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A new treatment of the oblique derivative condition in geodetic boundary-value problems

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We present a novel numerical scheme for approximation of the oblique derivative boundary condition in fixed gravimetric and nonlinear geodetic boundary value problems. The main idea is to understand the oblique derivative as an advection equation on the computational domain boundary and then to use the so-called up-wind principle for its approximation.
We combine this approach on the boundary with the finite volume approximation of the Laplace equation outside the Earth and we obtain the linear system with the M-matrix property. In the numerical experiments we first apply the proposed approach to testing examples in order to find its experimental order of convergence. Then we present practical numerical experiments in solving the fixed gravimetric boundary-value problem in chosen regions.