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Assessment of Release-6 monthly gravity field solutions based on GRACE satellite data

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Since the launch of the Gravity Recovery and Climate Experiment (GRACE) satellite mission in 2002, satellite gravimetry became the primary source of information about mass transport in the Earth system at the regional and global scale. This technique allows one to gain better understanding of various processes associated with continental hydrology, cryosphere, oceans, and solid Earth. In spite of a 15-year history of GRACE data processing, improving its quality is still on-going. This is mostly due to a progress in data processing algorithms, as well as due to a steadily increasing accuracy of background geophysical models. The goal of this study is to assess and compare GRACE-based monthly gravity field solutions released in the course of the last year. Among them, are the official GRACE Release-6 solutions prepared at the Center for Space Research of the University of Texas at Austin (CSR), the German Research Center for Geosciences (GFZ), and NASA's Jet Propulsion Laboratory (JPL). We also consider a number of alternative solution time-series, including the ITSG-Grace2018 solutions computed at the Institute of Geodesy at the Graz University of Technology (ITSG). The solution time-series are consistently processed with a low-pass filter to suppress high-frequency noise and converted into time-series of mass anomalies. A quantification of noise in an individual mass anomaly time-series per node of an equiangular grid is performed in the course of producing a combined regularized time-series. The noise variance is computed for each individual time-series using the Variance Component Estimation (VCE). The regularization functional is based, in the first instance, on a minimization of Month-to-month Year-to-year Double Differences (MYDD). Such a regularization does not introduce any bias into annual periodic variations and linear trends, which are the most common features of mass anomaly time-series. In this way, we analyse the accuracy of the time-series under consideration at different geographical locations. Furthermore, we compare the accuracy of the considered solutions in the time domain. Finally, we address the robustness of the obtained estimates by varying some parameters of our analysis technique, including the exploited regularization functional.