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De-correlated combination of two low-low Satellite-to-Satellite tracking pairs according to temporal aliasing

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The monitoring of the temporal changes in the Earth's gravity field is of great scientific and societal importance. Within several days a homogeneous global coverage of gravity observations can be obtained with satellite missions. Temporal aliasing of background model errors into global gravity field models will be one of the largest restrictions in future satellite temporal gravity recovery. The largest errors are due to high-frequent tidal and non-tidal atmospheric and oceanic mass variations. Having a double pair low-low Satellite-to-Satellite tracking (SST) scenario on different inclined orbits reduces temporal aliasing errors significantly. In general temporal aliasing effects for a single (-pair) mission strongly depend on the basic orbital rates (Murböck et al. 2013). These are the rates of the argument of the latitude and of the longitude of the ascending node. This means that the revolution time and the length of one nodal day determine how large the temporal aliasing error effects are for each SH order.

The combination of two low-low SST missions based on normal equations requires an adequate weighting of the two components. This weighting shall ensure the full de-correlation of each of the two parts. Therefore it is necessary to take the temporal aliasing errors into account. In this study it is analyzed how this can be done based on the resonance orders of the two orbits. Different levels of approximation are applied to the de-correlation approach. The results of several numerical closed-loop simulations are shown including stochastic modeling of realistic future instrument noise. It is shown that this de-correlation approach is important for maximizing the benefit of a double-pair low-low SST mission for temporal gravity recovery.

Murböck M, Pail R, Daras I and Gruber T (2013) Optimal orbits for temporal gravity recovery regarding temporal aliasing. Journal of Geodesy, Springer Berlin Heidelberg, ISSN 0949-7714, DOI 10.1007/s00190-013-0671-y