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Recovery of gravity information over polar gaps from the GOCE SGG data

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Global gravity models and topographic models provide essential information required for a better understanding of inner structure and geological properties such as the lithospheric flexure or isostatic relaxation of Earth. Moreover, the existing gravity models of Earth have a lower accuracy over polar regions because non-orbital orbit of satellites that have been used to determine the gravity field of Earth. We propose a simple approach of possibility of improving the gravity information over polar regions of Earth. GOCE was one of satellite gravity determination missions of earth. Since the orbital inclination of the GOCE satellite is not 90º, polar regions are not directly observed by the satellite gravity gradiometry (SGG). The polar gaps represent one of the major problems of the GOCE mission. To address this issue in this study we propose and test an iterative numerical procedure for the extrapolation of the gravity information over polar gaps. For this purpose, we use only the GOCE SGG data without any additional gravity information. The test results reveal that the proposed method could to some extent improve the gravity information over polar gaps even when using only the GOCE SGG data alone. Moreover, the analysis of the global gravity field shows that this improved information over polar gaps could be facilitated to partially improve the GOCE-only global gravitational models, especially at the medium wavelengths of the gravity spectrum. An additional gravity information (typically the SST precise kinematic orbits) is, however, required to avoid the worsening of the gravity information at the long wavelengths, while the terrestrial, airborne, seaborne, or other type of gravity data are still required to map the gravity field over polar gaps with a high accuracy and resolution. The application of our method is thus restricted to polar regions and global studies that deals only with the medium-wavelength gravity spectrum.