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On the role of covariance information for GRACE K-band observations in the Celestial Mechanics Approach

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The Astronomical Institute at the University of Bern (AIUB) derives static and time-variable gravity fields by means of the Celestial Mechanics Approach (CMA) from GRACE (level 1B) data. This approach makes use of the close link between orbit and gravity field determination. GPS-derived kinematic GRACE orbit positions, inter-satellite K-band observations, which are the core observations of GRACE, and accelerometer data are combined to rigorously estimate orbit and spherical harmonic gravity field coefficients in one adjustment step. Pseudo-stochastic orbit parameters are set up to absorb unmodeled noise.

The K-band range measurements in along-track direction lead to a much higher correlation of the observations in this direction compared to the other directions and thus, to north-south stripes in the unconstrained gravity field solutions, so-called correlated errors. By using a full covariance matrix for the K-band observations the correlation can be taken into account. One possibility is to derive correlation information from post-processing K-band residuals. This is then used in a second iteration step to derive an improved gravity field solution. We study the effects of pre-defined covariance matrices and residual-derived covariance matrices on the final gravity field product with the CMA.