Geophysical Research Abstracts
Vol. 14, EGU2012-8260, 2012
EGU General Assembly 2012

GRACE observations of 2010/2011 eastern Australian floods: Producing precise GRACE gravity fields in the absence of satellite accelerometer observations.

S. McClusky, P. Tregoning, and H. McQueen
Research School of Earth Sciences, ANU, Canberra, Australia (simon.mcclusky@anu.edu.au)

Between August 2010 and February 2011 the strongest La Niña event seen since 1973 fuelled widespread above average rainfall and flooding across much of north and eastern Australia. Rainfall for August to December was the highest on record across vast areas of eastern Australia, particularly in Queensland and northern Victoria. Many monthly rainfall records were set, flooding was a regular occurrence and there was substantial recharge in many depleted surface water storages. The most widespread and damaging floods of the year occurred across Queensland in the final week of 2010 and continued into early 2011. The most severe impacts felt in central and southern inland Queensland where numerous rivers reached all time record levels. Significant flooding occurred across much of inland New South Wales in December, particularly in the Murrumbidgee and Lachlan catchments. Major floods also occurred in northern Victoria and the New South Wales Riverina in early September, with northern Victoria again inundated by record-breaking rainfall and extensive flooding in late January 2011. This 2010 La Niña event also saw record sea surface temperatures recorded off the Queensland coast in late 2010, creating the perfect conditions for the formation of category 5 tropical cyclone Yasi which slammed in the northern Queensland coast on February 3rd 2011, causing $4B worth of damage.
The GRACE satellite mission provides a way of quantitatively measuring the large-scale spatial and temporal mass changes induced in hydrological systems across the Australian continent as a result of the large 2010 La Niña event. Of particular interest is the effect of such large scale flooding events on the rate of recharge of large-scale ground water systems. Unfortunately the official level2 GRACE gravity solutions commonly used to compute hydrological mass changes globally were either not computed or are significantly degraded from late December 2010 through to early February 2011 due to missing satellite accelerometer data needed to compute precise satellite orbital trajectories. During the GRACE satellite eclipse season (orbit B' ≈ 0) the satellite batteries are required to charge and discharge rapidly as the satellites moves from sun to shade. This rapid battery cycling causes heating to occur which if left unchecked cause premature battery failure. In late 2010 in an attempt maximize the already degraded GRACE battery life, GRACE operations managers implemented a strategy designed to maintain the aging GRACE spacecraft battery temperatures below a threshold considered safe ($\sim 15^\circ$ C). To meet this goal during the eclipse season beginning in late December 2010 it was necessary to minimize power usage on GRACE-B by shutting down the accelerometer subsystem, meaning the accelerometer measurements normally used to precisely determine its orbit during this period were not collected. In this study will investigate and present techniques for producing high quality gravity field time series and mass change estimates form GRACE K-band observations in the event that either one or both GRACE satellites are not collecting accelerometer data.