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GOCE SGG data downward continuation to the Earth's Surface

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The combination of GOCE Satellite Gravity Gradiometer (SGG) data with local free-air gravity anomalies, towards the estimation of improved geoid and gravity field models, requires their downward continuation to the Earth's surface (ES). Within the GeoGravGOCE project, which aims to explore the local improvements in geoid and gravity field modeling offered by GOCE, optimal combination of GOCE and surface data was sought in order to acquire insights of their contribution especially over poorly surveyed areas. GOCE SGG data are first pre-processed, to filter out noise and reduce long-wavelength correlated errors, and are consequently reduced to a mean orbit (MO) so that downward continuation to the Earth's surface can be carried out. The reduction from the orbit level to a MO was performed by estimating GGM gradient grids per 1 km from the MO to the maximum orbital level, and then linearly interpolating for the reduction from the actual satellite height. Having determined the filtered GOCE filtered SGG data to a MO, the next step referred to their downward continuation to the ES. Gravity anomalies from XGM2016 generated on the ES have been used as ground truth and were upward continued to the MO in the spectral domain through the input output system theory method. The evaluation of GOCE SGG data to the MO with GGM-derived gradients is performed using a Monte-Carlo annihilation method finding the global minimum of a cost function that may possess several local minima. The GOCE data that satisfy the aforementioned criteria of this simulated annealing method are frozen and the steps mentioned above are repeated until all generated SGG data meet the criterion. The developed procedure can be successfully applied for downward continuation of GOCE SGG from a MO to the ES for regional gravity field applications. The present work summarizes the results achieved while the evaluation is performed against local free-air gravity anomalies and residuals to XGM2019.