Low-degree gravity signature of short-wavelength models of subduction

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In the framework of the ongoing discussion concerning the importance of lateral viscosity variations (LVV) on geoid predictions, it is recognized that LVV of long wavelength (in the spectral domain, $\ell_{\text{max}} \simeq 20$) such as those associated to a temperature-dependent viscosity derived from seismic tomography, do not significantly affect inversions of the low-degree geoid ($2 \leq \ell \leq 10$). On the other hand, regional models of subduction zones generally fail to predict the correct high-degree geoid signal if LVV of sufficiently short-wavelength are not taken into account. Using a mixed spherical harmonic-finite element approach to model present-day mantle flow, we perform numerical experiments to investigate, in a spherical axisymmetric geometry, the effects of LVV on the low-degree geoid and gravity anomalies above a typical subduction zone. We present a systematic exploration of the parameters space, testing several combinations of density, viscosity and geometry of a subducted slab having a realistic lateral extent (~ 100 km), with the aim of predicting the characteristic broad positive highs that the low-degree geoid and gravity exhibit over major subduction zones.