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Global flood monitoring with GRACE/GRACE-FO

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The German Aerospace Center and NASA's joint mission, the Gravity Recovery and Climate Experiment (GRACE) operational from 2002 until October 2017, provided measurements of Earth's gravity field anomalies. Its follow-on mission GRACE-FO, implemented by NASA and GFZ, was launched in May 2018 and continued to give us large-scale measurements of the Earth's gravity variations. These variations in gravity are used to determine anomalies of total water storage (TWSA) which can provide us with insights into global water redistribution on a monthly up to a daily basis.

Most common natural disasters that still require efficient early warning systems are floods. Floods are causing significant economic and humanitarian losses on a global scale and are triggered by the interaction of different hydro-meteorological processes (e.g. precipitation, sub-surface water storage, snow cover).

We aim to explore GRACE and GRACE-FO products' possibilities to detect the water storage dynamics associated with floods in large river catchments. We include analysis of the basins' wetness states before the flood events, which eventually can give us early indicators of flood development. During the GRACE data period, we investigate around 2500 historical floods from the Dartmouth Flood Observatory (DFO). We acquire GRACE data with daily resolution from the latest releases of ITSG and GFZ for the spatial extent of DFO floods and reduce TWSA values by long-term trends and by average seasonal variability. Furthermore, we assess the available river discharge time series, during the GRACE period, obtained from the Global Runoff Data Centre (GRDC) for the flood event separation. We compare GRACE-based water storage anomalies to flood events' characteristics, like peak, volume, and duration. Results show the potential of GRACE-based TWSA to detect large-scale flood events.