

COMPARISON OF TWO PACKAGES FOR TIDAL ANALYSIS AND PREDICTION: AN EXEMPLAR CASE STUDY OF ABU-QIR BAY, ALEXANDRIA, EGYPT

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Abstract

The sea level at Abu-Qir bay was analysed and predicted with two tidal packages: *t_tide* and World Tides, each of which works under the Matlab environment. The five main tidal constituents, namely: O1, K1, N2, M2 and S2 were constructed for 2008 calendar year. The tidal elevations above the Mean Sea Level (MSL) were predicted for April 2010, and compared to the actual records. The Root Mean Square Error (RMSE) was used to evaluate the accuracy of the estimated data and to justify the preference of using any of the two packages in the area of investigation.

Keywords: Sea level, Surface waters, Tides, Nile Delta, South-Eastern Mediterranean

Abu-Qir Bay is a semi-circular basin lying 35 km east of Alexandria City between latitudes 31° 16' and 31° 28' N and longitudes 30° 03' and 30° 22' E. The present work aims at analysing the sea level in Abu-Qir bay, over the period 2005-2010, by the two different tidal packages namely: *t_tide* [1] and World Tides [2].

The year 2008, having the fully continuous hourly records, is then selected for a full independent analysis using the two packages. The *t_tide* is a package of routines that can be used to perform classical harmonic analysis with nodal corrections, inference, and a variety of user specified options. Moreover, it can be used for predictions using the analyzed constituents. The *t_tide* package is principally based on the concept of the ability of expressing the tidal amplitudes at any location as the sum of all the harmonic components. The World Tides is a package for sea level analysis and prediction, which permits quick separation of a time series of water level measurements into its tidal and non-tidal components using a selective least squares harmonic reduction employing up to 35 tidal constituents. The two software were also used for the sea level prediction above the MSL for April 2010. The Root Mean Square Error (RMSE) was determined in order to conclude any preference of one package over the other in the area of investigation. The hourly sea level data taken directly from the tide gauge in Abu-Qir Bay for the six-year period 2005-2010 consists of 43755 hourly records.

Over the period of investigation, the hourly sea level varied between 0.05 m and 1.0 m, i.e. 0.95 m tidal range, with a MSL of 0.507 m. During 2008, the records varied between 0.20 m and 0.84 m, with a Mean Sea Level (MSL) of 0.527 m. The astronomical elevations varied between 0.34 m and 0.67 m (*t_tide*), and between 0.51 m and 0.54 m (World Tide). The residual elevations varied between -0.34 m and + 0.34 m (*t_tide*), and between -0.32 m and +0.31 m (World Tide). There were large differences between the calculated phases of the five main astronomical constituents, but the amplitudes were almost the same (Table 1).

Tab. 1. Tidal harmonic constituents during 2008.

Tidal Constituents	T_tide Package		World Tides Package	
	Amplitude (m)	Phase (°)	Amplitude (m)	Phase (°)
O1	0.034	237.84	0.034	23.18
K1	0.033	158.87	0.033	358.98
N2	0.008	19.88	0.010	280.97
M2	0.042	47.79	0.040	33.89
S2	0.031	14.31	0.030	35.63

For the predicted elevations (Fig. 1), the RMSE of the predicted elevations in April 2010 using the two packages have shown the same value of 0.09.

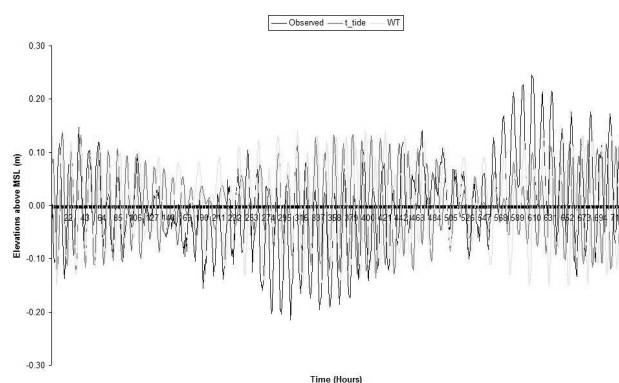


Fig. 1. The predicted water elevations above the MSL for April 2010.

In conclusion, there is no preference in using one of the two applied packages over the other. They both could be applied successfully in Abu-Qir Bay for the purpose of analysis and prediction and can be therefore recommended for any area along the Egyptian Mediterranean coast.

References

- 1 - Pawlowicz R., Beardsley B. and Lentz S., 2002. Classical tidal harmonic analysis including error estimates in MATLAB using T_TIDE", *Comp. Geosci.* 28: 929–937.
- 2 - Boon J., 2004. *Secrets of the Tide: Tide and Tidal Current analysis and Predictions, Storm surges and Sea Level Trends*, Horwood Publishing, Chichester, UK, 210p.