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Retrieval of surface water storage in large river basins from multi-satellite and topographic data

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Spatio-temporal variations of water storage in surface water bodies (rivers channels, lakes, floodplains and inundation areas) are still widely unknown for large areas. In this study, we present a technique to estimate surface water volumes for large river basins by the combination of (1) a global data set of inundation areas with a resolution of about 25km generated with a multi-satellite method using passive microwave (SSM/I), scatterometer (ERS) and visible and near-IR (AVHRR), and (2) topographic data from global Digital Elevation Models such as SRTM or ACE. We derived time series of monthly surface water storage for the period 1993-2004 based on a hypsographic curve approach. The average water level and volume per month and grid cell was estimated by intersecting the cumulative distribution function of elevation values in each grid cell with the inundation area extent. The focus of the study was the Amazon basin. For the Rio Negro sub-basin, results where compared to complementary methods that used altimetry-based and in-situ water level data. Additionally, results where compared to total water storage variations as derived from time-variable gravity fields of the GRACE satellite mission, highlighting the large contribution of surface water to total storage variations. The results are also discussed with respect to simulated surface water storage of the WaterGAP Global Hydrology Model (WGHM). Parameter values in WGHM have been constrained by using water storage from GRACE and the additional benefit of incorporating the surface water information into the calibration process is evaluated.