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Determination of the gravity potential and the height differences between the Eastern Mediterranean Sea and Black Sea using Jason-1, Jason-2, Topex/Poseidon and Envisat satellite altimetry data

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Satellite altimetry data is a valuable source for the determination of the gravity potential and some other gravity related functions over the seas. Given the geodetic latitude, longitude and Sea Surface Height (ellipsoidal height), gravity potential of a point over the sea surface can be computed using a global Earth gravitational model such as EGM08. In this work, the height and gravity potential differences of the Eastern Mediterranean Sea and Black Sea have been investigated by making use of the satellite altimetry data, namely Corrected Sea Surface Heights (CorrSSH). The data used in this study is provided by AVISO (Archiving, Validation and Interpretation of Satellite Oceanographic data) concerning CorrSSH data of all four active altimetry missions, Jason1, Jason2, T/P and Envisat from 2002 to 2012 have been utilized in this work. Although all of the missions revolve in repeat orbit, due to certain deficiencies the footprint of observations do not concentrate on a single ground track at each pass. Because of that all of the observations have to be projected to a nominal ground track and the geoid difference between the actual point and the projected one is used for projecting the SSH values to nominal ground track. To concentrate all the data on a single time epoch, time series analysis has been performed by clustering the altimetry data points. After that, the computed trend from the time series is used for bringing all the data to the same time epoch. Next, the gravity potentials of the projected data points have been computed using the global model EGM08. The common pass numbers in Eastern Mediterranean Sea and Black Sea are used for comparison of the gravity potential and height. In the last step, the height and potential differences between the Black Sea and Eastern Mediterranean Sea have been determined by using the passes that cover the both seas. The differences have been computed in the same distances from the north and south coasts of Turkey at each pass. Results show that the Black sea is higher than the Mediterranean and computed height differences between Eastern Mediterranean and Black Sea vary from 20 to 50 cm which changes spatially from west to east.
Keywords: satellite altimetry, gravity potential difference, height difference