

GPS Monitoring of the Vertical Motion of Phuket, Thailand due to the Sumatra-Andaman Mega-thrust Earthquake Cycle: Relevance for Shallow Coral Reefs

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Macro-tidal coral reefs are particularly sensitive to medium to long-term changes in sea level. Vertical motions of the seabed contribute to both lower or higher relative sea level changes, particularly in tectonic plate boundary deformation zones along active subduction trenches. The island of Phuket, South Thailand, located 500 to 650 km away from the Andaman and Sumatra trenches is subjected to both horizontal and vertical land deformations during the seismic cycle of mega thrust earthquakes like the Mw 9.2 event at the end of 2004. The relative sea level changes in this region were historically monitored with the space geodetic techniques GPS and satellite altimetry alongside the traditional tide-gauge measurements. Continuous GPS position time series show that the south of Thailand is still undergoing post-seismic deformations, horizontally moving at present 2 cm/yr slower in SW direction than the Sundaland platelet with a significant change in vertical motion pattern as a result of the mega-thrust earthquake: from quasi-linear tectonic uplift at 5 ± 1 mm/yr in the inter-, to (temporary) non-linear tectonic subsidence rates of 5-10 mm/yr in the first 7 years of the post-seismic cycle phase. Based on almost 25 years of satellite altimetry (SALT) data, the absolute sea-level rise in the Andaman Sea around Phuket is estimated at 4 ± 0.5 mm/yr. Therefore relative sea-level changes in Phuket appear to have been quasi stable since the mid 90's, followed by a significant increase following the Mw 9.2 earthquake averaging about 10 mm/yr that accumulated in 7 ± 1 cm by the end of 2011 which may have positively enhanced the shallow coral reef growth and bleaching recovery in large parts of the Andaman Sea.