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Combinations of terrestrial and satellite gravity field data treated as an optimized solution of boundary problems in a close neighborhood of the Earth

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The purpose of this paper is to discus and further develop a method for combining terrestrial and satellite gravity field data which rests on an optimized solution of boundary problems in a close neighborhood of the Earth. The solution is harmonically extended and it is regular at infinity. A short review on results achieved so far is given first. In an initial step they exploit a solution of boundary problems in a spherical layer. The optimized solution is expressed in the spectral as well as space domain, including the structure of the respective Green's integral kernels. Subsequently, the results are considerably generalized in this paper. Effects of the topography of the Earth and of a more precise structure of the boundary conditions for the disturbing potential are taken into account. This refinements are expressed as corrections constructed by means of an iteration method. The starting point is a transformation of the boundary problems considered under a small modification of curvilinear coordinates. In consequence a spherical resolvent operator may be applied rigorously at each iteration step. This approach gives a practical and operational tie to the results originally deduced for the spherical case and also to original numerical simulations for parameters close to the orbit of the expected GOCE mission.