arises as a natural consequence of the conservation of energy. Moreover, the conservation of mass rather than volume leads to the development of pressure anomalies that would not develop if the Boussinesq approximation is considered.