

The 2009 exceptional Amazon flood and interannual terrestrial water storage change observed by GRACE

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[1] The Gravity Recovery and Climate Experiment (GRACE) satellite gravity mission provides a new capability for measuring extreme climate events, such as floods and droughts associated with large-scale terrestrial water storage (TWS) change. GRACE gravity measurements show significant TWS increases in the lower Amazon basin in the first half of 2009, clearly associated with the exceptional flood season in that region. The extended record of GRACE monthly gravity solutions reveals the temporal and spatial evolution of both nonseasonal and interannual TWS change in the Amazon basin over the 7 year mission period from April 2002 to August 2009. GRACE observes a very dry season in 2002–2003 and an extremely wet season in 2009. In March 2009 (approximately the peak of the recent Amazon flood), total TWS surplus in the entire Amazon basin is $\sim 624 \pm 32$ Gt, roughly equal to U.S. water consumption for a year. GRACE measurements are consistent with precipitation data. Interannual TWS changes in the Amazon basin are closely connected to ENSO events in the tropical Pacific. The 2002–2003 dry season is clearly tied to the 2002–2003 El Niño and the 2009 flood to the recent La Niña event. The most significant contribution of this study in the area of water resources is to confront the hydrological community with the latest results of the GRACE satellite mission and further demonstrates the unique strength of GRACE and follow-up satellite gravity observations for measuring large-scale extreme climate events.

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