Application of satellite altimetry observations as a monitoring device for long terms sea level changes. Case study: Persian Gulf and Oman Sea

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Using the data of 13 years of Topex/Poseidon and 2 years of Jason satellite altimetry missions possibility of establishing a monitoring technique for sea level variations is studied and numerically tested at the Persian Gulf and Oman Sea. The main features of the methodology can be summarized as follows:

1. From repeated observations at the footprints of the satellite along track a time series with 9.915 days time interval is constructed.

2. Using a two-step process the frequency components with the periods larger than 9.915*2 (days) are recognized: (i) Fourier Power Spectrum analysis to get initial values of the frequency constituents. (ii) Using a step-wise least squares process to find least square estimates of the frequency constituents derived in step (i) and using the Fourier estimated frequency as the initial value.

3. Removing the effect of the estimated frequencies from the along track time series to remain with a "residual time series".

4. Reconstructing a new time series from residual time series with 2h 2min time interval (from integer part of the repeating time interval 10-9.915=2h 2 min).

5. Repeating the process of step (2) for the time series generated in step (4) to derive the tidal frequencies with the period larger than (2h 2min)*2.

Using the aforementioned steps periodical variations of the sea level are estimated. Removal of the modeled part of the signal could result in computation of Mean Sea Level (MSL) and its time derivative.

The whole results of the process can be summarized as follows: (1) computation of a point-wise model for global tidal prediction, (2) a global point-wise MSL model. (3) a global point-wise time variation of the MSL.

Time variation of the global MSL could be associated the global sea level rises. The whole procedure is tested numerically at the Persian Gulf and Oman sea and as a result 772 tide estimation point, MSL point values and MSL(dot) point values are estimated for the test area.

The details of the computation theory and the numerical results from the test area are given in the paper.