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18.6-year Lunar Nodal Modulation of the Tides of the Malacca Strait and the Southern South China Sea

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High tidal levels contribute to the occurrence of extreme high sea levels, and the impacts can be devastating when the extreme events occur along the low-lying and highly populated coastlines. Over decadal timescales, variations in high tides arise as a result of the 18.6-year lunar nodal cycle, which can increase the risk of coastal flooding at specific times. In this study, we firstly investigate the influence of the 18.6-year lunar nodal cycle on the annualized mean high-water levels (AMHWL) at sites in the Malacca Strait and the adjacent Southern South China Sea from the hourly tide gauge records, and then examine both the amplitude and phase of nodal modulations in the major tidal constituents which were estimated from the tide gauge data with the Utide software package.

Our preliminary results indicate that the contribution of the 18.6-year nodal cycle to the AMHWL exhibits a spatial pattern related to the form of the tides: at sites with semi-diurnal tides, the nodal modulation is negligible, while the nodal modulation amplitude reaches up to 4 cm ($\sim$2% of tidal range) at sites with mixed tides. In general, the derived nodal modulations of the diurnal (K1 and O1) and semi-diurnal constituents (M2, N2, and K2) follow the equilibrium tidal theory; and the M2 constituent has the largest tidal amplitude (up to 1.4m) in the region of interest, while the K2 and O1 constituents have the highest nodal modulation amplitudes (2 $\sim$ 8cm). Our results derived from the tide gauge records shows a good agreement with the study of Haigh et al. (2011) who assessed the global influence of the 18.6-year nodal cycle and 8.85-year cycle of lunar perigee on high tidal levels with the TPXO7.2 tidal model.