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Variations of inundation areas and surface water storage in large river basins: A comparison of different global data sources

A. Güntner (1), F. Papa (2) and F. Frappart (3)

(1) GeoForschungsZentrum Potsdam (GFZ), Germany, (2) NOAA-CREST Center, The City College of New York, USA, (3) CESBIO, Toulouse, France (guentner@gfz-potsdam.de / +49 331 2881570)

The knowledge of spatio-temporal variations of inundation area extent and water storage in surface waters and their relation to climatic variability is still limited for large areas. In this study, we derive and compare time series of surface water variables at the scale of large river basins worldwide. The following data are analyzed: (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). (2) Water mass variations derived from time-variable gravity fields of the Earth as monitored by the GRACE satellite mission. (3) Surface water volume changes simulated by simple algorithms for river, lake and wetland storage with the WaterGAP Global Hydrology Model (WGHM). (4) Basin-average precipitation from global data sets such as GPCP and GPCC. The focus of the analyses is on large river basins in different climates for the period 2003-2004. For selected study areas, two additional estimates of water volume changes derived from combination approaches with the potential of global-scale applicability are used for comparison: (5) Combination of the inundation data set with water levels from satellite altimetry and (6) combination of the inundation data set with a global Digital Elevation Model (GTOPO30) to get water volume changes based on a hypsographic curve approach. In general, the results show similar seasonal and inter-annual variations for the different data sets. Phase differences between precipitation and water storage reveal the effect of water transport processes within the river basins. Phase differences and a hystere-

sis behaviour between inundation area and water storage time series demonstrate the complex dynamics of inundation processes and the importance of other than the surface component when compared to total water storage change from GRACE. In total the results highlight the value of using multi-method and multi-satellite techniques for assessing surface water storage and improving large-scale hydrological modelling.