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G3P v1.12: Advancements of a Global Groundwater Storage Anomaly Dataset from Satellite Gravimetry

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The Global Gravity-based Groundwater Product (G3P) has evolved with a new version (V1.12), bringing substantial enhancements to our satellite-based groundwater storage anomaly dataset—a prototype for a future product within the EU Copernicus Climate Change Service. Groundwater as the world's largest distributed freshwater storage, is a vital resource for human, industrial, and agricultural needs. Despite its significance, Copernicus lacks a service delivering operational, observation-based, and globally comprehensive data on changing groundwater resources. G3P could serve as a pivotal extension to the Copernicus portfolio. Leveraging the unique capabilities of GRACE and GRACE-FO satellite gravimetry, G3P monitors subsurface mass variations employing a mass balance approach. This involves subtracting the satellite-based and partly model-based water storage compartments (WSCs) snow water equivalent, root-zone soil moisture, glacier mass and surface water storage from GRACE/GRACE-FO monthly terrestrial water storage anomalies (TWSA). Ensuring a consistent subtraction of individual WSCs from GRACE-TWSA involves filtering them similarly to GRACE-TWSA, using filters whose type and parametrization had to be derived by spatial correlation analyses. The G3P dataset spans more than two decades (from 2002 to 2023) with a monthly resolution and global coverage at 0.5-degree spatial resolution. Notable updates in V1.12 compared to previous versions include an extended data time period until September 2023, modifications of the methodology of several WSCs, and the incorporation of new evaluation results.

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