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Satellite-based Estimates of Surface and Groundwater Storage Variations in the Amazon Basin

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The Amazon river basin has been recently affected by extreme climatic events, such as the exceptional drought of 2005, with signi[U+FB01]cant impacts on human activities and ecosystems. In spite of the importance of monitoring freshwater stored and moving in such large river basins, only scarce measurements of river stages and discharges are available and the signatures of extreme drought conditions on surface freshwater dynamics at the basin scale are still poorly known. Here we use continuous multisatellite observations of inundation extent and water levels between 2003 and 2007 to monitor monthly variations of surface water storage at the basin scale. During the 2005 drought, the amount of water stored in the river and [U+FB02]oodplains of the Amazon basin was ∼130 km3 (∼70%) below its 2003–7 average. This represents almost a half of the anomaly of minimum terrestrial water stored in the basin as estimated using the Gravity Recovery and Climate Experiment (GRACE) data. Water stored in the aquifer is isolated from the total water storage measured by GRACE by removing the contributions of both the surface reservoir, previously derived from satellite imagery and radar altimetry, and the root zone reservoir simulated by hydrological models such as LaD and WGHM. The spatio-temporal variations of surface and groundwater reservoirs are compared to other hydrological datasets (i.e. rainfall from TRMM or GPCP, discharges, ...) and analyzed at subbasin scale in the context of the climate variability and recent extreme events such as the drought of 2005.