



Sea level rise and variability around Peninsular Malaysia

Pavel Tkalich, Quang-Hung Luu, and Tze-Wei Tay

National University of Singapore, TMSI, Singapore, Singapore (tmspt@nus.edu.sg)

Peninsular Malaysia is bounded from the west by Malacca Strait and the Andaman Sea, both connected to the Indian Ocean, and from the east by South China Sea being largest marginal sea in the Pacific Basin. As a result, sea level along Peninsular Malaysia coast is assumed to be governed by various regional phenomena associated with the adjacent parts of the Indian and Pacific Oceans. At annual scale, sea level anomalies (SLAs) are generated by the Asian monsoon; interannual sea level variability is determined by the El Niño-Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD); whilst long term sea level trend is coordinated by the global climate change. To quantify the relative impacts of these multi-scale phenomena on sea level trend and variability surrounding the Peninsular Malaysia, long-term tide gauge record and satellite altimetry are used. During 1984-2011, relative sea level rise (SLR) rates in waters of Malacca Strait and eastern Peninsular Malaysia are found to be 2.4 ± 0.8 mm/yr and 2.7 ± 0.6 mm/yr, respectively. Discounting for their vertical land movements (0.8 ± 2.6 mm/yr and 0.9 ± 2.2 mm/yr, respectively), their pure SLR rates are 1.6 ± 3.4 mm/yr and 1.8 ± 2.8 mm/yr, respectively, which are lower than the global tendency. At interannual scale, ENSO affects sea level over the Malaysian east coast in the range of ± 5 cm with very high correlation coefficient. Meanwhile, IOD modulates sea level anomalies in the Malacca Strait in the range of ± 2 cm with high correlation coefficient. Interannual regional sea level drops are associated with El Niño events and positive phases of the IOD index; while the rises are correlated with La Niña episodes and the negative periods of the IOD index. Seasonally, SLAs are mainly monsoon-driven, in the order of 10-25 cm. Geographically, sea level responds differently to the monsoon: two cycles per year are observed in the Malacca Strait, presumably due to South Asian - Indian Monsoon; while single annual cycle is noted in the remaining region, mostly due to East Asian - Western Pacific Monsoon. These results imply that a narrow topographic constriction off Singapore may separate different modes of annual and interannual sea level variability along coastline of Peninsular Malaysia.