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Regional hydrological recovery using one year of simulated observations of the GRACE and Bender constellations

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Increasing the spatial sampling isotropy has become a major issue in designing future missions dedicated to pursue the task of GRACE, from which the Bender-type multi-orbit satellite configuration seems to be a suitable choice since it reduces the temporal aliasing and has the potential to provide better spatial resolution. Via simulations, this contribution examines the performance of a Bender-type solution, consisting 2 GRACE-like orbits with inclinations of 89.5o and 63o, for hydrological applications. To this end, we created one full year of simulated observations of the GRACE and Bender configurations. Our investigations include: 1) evaluating the feasible spatial resolution for recovery of hydrological signals in the presence of realistic instrumental noise and errors in the background models; 2) assessing the behavior of the aliasing errors in the hydrological recovery and its separation from instrumental noise and the introduced hydrological signals; 3) examining the regional behavior of the hydrological products by computing water storage changes over the 33 world largest river basins. From our results, the Bender-derived error curves at different spatial resolutions indicated that, away from the instrumental noises, the aliasing errors still contaminate the gravity solution as a dominant error source. Moreover, our analyses show that the Bender constellation determines the annual mass variations in small basins which are undetected by the simulated GRACE solution. The results are given in different spectral domains up to spherical harmonic degrees and orders 40, 80 and 100.