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Spatio-temporal analysis of the sea level in the Eastern Mediterranean Sea and Black Sea using Jason-1, Jason-2, Topex/Poseidon and Envisat satellite altimetry data from 2002 - 2012

Armin Aghakarimi (1), Coşkun Demir (3), Mahmut Onur Karslıoğlu (1,2), and Ali Kılıçoğlu (3)

(1) Department of Geodetic and Geographic Information Technologies, Middle East Technical University, Ankara,Turkey (armin.aghakarimi@gmail.com), (2) Department of Civil Engineering, Geomatics Engineering Division, Middle East Technical University, Ankara,Turkey (karsliog@metu.edu.tr), (3) Private Sectors, Ankara,Turkey (csdemir@gmail.com)

Altimetry satellites basically determine the distance from the satellite to a target surface by measuring the satellite-to-surface round-trip time of a radar pulse, and thus the sea surface height from the reference ellipsoid. Satellite altimetry, supplying continuous long term observations, has been contributing to understanding the sea surface height variations. Spatial and temporal variability of the Eastern Mediterranean Sea and Black Sea have been investigated in this work using 10 years data of four satellite altimetry missions; Jason-1, Jason-2 , Topex/Poseidon and Envisat. In order to perform time series analysis, altimetry data points along each pass are clustered in a way that each cluster contains only one observation of a cycle. The method of clustering is referred to a pattern of the altimetry data along the geodetic latitude. Sea Surface Height (SSH) of all data points of the clusters have been projected to the center of the clusters using the geoidal trend which is calculated on the basis of a global gravitational model, namely EGM08. Harmonic analysis has been performed for time series of all clusters and then trends of them have been computed. Also in this step Pope Test has been used for outlier detection. The significance of the calculated trends has been investigated using t-test. For analyzing the spatial variability of the sea level through the seas, Principal Component Analysis (PCA) has been used. Spline interpolation is applied to fill the possible data gaps in time series. PCA is also used for investigating the dominant variability of the sea level. For this purpose the sea level variation signal has been reconstructed by using the first three principal components. Results show that there is a general decreasing but very small tendencies in the most of clusters for all altimetry missions in both seas.
Keywords: satellite altimetry, sea level change, time series, PCA