

## CHAPTER 5

### CONCLUSIONS AND DISCUSSION

The results of fitting simple harmonic models for the heights and its times of occurrence obtained in Chapter 4 are summarized in Table 5.1 and Table 5.2. Table 5.1 presents the coefficients for each harmonic of the models fitted to the heights at each of the four locations in 1994. Table 5.2 gives a similar table for the times of occurrence at each of the four locations. Tables 5.3 and 5.4 show the results of models fitted for the heights and times of occurrence at Pattani and Songkhla in 1996 obtained from Kumpai (1997).

#### Harmonic components of tide heights

Table 5.1 Coefficients in fitted models for tide height(dm)

Location	Tide type	Frequency (cycles/year)											r-sq	
		1	2	11	12	13	14	24	25	26	37	38		39
Laem Ta Chi	Low - 1	1.94	0.43	0.36	-	0.89	0.12	0.22	-	0.10	-	-	-	0.982
	High - 1	1.97	0.56	0.45	-	1.32	0.21	0.19	-	0.23	-	-	-	0.981
	Low - 2	1.97	0.51	0.44	-	1.03	0.13	0.23	-	0.14	-	-	-	0.983
	High - 2	1.91	0.49	0.46	-	1.78	0.20	0.22	-	0.18	-	-	-	0.984
Ko Nu	Low - 1	-	-	-	-	0.96	0.14	0.20	0.27	0.25	-	-	-	0.889
	High - 1	-	-	-	-	0.64	-	0.41	-	0.09	0.16	-	-	0.882
	Low - 2	-	-	-	-	1.82	-	0.72	0.2	0.11	-	-	-	0.954
	High - 2	-	-	-	-	0.96	-	0.35	-	-	-	-	-	0.883
Bang Nara	Low - 1	-	-	0.30	-	0.65	-	0.37	0.18	0.70	0.24	-	-	0.881
	High - 1	-	-	0.48	0.12	2.05	0.22	0.71	-	0.31	-	-	-	0.945
	Low - 2	-	-	0.40	-	1.32	-	0.44	-	0.45	0.24	-	-	0.911
	High - 2	-	-	0.25	0.28	2.87	0.42	0.71	-	0.29	-	-	-	0.953
Pak Phun	Low - 1	-	-	-	-	0.54	0.37	0.90	0.29	0.58	-	-	0.56	0.810
	High - 1	-	-	-	-	0.67	-	0.81	0.39	1.02	-	-	-	0.800
	Low - 2	-	-	-	-	1.69	-	1.32	0.77	2.14	-	-	1.01	0.945
	High - 2	0.37	-	0.32	-	2.90	0.48	0.81	-	-	0.39	-	0.56	0.960

Note that table 5.1 shows the harmonic components that were fitted in the model at four locations. Laem Ta Chi is different from the others, and the effect from the 1<sup>st</sup> harmonic gives the high coefficients of 1.94, 1.97, 1.97 and 1.91 in each tide type, and this effect does not occur in the other locations. However, model fitting gives high r-squareds (especially for Laem Ta Chi), indicating that the data are fitted very well with the signal.

### Harmonic components of times of occurrence

Table 5.2 Coefficients in fitted models for times of occurrence of tide

Location	Tide type	Frequency (cycles/year)											r-sq	
		1	2	11	12	13	14	24	25	26	37	38		39
Laem Ta Chi	Low - 1	-	-	0.26	-	0.56	-	0.14	-	-	-	-	-	0.761
	High - 1	-	-	0.20	-	0.89	-	-	-	-	-	-	0.873	
	Low - 2	-	-	0.13	-	1.09	-	0.13	-	-	-	-	0.916	
	High - 2	-	-	0.20	-	-	-	0.12	-	0.09	-	-	0.348	
Ko Nu	Low - 1	-	-	0.32	-	0.57	-	0.63	0.23	0.24	0.31	-	0.779	
	High - 1	-	-	0.47	-	0.76	-	0.92	-	-	0.31	-	0.665	
	Low - 2	-	-	0.30	-	0.73	-	0.68	0.26	-	0.24	-	0.649	
	High - 2	-	-	-	-	0.42	-	0.77	0.25	-	-	-	0.746	
Bang Nara	Low - 1	-	-	0.39	-	1.54	-	1.26	0.38	-	0.48	0.20	0.782	
	High - 1	-	-	0.11	-	0.86	-	0.98	-	0.41	0.41	-	0.812	
	Low - 2	-	-	0.32	-	2.83	-	0.76	0.15	-	0.58	-	0.911	
	High - 2	-	-	0.29	-	0.92	-	0.99	0.33	-	0.30	-	0.753	
Pak Phun	Low - 1	-	-	-	-	3.03	0.41	1.21	0.26	0.56	-	-	0.38	0.783
	High - 1	-	-	-	-	1.01	-	1.54	0.50	0.85	-	-	0.717	
	Low - 2	-	-	-	-	0.63	-	0.50	0.25	0.47	-	-	0.30	0.830
	High - 2	0.18	-	0.82	-	1.20	-	0.92	-	-	-	0.28	0.56	0.706

Note that Table 5.2 shows the major harmonic components used to fit the times of occurrence. The models are based on harmonic 11, 13, 24, 25 and 37, with r-squareds not quite as high as the model-fitting to the heights. Especially, for the tide type high-2 at Laem Ta Chi, the signal does not fit the data well because of the influence of the noise, and the r-squared is 0.348.

### Comparison of models in year 1994 and year 1996

Table 5.3 Coefficients in fitted models for tide height(dm) at Pattani and Songkhla in 1996 (Khumpai, 1997 : 47)

Location	Tide type	Frequency (cycles/year)											r-sq	
		1	2	11	12	13	14	24	25	26	37	38		39
Pattani	Low - 1	1.90	0.57	0.23	-	0.83	0.59	-	0.58	-	-	-	-	0.942
	High - 1	2.04	0.49	0.27	-	0.60	0.32	-	0.65	-	-	-	-	0.962
	Low - 2	1.84	0.54	0.16	-	0.48	0.48	-	0.64	-	-	-	-	0.934
	High - 2	2.10	0.51	0.24	-	0.47	0.28	-	0.51	-	-	-	-	0.960
Songkhla	Low - 1	2.30	0.52	0.35	-	1.01	0.91	-	0.45	-	-	-	-	0.940
	High - 1	2.18	0.48	0.11	-	0.37	0.15	-	0.94	-	-	-	-	0.970
	Low - 2	2.20	0.52	0.39	-	0.83	0.58	-	0.49	-	-	-	-	0.941
	High - 2	2.21	0.50	0.13	-	0.51	0.31	-	0.69	-	-	-	-	0.951

These results look the same for the major harmonic components for the tide heights in the years 1994 and 1996 at Pattani (see Table 5.1 and Table 5.3) but are different at Songkhla.

Table 5.4 Coefficients in fitted models for times of occurrence of tide at Pattani and Songkhla in 1996 (Khumpai, 1997 : 46)

Location	Tide type	Frequency (cycles/year)											r-sq	
		1	2	11	12	13	14	24	25	26	37	38		39
Pattani	Low - 1	-	-	-	0.37	0.45	-	0.18	0.80	0.27	-	-	-	0.583
	High - 1	-	-	-	0.21	0.34	-	0.16	0.81	0.25	-	-	-	0.602
	Low - 2	-	-	-	0.11	0.59	-	0.20	0.66	0.28	-	-	-	0.714
	High - 2	-	-	-	0.12	0.89	-	0.17	0.71	0.28	-	-	-	0.662
Songkhla	Low - 1	-	-	-	0.24	0.33	-	0.11	0.82	0.14	-	-	-	0.592
	High - 1	-	-	-	0.08	0.55	-	0.08	0.49	0.05	-	-	-	0.686
	Low - 2	-	-	-	0.12	0.56	-	0.16	0.62	0.16	-	-	-	0.713
	High - 2	-	-	0.36	0.10	0.58	0.28	0.11	0.41	0.09	-	-	-	0.773

For the times of occurrence, there are differences in the major harmonic components in the years 1994 and 1996 at Pattani and Songkhla (see Table 5.2 and Table 5.4).

Table 5.5 shows the main harmonic components used to fit the models for the heights of tides and their times of occurrence.

Table 5.5 Basis of harmonic components for model fitting

Frequency	Cause
1, 2	Annual effect (monsoon)
11, 13	Lunar rotational effect
24, 25, 26	Lunar effect (elliptical orbit)
37, 39 and other	other effects (e.g., coastal basin, currents, winds)

### Discussion and limitations

Graphical display is the best method to describe characteristics of the data. The characteristics are thus better understood, and analysis is made easier (modelling and forecasting). In this study, the results are the new method for graphing tides and the simple harmonic model fitting. This model can be used to forecast the water heights at any locations. The information obtained from this model would be a useful information for local fisheries, coastal aquaculture, channel dredging, navigation and port management, mangrove rehabilitation, salt water intrusion prevention and others that require understanding of the tidal characteristics.

However, the reconstruction of water height is limited by the fact that each point is joined with a straight line, which does not fit as well as joining with sine or cosine curves.

The data contained in this study were taken from tide tables, which is predicted data. So the accuracy of the results depends on the method of prediction of the tide table.

For further research, (a) one should get direct observation data to test the model and compare the results, (b) test this method with other tidal characteristics, (pure diurnal tides), and (c) get more locations and more duration of tide data to improve the fitting of the harmonic components.