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Flood Monitoring from Space

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Advances in contemporary space geodetic and remote-sensing technologies have enabled innovative scientific research and applications in terrestrial hydrology. The use of satellite radar altimetry via waveform retracking and backscatter coefficients enables hydrologic water level monitoring over relatively small bodies of inland water, and flood extent classification, respectively. The sensor fusion approach integrating collocated radar altimetry and interferometric SAR (InSAR) measurements (L-band and C-band) yields centimeter-level geocentrically referenced water level changes over inundated wetlands with seasonally varying vegetation. Spatial resolution of the dh/dx measurements is as high as 40-m at SAR acquisition times, while the temporal resolution is weekly to monthly from satellite altimetry repeat-orbit cycles. The Gravity Recovery and Climate Experiment (GRACE) twin-satellite gravity mission data represents a new sensor for basin-scale hydrologic measurements of surface water and subsurface soil moisture changes with a spatial resolution of as fine as 300 km and monthly sampling. The future wide-swath interferometric altimetry, the SWOT mission, is anticipated to revolutionize hydrologic surface water measurement from space. While InSAR technology at present suffers latency problems, satellite radar altimetry is on the verge of being able to provide near-real time data for flood monitoring. An experimental quick-look (QL) GRACE data product with low-latency ($\sim$7 days after data acquisition) and $\sim$15 day temporal resolution with one-day steps has the potential for timely large-scale flood monitoring and flood mitigation. In this study, we describe the results of using contemporary space geodetic measurements for proof-of-concept timely flood monitoring, including the 1997 Red River floods, the 2009 Amazon near-record flood on Rio Negro, the 2010 Pakistan and China flood, and the 2011 Australian flood.