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Influence of grain-size evolution on the self-consistent generation of LLSVPs from primordial material and subducted MORB

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In recent numerical studies using the convection code StagYY, we have been able to reproduce the viscosity profile of the Earth together with a physical model of non-equilibrium grain size evolution. Melting and crustal production (in a simplified system considering a mixture of harzburgite and pyroxene-garnet) is also considered. It helps buffering the internal temperature of the Earth and affects the tectonic regime as it generates compositional heterogeneities such as subducted MORB. The present study focusses on the impact of grain size evolution on the development of large chemical heterogeneities appearing at the core-mantle boundary.

We present a new set of numerical simulations in which we consider both a primordial layer and a time-dependent basalt production at the surface considering to dynamically form the present-day chemical heterogeneities. We test the influence of density and viscosity of both subducted MORB and the primordial layer on the morphology of the LLSVPs.

Additionally, our model of grain size evolution allows us to use a composite visco-plastic rheology using only a Byerlee law, and to control the partitioning of diffusion and dislocation creep in the mantle. We then report observations of the competition between intense grain growth close to the CMB due to large core temperature and the presence of the post-perovskite phase transition which tends to diminish grain size.