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Sea Level Variability in the Central Region of the Red Sea

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An array of three bottom pressure/temperature/conductivity (PTC) instruments was deployed along the Saudi Arabian coast of the eastern Red Sea since 2008. These locations, represent the central region of the Red Sea; Al-Lieth (100km south of Jeddah), Thuwal (KAUST) and Arriyas (100km north of Rabigh). Surface sea level/height was calculated from the bottom pressure measurements using the hydrostatic equation. The data analysis displayed the sea level variability into three different scales: 1) On daily time scales: the data showed the most energetic component of sea level variability was the diurnal and semidiurnal tides dominated by the M2, N2, K1 and O1 tidal constituents. 2) On weekly time scales ($\sim$10 days): the sea level variability was wind driven with setup and set down up to 40 cm due to the local wind stress. 3) On yearly time scales: the sea level varied approximately 50 cm and was highest in winter (January-February) and lowest in summer (July-August). Barometric pressure also had an annual cycle of approximately 10mb and was highest in January, thus attenuating the amplitude of the annual sea level variability. The data analysis postulate that the only mechanism behind the higher sea level in the central Red Sea during winter months was due to a response to the convergent in the large-scale Red Sea wind stress associated with the Indian Monsoon, which is consisting of NNW winds in the northern part of the Red Sea and SSE winds in the southern part. The amplitude of the principal tidal and sub-tidal sea level variability was coherent at the three sites, but the direction of phase propagation could not be resolved with confidence.