Detection of large flood events using GRACE regional solutions

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A constrained least-squares approach has been applied to estimate regional maps of equivalent water heights by inverting GRACE-based potential anomalies at satellite altitude. According to the energy integral method, the anomalies of difference of geo-potential between the two GRACE vehicles are derived from along-track K-Band Range-Rate (KBRR) residuals that correspond mainly to the continental water storage changes, once a priori known accelerations (i.e. static field, polar movements, atmosphere and ocean masses including tides) are removed during the orbit adjustment process (Ramillien et al., 2010). Unlike the «mascons» approach, no basis of orthogonal functions (e.g., spherical harmonics) is used, so that the proposed regional method does not suffer from drawbacks related to any spectrum truncation. This approach, consistent with independent datasets: hydrological models outputs, «mascons» and global GRACE solutions, was used to compute time-series of 10-day regional maps at 2° of spatial resolution over South America (Ramillien et al., 2011). A Principal Component Analysis (PCA) approach was applied to the regional, "mascons" and global GRACE solutions over 2003-2010. Comparisons were made with external datasets: water levels and wetlands and floodplains maps. Some spatial modes and corresponding time components can be related to seasonal flood events, and especially for the exceptional flood event that occurred in 2009. Better results were obtained using the GRACE solutions computed using the regional method.