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MEAN SEA LEVEL VARIATION FROM TIDE GAUGE AND ALTIMETRY DATA IN COLOMBO, SRI LANKA

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The ocean thermal expansion related to ocean warming has contributed to the global mean sea-level rise. The sea-level fluctuations are conventionally measured by tidal stations around the globe with long records. However, tidal stations are sparse and distributed randomly. With the advent of satellite altimetry (SA) missions like TOPEX/Poseidon, Jason-1, Envisat, and more recent missions like Jason-2 and Jason-3, an effective technique of measuring global sea-level fluctuations by merging tide gauge (TG) and SA data are possible with remarkable accuracy. However, altimetry measurements, which can measure the ranges within a few centimetres, are absolute and geocentric, whereas tide gauge measurements are relative and referenced to the Earth's crust. The Earth's crust may be affected by vertical crustal movements (VCM) detected by long-term Global Positioning System (GPS) measurements. The main objective of this study is to assess the mean sea level (MSL) rise by merging TG and SA measurements with continuous GPS data. Long-term records of SA and TG (from 1993 to 2018) and continuous GPS data from 2012 to 2020 (average velocity 0.05 ± 1.03 mm/yr) were used for the analysis. The linear trend analysis of continuous GPS data showed no VCM effects and subsidence in the Colombo tide gauge location. The SA and TG variations showed a similar linear trend which implicitly validates the effectiveness of SA for analyzing the MSL variations. A combined solution from long-term TG and SA data revealed that the MSL rise in the Colombo tide gauge location is around 3 mm per year.

Keywords: Mean Sea level, Satellite altimetry, Tide gauge, Vertical crustal movement