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Gravity gradient preprocessing at the GOCE HPF

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One of the products derived from the GOCE observations are the gravity gradients. These gravity gradients are provided in the Gradiometer Reference Frame (GRF) and are calibrated in-flight using satellite shaking and star sensor data. In order to use these gravity gradients for application in Earth sciences and gravity field analysis, additional pre-processing needs to be done, including corrections for temporal gravity field signals to isolate the static gravity field part, screening for outliers, calibration by comparison with existing external gravity field information and error assessment. The temporal gravity gradient corrections consist of tidal and non-tidal corrections. These are all generally below the gravity gradient error level, which is predicted to show a 1/f behaviour for low frequencies. In the outlier detection the 1/f error is compensated for by subtracting a local median from the data, while the data error is assessed using the median absolute deviation. The local median acts as a high-pass filter and it is robust as is the median absolute deviation. Three different methods have been implemented for the calibration of the gravity gradients. All three methods use a high-pass filter to compensate for the 1/f gravity gradient error. The baseline method uses state-of-the-art global gravity field models and the most accurate results are obtained if star sensor misalignments are estimated along with the calibration parameters. A second calibration method uses GOCE GPS data to estimate a low degree gravity field model as well as gravity gradient scale factors. Both methods allow to estimate gravity gradient scale factors down to the 10^{-3} level. The third calibration method uses high accurate terrestrial gravity data in selected regions to validate the gravity gradient scale factors, focussing on the measurement band. Gravity gradient scale factors may be estimated down to the 10^{-2} level with this method.