

The Effect of Seasonal Variability in Mean Sea Level and Tidal Constituents: A Case Study in Sri Lanka

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Abstract

The seasonal fluctuations cause water level variations in coastal regions. This research aims to investigate the seasonal variability of tidal constituents and Mean Sea Level (MSL). Tidal data of seven years from the Colombo Port was used to investigate the seasonal variability of both MSL and tidal constituents. The processing of tidal data was performed by using a harmonic analysis based tidal processing and analysis software TOTIS. The findings indicate that the MSL at Colombo exhibit a pattern with seasonal variations. MSL is high during the Southwest monsoon season than the Northeast monsoon season in generally. Then, the variability of amplitude and phase of diurnal (K1, M1, S1, O1), semi-diurnal (K2, M2, S2, T2), and long period (MF, MM, MSF, and SSA) tidal constituents were investigated for Colombo Port. The amplitude of all diurnal constituents exhibited a pattern with seasonal variations, with higher values during the Northeast monsoon season than the Southwest monsoon season. The amplitudes of all semidiurnal constituents exhibited a pattern opposite to that of the diurnal constituents in generally. However, it exhibited a complete opposite pattern during the years 2025 & 2020 where the MSL variation also altered. The long constituents were also exhibited a pattern with seasonal variations. The study found that the phase of each tidal constituent exhibited the same pattern in all years, although K1, M1, M2 and S2 changed the patterns during the same years in which the pattern of MSL was changed. Furthermore, unlike the amplitude variability patterns, the phase component patterns within the same category were not similar to each other. Finally, the study emphasized that amplitudes and phases of tidal constituents exhibit significant alterations with seasonal variations.

Keywords: *Harmonic Analysis, MSL, Seasonal Variability, Tidal Constituents, Tide.*