Future gravity field missions are expected to use new generation instruments of unprecedented accuracy that will affect the error tree of spaceborne gravity field recovery methods as we know it today. Temporal aliasing remains one of the biggest contributors to the error budget, even if more complex satellite formations (e.g. two pairs instead of one) are deployed. This study, which was part of the ESA project “Assessment of Satellite Constellations for Monitoring the Variations in Earth Gravity Field (SC4MGV)”, investigates the impact of temporal aliasing effects in case of a so-called Bender-type constellation, as one of the best candidates of satellite formations to be launched in the future. An error assessment is performed, and the effect of different sources of aliasing is highlighted.

A method called the Wiese approach (Wiese et al, 2013) that results in reduction of temporal aliasing effects is investigated for a Bender-type constellation. This method employs a gravity field processing technique that co-estimates low resolution gravity fields at short time intervals together with the higher resolution gravity field which is sampled at a longer time interval. The approach opens a big search space for parameterization choices, which is thoroughly investigated. The effect of each choice is assessed, and the long-term as well as the short-term fields are validated. The method is also extended in order to retrieve even more signal variability at higher frequencies, by parameterizing in multiple time periods instead of single (Daras, 2015). A fine-tuning is performed in terms of temporal sampling and maximum resolution of the short-term gravity fields that leads to the biggest reduction of aliasing errors. The contribution of individual aliasing components to the error-budget is assessed, and the effectivity of the Wiese parameterization to reduce their effects is demonstrated. An attempt is also made to extract possible correlations between the short-term fields and other co-estimated parameters (e.g. boundary arc conditions, empirical accelerations), and to analyze their impact on the gravity field solutions.

Finally, it is demonstrated that future gravity satellite missions of a Bender-type constellation processed with the proposed parameterization, have the possibility to estimate the full spectrum of geophysical processes that comprise system Earth, including variations of atmosphere and ocean. The averaged long-term fields, together with the short-term low-resolution fields (new bi-product) of this content, comprise an innovative product that may open doors to new fields of application.