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Numerical solution of the altimetry-gravimetry BVP for high-resolution modelling of the altimetry-derived gravity data

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We present a numerical solution of the altimetry-gravimetry boundary-value problem using the finite volume method, which discretizes the 3D computational domain between an ellipsoidal approximation of the Earth's surface and an upper boundary given at the mean altitude of the GOCE orbits. A parallel implementation of the finite volume numerical scheme and large-scale parallel computations on clusters with distributed memory allow high-resolution modelling of the altimetry-derived gravity disturbances over oceans. Here the Dirichlet boundary conditions in form of the disturbing potential are prescribed. They are obtained by nonlinear diffusion filtering of the geopotential generated on the mean sea surface from the GRACE/GOCE-based satellite-only geopotential model. On the upper boundary, the Dirichlet boundary conditions generated from the same model are prescribed as well. Numerical experiments present the detailed gravity disturbances derived over oceans from the DTU13 mean sea surface model and the GO_CONS_GCF_2_DIR_R5 geopotential model. Their comparison with the DTU13_GRAV altimetry-derived gravity data indicates an importance of a-priori information about the mean dynamic topography for achieved accuracy, especially in zones of main ocean geosprophic surface currents.