TIDE AND STORM SURGES ON THE EGYPTIAN MEDITERRANEAN COAST

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Over the Egyptian Mediterranean coast, in particular at Alexandria the prevailing wind is mainly from the North-West direction during most of the year. The shear stress exerted by the wind on the water surface is usually the most important factor in the generation of storms in shallow coastal waters, as in the case along Alexandria coast.

The main object of the analysis is to study and calculate the storm surge heights at Alexandria during the years 1964-1969. The harmonic tidal constants from the hourly height of sea level at Alexandria for the period of investigation have been calculated. From the meteorological parameters over the surrounding areas of Alexandria, using the synoptic charts, the storm heights were calculated mainly during the winter season.

The data used in the storm surge analysis are those of the hourly readings of the sea level obtained from the tidal record at Alexandria for the period 1964-1969. The meteorological data are only used at the stormy days, where the wind velocity exeeds 20 knots during the period 1964-1969.

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The method used in our calculation of the harmonic tidal constants is similar to the method developed by A.T. Doodson for 29 days (Moursy 1976). The 29 days were taken for the month of October. The four harmonic constituents calculated with the modified Doodson's method are M_2, S_2, K_1 and O_1.

From the meteorological conditions over any area, there are various approaches to determine or to evaluate the storm surge (Harris 1963, Bretschneider 1958, Reid 1965 and Freeman & al 1957). The equation for the total storm water depth is defined by

$$d = d\ (MLW) + A_s + S_1 + S_2 + S_3$$

where d' (MLW) is mean low water depth. A_s is stronomical tide. The difinition of terms S_1, S_2 and S_3 are the same as defined in the technical report N° 4 (1966). The selected section, taken at Alexandria was along the longitude 30° E.

Using the modified Doodson method, the four harmonic constituents for Alexandria harbour for the years (1965-1968) are given in table (1). The values of the harmonic constituents obtained by this method are very near to the one obtained before from one year analysis.

The time variations of the surge height of some storms occured at Alexandria during the period from November 1967 to March 1968 are represented in Fig.(1). The general remark is that is most of the storms the surge height gradually decreased as the storms died down. The maximum surge height recorded at Alexandria during the period of investigation is 39 cm, calculated from the tidal analysis.

From the synoptic weather charts and using the forecasting techniques for deep waters areas (Bretschneider revised, Serdrup - Munk or S.M.B. method technical report N°4, 1966). The terms S_1, S_2 and S_3 were calculated for different days at Alexandria, from which the surge heights were deduced at these days.

The maximum surge height calculated from meteorological conditions

over the Egyptian Mediterranean coast at Alexandria is 47 cm.

From the investigation of 15 days under the prevailing wind over Alexandria it was shown that the surge height calculated from the tidal analysis usually correlated with the corresponding values of the surge height obtained from the meteorological conditions. FIG.(2).

Table (1) : Harmonic constants for Alexandria Harbour (lat. 31°12'N long. 29°57')

Harmonic Constant.	M_2		S_2		K_1		O_1	
Period	H cm	° degree	H cm	° degree	H cm	° degree	H cm	° degree
OCTOBER								
1965	7.57	332	4.31	307	1.19	297	1.34	220
1966	7.08	330	4.36	312	1.84	354	1.22	286
1967	7.09	329	4.37	309	1.68	373	1.44	371
1968	7.01	310	4.32	306	1.64	244	1.37	324
Mean	7.19	325	4.34	309	1.58	317	1.34	300

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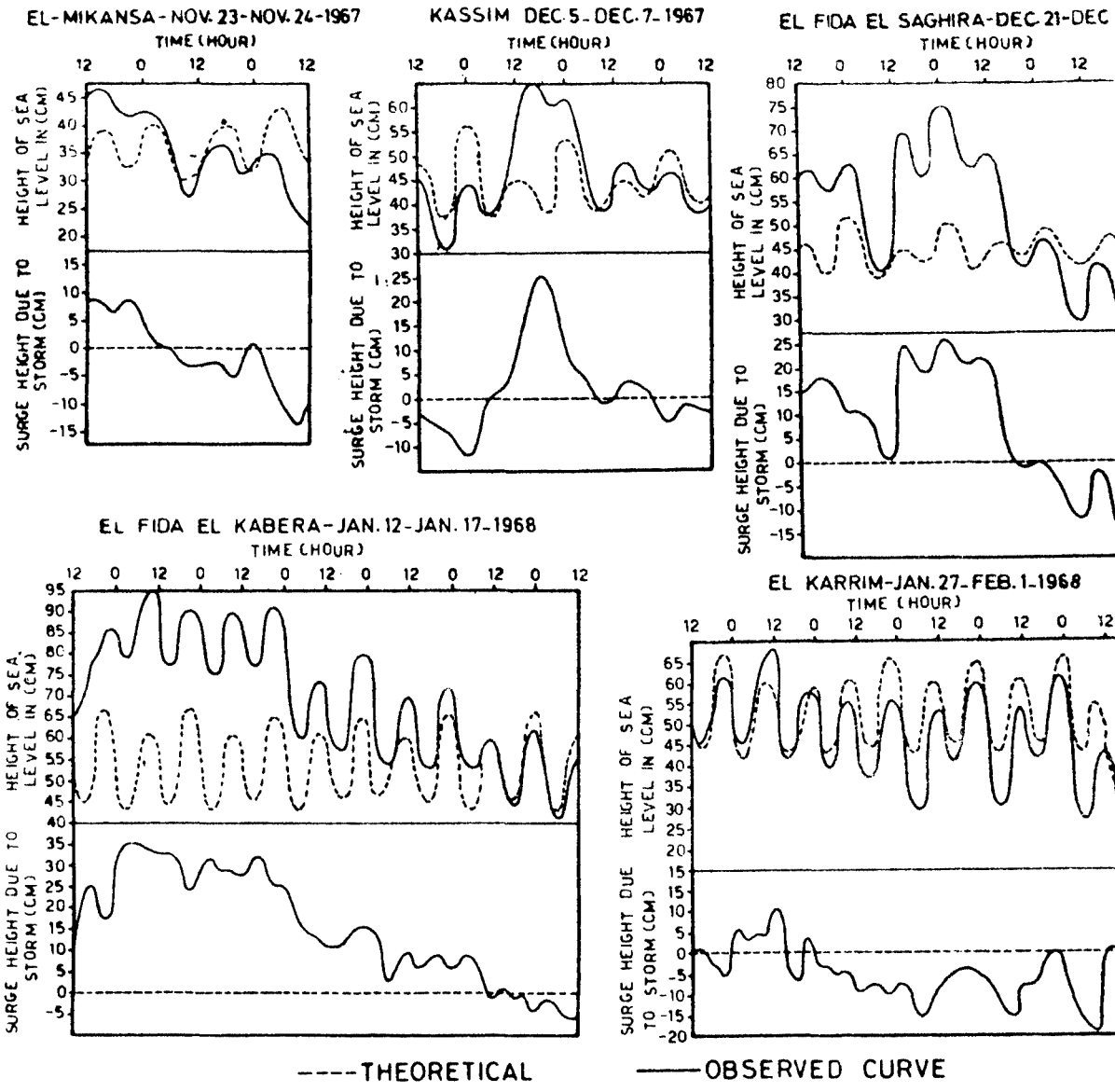

FIG 1 - OBSERVED SEA LEVEL, PREDICTED SEA LEVEL AND STORM SURGE H

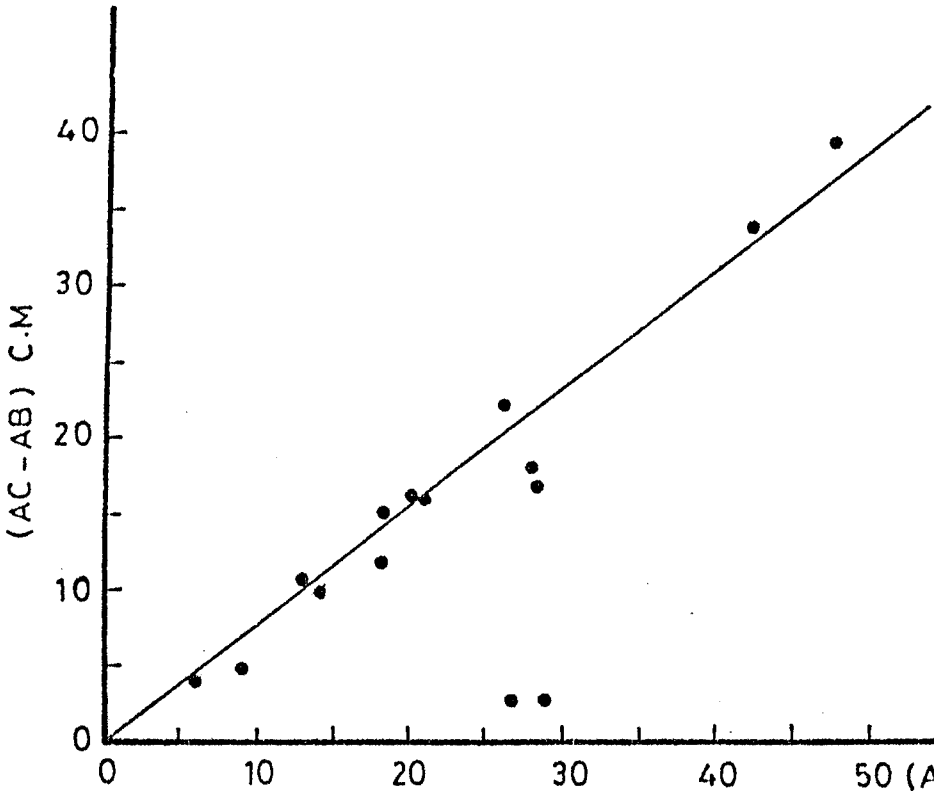

FIG 2 - THE RELATION BETWEEN THE SURGE HE
CALCULATED FROM TIDAL ANALYSIS AND
HEIGHT CALCULATED FROM METEOROLOGI
CONDITION UNDER THE PREVAILING WIND