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An improved accelerometer calibration model for gravity field estimates

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During gravity field modelling, accelerometer measurements must be calibrated via scale and bias parameters. Klinger and Mayer-Gürr (2016) found that behaviors of both scales and biases are related to the thermal control service for the accelerometers. This finding indicates that the scale and bias may change significantly after April 2011 as the thermal control service has been switched off since then. To improve gravity field estimates, the time-related variations in either scales or biases should be better modelled. For the purpose of considering the time-dependent changes of scales and biases, we propose an improved accelerometer calibration model in this study, where the scales and biases are modelled by polynomials besides estimating the errors of attitude and accelerometer data. Detailed discussions on the selection of the optimal orders of polynomials for scales and biases, their time-dependent changes and the rationality of the improved accelerometer calibration model are given in this investigation. Compared to other accelerometer calibration models, the improved model has the comparable ability to calibrate the accelerometer measurements, while it achieves better conditioned normal equation and improved gravity field estimates. Considering the performance of the enhanced accelerometer calibration model, this calibration model is adopted in developing Tongji-Grace02s static gravity field solution.