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Co-seismic and post-seismic signatures of the Sumatra December 2004 and March 2005 earthquakes in GRACE satellite gravity

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We investigate the co-seismic and post-seismic gravity signals associated to the Sumatra December 2004 and March 2005 earthquakes using GRACE geoid products by Biancale et al. (2006). In order to isolate the geodynamic signature from the noise in the data, we apply a wavelet analysis of the GRACE geoids. We then show that the gravity field variations caused by the December 2004 and March 2005 Sumatra earthquakes can be detected. The December 2004 earthquake produced a strong co-seismic decrease of the gravity field in the Andaman Sea. During the first year following the earthquake, we observe a gravity relaxation characterized by a broad gravity increase in the area affected by both the Andaman 2004 and the Nias 2005 earthquakes. This gravity relaxation initiates in the vicinity of the Central Andaman ridge, where a transient component is observed. We discuss our co-seismic observations in terms of crustal and upper mantle rocks density changes, and of the vertical displacements in the Andaman Sea. We discuss the post-seismic gravity signal in terms of the visco-elastic response of the Earth's mantle. The transient component of the relaxation may indicate the presence of hot, viscous material beneath the active Central Andaman Basin.