

APPENDIX

A. Raw data***Direct observation data***

Direct observation data at 15 minutes intervals. The data thus comprise three columns: (1) water level (cm); (2) time and (3) study period (1 = May 25, 2 = June 1).

This data shown as follow.

45.17	9:00	1	43.41	18:00	1	55.01	3:00	1
45.17	9:15	1	41.87	18:15	1	55.67	3:15	1
46.51	9:30	1	39.14	18:30	1	55.24	3:30	1
46.74	9:45	1	35.07	18:45	1	58.37	3:45	1
46.34	10:00	1	32.97	19:00	1	58.57	4:00	1
46.21	10:15	1	31.97	19:15	1	58.24	4:15	1
47.04	13:30	1	30.47	19:30	1	59.04	4:30	1
47.37	10:45	1	29.61	19:45	1	58.54	4:45	1
49.44	11:00	1	27.91	20:00	1	58.87	5:00	1
50.24	11:15	1	26.21	20:15	1	58.54	5:15	1
51.81	11:30	1	24.54	20:30	1	59.54	5:30	1
52.24	11:45	1	24.31	20:45	1	59.31	5:45	1
52.07	12:00	1	24.34	21:00	1	59.47	6:00	1
55.54	12:15	1	25.64	21:15	1	59.24	6:15	1
56.54	12:30	1	24.94	21:30	1	59.74	6:30	1
58.47	12:45	1	25.94	21:45	1	61.04	6:45	1
59.64	13:00	1	26.04	22:00	1	58.94	7:00	1
59.87	13:15	1	26.97	22:15	1	59.67	7:15	1
61.91	13:30	1	26.71	22:30	1	57.61	7:30	1
62.61	13:45	1	28.11	22:45	1	57.21	7:45	1
62.37	14:00	1	28.07	23:00	1	57.81	8:00	1
63.24	14:15	1	30.91	23:15	1	54.61	8:15	1
62.94	14:30	1	31.97	23:30	1	55.24	8:30	1
61.67	14:45	1	33.74	23:45	1	54.71	8:45	1
60.47	15:00	1	35.17	0:00:0	1	52.94	9:00	1
59.17	15:15	1	35.21	0:15	1	53.14	9:15	1
58.94	15:30	1	36.34	0:30	1	50.04	9:30	1
57.97	15:45	1	39.01	0:45	1	49.11	9:45	1
54.71	16:00	1	40.41	1:00	1	46.67	10:00	1
53.74	16:15	1	41.14	1:15	1	85.01	9:00	2
53.77	16:30	1	43.74	1:30	1	84.51	9:15	2
51.47	16:45	1	46.14	1:45	1	85.14	9:30	2
49.04	17:00	1	49.34	2:00	1	84.77	9:45	2
47.11	17:15	1	52.61	2:15	1	82.87	10:00	2
44.64	17:30	1	54.01	2:30	1	81.34	10:15	2
43.07	17:45	1	53.84	2:45	1	78.81	13:30	2

75.01	10:45	2	46.41	18:45	2	34.57	2:45	2
72.44	11:00	2	49.74	19:00	2	36.27	3:00	2
68.57	11:15	2	52.14	19:15	2	36.57	3:15	2
64.54	11:30	2	55.97	19:30	2	38.04	3:30	2
60.77	11:45	2	60.11	19:45	2	39.87	3:45	2
57.21	12:00	2	63.47	20:00	2	42.24	4:00	2
53.44	12:15	2	66.94	20:15	2	45.34	4:15	2
49.07	12:30	2	67.74	20:30	2	45.34	4:30	2
45.81	12:45	2	70.01	20:45	2	45.67	4:45	2
42.41	13:00	2	72.44	21:00	2	48.47	5:00	2
39.54	13:15	2	75.14	21:15	2	49.47	5:15	2
37.11	13:30	2	76.04	21:30	2	51.41	5:30	2
34.34	13:45	2	76.47	21:45	2	52.34	5:45	2
29.54	14:00	2	74.27	22:00	2	53.14	6:00	2
26.54	14:15	2	71.51	22:15	2	55.54	6:15	2
24.21	14:30	2	68.97	22:30	2	56.41	6:30	2
21.34	14:45	2	66.04	22:45	2	58.77	6:45	2
19.51	15:00	2	63.44	23:00	2	60.41	7:00	2
18.87	15:15	2	60.17	23:15	2	62.11	7:15	2
18.37	15:30	2	55.67	23:30	2	64.54	7:30	2
17.54	15:45	2	50.51	23:45	2	65.77	7:45	2
17.71	16:00	2	45.27	00:00:0	2	69.17	8:00	2
18.27	16:15	2	42.27	0:15	2	72.27	8:15	2
19.27	16:30	2	41.64	0:30	2	75.11	8:30	2
20.84	16:45	2	39.44	0:45	2	77.91	8:45	2
23.24	17:00	2	37.17	1:00	2	80.67	9:00	2
25.91	17:15	2	35.64	1:15	2	83.07	9:15	2
28.21	17:30	2	34.77	1:30	2	86.61	9:30	2
31.94	17:45	2	33.54	1:45	2	87.54	9:45	2
37.11	18:00	2	33.97	2:00	2	88.74	10:00	2
40.37	18:15	2	35.11	2:15	2			
42.94	18:30	2	34.41	2:30	2			

Tide table data

The tide table produced by the Hydrographic Department, Royal Thai Navy. Data from the tide table are obtained by predictions of the times and heights of high and low waters at various station using harmonic method. Figure 7 and 8 show the data from the tide table at Pattani and Songkhla.

Table 7: Tide tables data at Pattani

Pak Nam Pattani (Pattani)																	
January					February					March							
Date	time	HT	Date	time	HT	Date	time	HT	Date	time	HT	Date	time	HT			
1	5:34	0.95	16	4:23	0.92	1	1:50	0.67	16	1:15	0.58	1	1:24	0.6	16	1:07	0.51
MO	11:05	0.84	TU	10:31	0.73	TH	8:31	0.90	FR	7:05	0.89	FR	8:35	0.85	SA	7:58	0.85
	18:25	1.09		17:38	1.03		12:53	0.79		12:38	0.71		12:54	0.74		12:58	0.7
							20:02	1.02		19:36	1.02		19:25	0.92		19:02	0.94
2	1:10	0.78	17	0:07	0.69	2	2:45	0.63	17	2:20	0.54	2	2:23	0.56	17	2:07	0.49
TU	6:43	0.95	WE	6:05	0.94	FR	8:57	0.93	SA	8:12	0.94	SA	8:59	0.88	SU	8:35	0.9
	12:14	0.84		11:49	0.73		13:36	0.77		13:23	0.70		13:36	0.7		13:40	0.67
	19:23	1.10		18:45	1.06		20:51	1.04		20:30	1.06		20:17	0.94		20:01	0.97
3	2:08	0.72	18	1:22	0.64	3	3:28	0.59	18	3:10	0.51	3	3:04	0.52	18	2:53	0.47
WE	7:48	0.97	TH	7:08	0.98	SA	9:20	0.95	SU	9:00	0.98	SU	9:11	0.9	MO	8:59	0.95
	13:06	0.83		12:46	0.73		14:06	0.74		14:03	0.68		14:04	0.67		14:12	0.64
	20:20	1.11		19:54	1.10		21:27	1.06		21:17	1.10		20:53	0.96		20:44	0.99
4	2:58	0.68	19	2:25	0.59	4	4:04	0.56	19	3:50	0.49	4	3:30	0.5	19	3:27	0.46
TH	8:38	1.00	FR	8:07	1.02	SU	9:39	0.97	MO	9:38	1.02	MO	9:23	0.91	TU	9:26	1
	13:43	0.82		13:30	0.72		14:35	0.71		14:43	0.66		14:30	0.64		14:49	0.6
	21:08	1.12		20:54	1.14		21:57	1.07		21:53	1.13		21:23	0.97		21:23	1.02
5	3:41	0.64	20	3:19	0.56	5	4:25	0.55	20	4:21	0.48	5	3:13	0.48	20	3:50	0.46
FR	9:16	1.02	SA	8:59	1.05	MO	10:03	0.98	TU	10:17	1.05	TU	9:43	0.93	WE	10:00	1.03
	14:14	0.80		14:08	0.71		15:05	0.69		15:27	0.64		15:00	0.61		15:33	0.57
	21:47	1.13		21:41	1.18		22:23	1.06		22:29	1.14		21:51	0.98		22:00	1.02
6	4:17	0.62	21	4:02	0.53	6	4:01	0.53	21	4:51	0.48	6	3:30	0.46	21	4:06	0.47
SA	9:47	1.03	SU	9:45	1.07	TU	10:28	0.99	WE	10:57	1.07	WE	10:09	0.95	TH	10:37	1.05
	14:44	0.77		14:49	0.71		15:38	0.67		16:16	0.63		15:33	0.59		16:23	0.54
	22:20	1.14		22:20	1.21		22:48	1.08		23:06	1.13		22:16	0.98		22:38	1.01
7	4:38	0.61	22	4:38	0.52	7	4:25	0.52	22	5:22	0.50	7	3:56	0.45	22	4:28	0.48
SU	10:15	1.04	MO	10:30	1.09	WE	10:57	1.00	TH	11:38	1.07	TH	10:38	0.97	FR	11:14	1.04
	15:18	0.76		15:32	0.71		16:13	0.66		17:12	0.63		16:08	0.56		17:28	0.52
	22:49	1.15		22:57	1.23		23:11	1.07		23:40	1.09		22:40	0.98		23:13	0.97
8	4:23	0.59	23	5:17	0.53	8	4:56	0.51	23	5:48	0.53	8	4:25	0.44	23	4:56	0.52
MO	10:45	1.04	TU	11:15	1.10	TH	11:28	1.00	FR	12:20	1.05	FR	11:08	0.98	SA	11:52	1.01
	15:53	0.75		16:20	0.72		16:56	0.65		18:35	0.63		16:53	0.54		18:27	0.54
	23:17	1.14		23:35	1.22		23:35	1.05					23:08	0.97		23:50	0.92
9	4:52	0.58	24	5:59	0.54	9	5:31	0.52	24	6:15	1.03	9	5:01	0.46	24	5:30	0.56
TU	11:18	1.03	WE	12:02	1.09	FR	12:04	1.00	SA	6:13	0.58	SA	11:44	0.98	SU	12:28	0.98
	16:29	0.75		17:14	0.74		17:49	0.65		12:59	1.01		17:48	0.52		19:14	0.51
	23:44	1.13		0:11	1.18					19:35	0.62		23:44	0.95		0:28	0.86
10	5:25	0.59	25	6:43	0.57	10	6:06	1.03	25	6:49	0.95	10	5:42	0.49	25	6:10	0.6
WE	11:53	1.02	TH	12:51	1.08	SA	6:09	0.54	SU	6:44	0.63	SU	12:27	0.97	MO	13:08	0.94
	17:11	0.76		18:23	0.75		12:46	0.99		13:36	0.98		19:20	0.51		19:58	0.51
							18:51	0.65		20:23	0.63						
11	6:09	1.10	26	6:45	1.12	11	6:42	0.99	26	7:28	0.88	11	6:28	0.91	26	6:14	0.79
TH	12:31	1.01	FR	7:20	0.62	SU	6:52	0.57	MO	7:23	0.68	MO	6:25	0.53	TU	6:54	0.65
	18:00	0.77		13:44	1.05		13:35	0.90		14:24	0.94		13:17	0.95		13:53	0.9
				19:53	0.76		20:25	0.64		21:09	0.63		20:22	0.51		20:45	0.52
12	6:35	1.07	27	7:17	1.05	12	7:29	0.93	27	8:19	0.81	12	7:20	0.86	27	7:21	0.74
FR	13:15	1.00	SA	7:38	0.68	MO	7:35	0.62	TU	8:08	0.73	TU	7:10	0.59	WE	7:57	0.7
	18:57	0.78		14:58	1.03		14:30	0.97		16:00	0.92		14:12	0.93		14:53	0.86
				20:46	0.76		21:29	0.63		22:03	0.63		21:17	0.51		21:38	0.56
13	7:06	1.03	28	7:52	0.97	13	7:29	0.88	28	8:08	0.79	13	7:25	0.8	28	6:58	0.77
SA	13:18	0.65	SU	8:00	0.73	TU	8:23	0.66	WE	10:02	0.76	WE	7:58	0.65	TH	9:56	0.73
	14:05	0.99		16:03	1.01		15:38	0.96		17:09	0.91		15:23	0.92		16:23	0.84
	20:20	0.78		21:36	0.75		22:32	0.63		23:13	0.63		22:19	0.53		22:38	0.54
14	7:49	0.99	29	8:38	0.90	14	8:02	0.85	29	8:50	0.82	14	8:40	0.79	29	7:47	0.8
SU	13:01	0.68	MO	8:39	0.78	WE	9:32	0.71	TH	11:36	0.76	TH	9:02	0.7	FR	12:15	0.72
	15:02	1.00		16:56	1.00		17:12	0.97		18:15	0.91		16:49	0.91		17:30	0.83
	21:50	0.76		22:37	0.74		23:50	0.62					23:42	0.53			
15	7:51	0.95	30	8:47	0.86	15	8:53	0.86				15	8:56	0.81	30	8:10	0.53
MO	13:52	0.71	TU	10:22	0.81	TH	11:32	0.72				FR	11:34	0.71	SA	8:22	0.82
	16:16	1.01		17:52	1.00		18:23	0.99					17:55	0.92		13:10	0.69
	22:54	0.73														18:33	0.82
			31	9:23	0.72										31	1:30	0.51
			WE	7:53	0.87										SU	8:42	0.84
				11:48	0.81											13:44	0.66
				18:56	1.01											19:27	0.83

Source: Hydrographic Department Royal Thai Navy, 1996: 125.

Table 7 (continue)

Pak Nam Pattani (Pattani)														
year 1996														
July			August			September			September			September		
Date	time	HT	Date	time	HT	Date	time	HT	Date	time	HT	Date	time	HT
1	2:13	0.34	16	2:46	0.38	1	3:17	0.32	16	3:39	0.34	1	4:57	0.33
MO	9:49	0.78	TU	10:21	0.74	TH	10:47	0.80	FR	10:47	0.71	SU	11:29	0.81
	16:10	0.23		17:02	0.25		17:27	0.18		17:44	0.24	MO	16:45	0.33
	21:38	0.57		22:18	0.61		23:03	0.67		22:57	0.62		23:30	0.70
2	2:47	0.34	17	3:15	0.36	2	4:03	0.33	17	4:13	0.33	2	0:08	0.77
TU	10:32	0.81	WE	10:50	0.74	FR	11:24	0.81	SA	11:11	0.69	MO	0:19	0.34
	17:01	0.21		17:39	0.24		18:11	0.18		16:56	0.24	TU	12:08	0.76
	22:26	0.57		22:47	0.61		23:50	0.68		23:26	0.62		18:55	0.33
3	3:25	0.35	18	3:40	0.36	3	4:56	0.34	18	4:50	0.33	3	0:50	0.75
WE	11:12	0.82	TH	11:18	0.73	SA	12:04	0.79	SU	11:36	0.68	TU	7:22	0.34
	17:49	0.21		18:11	0.24		18:57	0.20		17:27	0.25	WE	12:46	0.70
	23:17	0.67		23:19	0.60					23:57	0.61		19:27	0.38
4	4:10	0.38	19	4:26	0.36	4	0:40	0.67	19	5:34	0.33	4	1:31	0.71
TH	11:53	0.83	FR	11:47	0.71	SU	6:08	0.38	MO	12:01	0.65	WE	8:10	0.35
	18:37	0.21		18:41	0.25		12:44	0.75		18:04	0.27	TH	13:28	0.64
				23:53	0.58		19:42	0.24					19:50	0.43
5	0:10	0.66	20	5:06	0.38	5	1:39	0.65	20	0:32	0.61	5	2:15	0.68
FR	5:02	0.41	SA	12:16	0.68	MO	7:49	0.36	TU	6:29	0.33	TH	8:57	0.36
	12:36	0.82		19:09	0.26		13:23	0.68		12:34	0.62	FR	14:28	0.59
	19:25	0.23					20:23	0.30		18:43	0.29		20:40	0.48
6	1:13	0.65	21	0:29	0.56	6	2:54	0.63	21	1:13	0.60	6	3:50	0.68
SA	6:04	0.44	SU	5:51	0.39	TU	8:43	0.37	WE	8:18	0.33	FR	9:40	0.37
	13:21	0.78		12:44	0.64		14:01	0.62		13:18	0.59	SA	18:23	0.58
	20:15	0.26		19:30	0.28		20:58	0.35		19:27	0.32		21:51	0.51
7	2:30	0.65	22	1:08	0.54	7	3:58	0.62	22	2:04	0.59	7	4:56	0.68
SU	8:13	0.46	MO	6:45	0.40	WE	9:33	0.37	TH	9:13	0.32	SA	10:53	0.38
	14:07	0.73		13:13	0.60		14:56	0.56		14:15	0.56	SU	19:26	0.60
	21:06	0.30		19:36	0.30		21:30	0.40		20:14	0.38			
8	3:39	0.65	23	1:51	0.53	8	4:55	0.62	23	3:08	0.59	8	0:12	0.52
MO	9:17	0.45	TU	8:56	0.40	TH	10:29	0.37	FR	10:11	0.32	SU	6:05	0.66
	14:59	0.67		13:50	0.56		17:02	0.53		15:37	0.53	MO	12:48	0.37
	21:57	0.35		20:14	0.32		22:23	0.43		21:45	0.39		20:12	0.64
9	4:42	0.66	24	2:43	0.53	9	5:54	0.62	24	4:55	0.60	9	1:17	0.50
TU	10:24	0.45	WE	9:45	0.38	FR	12:05	0.36	SA	11:18	0.31	MO	7:21	0.68
	16:11	0.62		14:41	0.53		19:21	0.53		17:24	0.54	TU	13:54	0.35
	23:12	0.40		21:22	0.34					23:14	0.41		20:47	0.66
10	5:43	0.66	25	4:29	0.54	10	0:23	0.44	25	6:07	0.63	10	2:07	0.47
WE	11:46	0.43	TH	10:40	0.36	SA	7:05	0.63	SU	12:37	0.30	TU	8:11	0.71
	17:14	0.58		16:01	0.52		13:22	0.33		10:30	0.57	WE	14:46	0.33
				22:33	0.35		20:18	0.55					21:10	0.69
11	0:10	0.43	26	5:38	0.57	11	1:19	0.42	26	0:28	0.41	11	2:52	0.44
TH	6:41	0.67	FR	11:43	0.33	SU	8:01	0.65	MO	7:18	0.67	WE	8:49	0.73
	12:48	0.40		17:40	0.53		14:23	0.30		13:48	0.27	TH	15:27	0.32
	18:15	0.57		23:40	0.35		20:55	0.58		19:38	0.61		21:25	0.70
12	0:53	0.44	27	6:41	0.61	12	2:05	0.40	27	1:21	0.40	12	3:28	0.42
FR	7:34	0.68	SA	12:53	0.29	MO	8:46	0.68	TU	8:21	0.72	TH	9:19	0.74
	13:47	0.36		18:43	0.55		15:16	0.26		14:46	0.24	FR	16:00	0.32
	19:21	0.57					21:24	0.80		20:42	0.65		21:42	0.72
13	1:28	0.43	28	0:40	0.34	13	2:40	0.38	28	1:59	0.38	13	3:22	0.40
SA	8:23	0.70	SU	7:48	0.65	TU	9:23	0.70	WE	9:04	0.77	FR	9:45	0.75
	14:42	0.32		14:01	0.25		16:02	0.24		15:35	0.23	SA	15:22	0.32
	20:27	0.58		19:44	0.58		21:48	0.61		21:25	0.69		22:05	0.73
14	2:00	0.41	29	1:26	0.33	14	2:50	0.36	29	2:35	0.36	14	3:39	0.38
SU	9:07	0.72	MO	8:48	0.70	WE	9:55	0.71	TH	9:38	0.81	SA	10:10	0.75
	15:33	0.29		15:02	0.22		16:42	0.23		16:15	0.22	SU	15:44	0.32
	21:14	0.60		20:43	0.61		22:08	0.62		22:04	0.73		22:32	0.75
15	2:23	0.40	30	2:02	0.32	15	3:10	0.35	30	3:16	0.35	15	4:08	0.36
MO	9:46	0.73	TU	9:34	0.75	TH	10:22	0.72	FR	10:13	0.83	SU	10:35	0.75
	16:20	0.26		15:56	0.19		17:17	0.23		16:52	0.23	MO	16:12	0.32
	21:49	0.61		21:33	0.63		22:30	0.62		22:43	0.76		23:00	0.78
			31	2:38	0.32				31	4:02	0.34			
			WE	10:11	0.78				SA	10:51	0.83			
				16:43	0.18					17:31	0.25			
				22:18	0.65					23:25	0.78			

Source: Hydrographic Department Royal Thai Navy, 1996: 127.

Table 8: Tide tables data at Songkhla

Ko Nu (Songkhla)												year 1996		
January			February			February			March					
Date	time	HT	Date	time	HT	Date	time	HT	Date	time	HT	Date	time	HT
1	6:19	1.49	16	10:45	1.29	1	1:06	1.11	16	0:36	1.05	1	0:22	1.07
MO	11:57	1.34	TU	17:53	1.54	TH	8:13	1.46	FR	7:17	1.51	FR	8:03	1.4
	18:49	1.58		23:54	1.17		13:09	1.33		12:36	1.29		13:00	1.25
							20:18	1.43		20:04	1.49		19:50	1.39
													19:33	1.43
2	0:53	1.17	17	6:24	1.53	2	1:56	1.08	17	1:38	1	2	1:17	1.04
TU	7:31	1.51	WE	11:52	1.32	FR	8:46	1.5	SA	8:09	1.57	SA	8:32	1.43
	12:53	1.37		19:10	1.54		14:00	1.31		13:31	1.27		13:58	1.23
	19:45	1.57					21:01	1.52		20:53	1.55		20:34	1.43
													20:24	1.48
3	1:45	1.13	18	0:57	1.12	3	2:38	1.05	18	2:34	0.95	3	2:04	1.01
WE	8:14	1.54	TH	7:24	1.59	SA	9:15	1.53	SU	8:55	1.62	SU	8:57	1.46
	13:39	1.37		12:49	1.33		14:57	1.3		14:26	1.25		14:42	1.21
	20:35	1.58		20:20	1.57		21:38	1.55		21:34	1.61		21:08	1.47
													21:06	1.54
4	2:27	1.11	19	1:53	1.06	4	3:15	1.03	19	3:23	0.91	4	2:45	0.98
TH	8:50	1.57	FR	8:18	1.64	SU	9:38	1.55	MO	9:38	1.66	MO	9:15	1.40
	14:21	1.37		13:37	1.33		15:47	1.28		15:25	1.21		15:22	1.19
	21:19	1.6		21:12	1.62		22:09	1.59		22:10	1.66		21:34	1.5
													21:43	1.58
5	3:03	1.09	20	2:45	1.01	5	3:50	1.01	20	4:09	0.9	5	3:23	0.96
FR	9:21	1.6	SA	9:05	1.69	MO	9:58	1.58	TU	10:20	4.68	TU	9:34	1.52
	15:06	1.37		14:22	1.33		16:27	1.27		15:23	1.17		15:59	1.16
	21:57	1.62		21:56	1.67		22:35	1.61		22:45	1.68		21:58	1.54
													22:19	1.6
6	3:35	1.07	21	3:33	0.97	6	4:23	0.99	21	4:53	0.91	6	3:58	0.95
SA	9:48	1.62	SU	9:50	1.72	TU	10:23	1.6	WE	11:02	1.68	WE	10:03	1.56
	15:55	1.36		15:14	1.31		17:03	1.25		17:16	1.12		10:34	1.13
	22:32	1.65		22:35	1.71		22:58	1.63		23:20	1.68		22:25	1.57
													22:55	1.59
7	4:06	1.06	22	4:20	0.95	7	4:55	0.99	22	5:36	0.94	7	4:33	0.95
SU	10:11	1.64	MO	10:33	1.74	WE	10:55	1.62	TH	11:45	1.66	TH	10:38	1.58
	16:41	1.35		16:19	1.3		17:36	1.23		18:05	1.09		17:08	1.1
	23:01	1.66		23:11	1.74		23:23	1.64		23:54	1.65		22:55	1.59
													23:31	1.56
8	4:37	1.05	23	5:05	0.95	8	5:27	1	23	6:18	1	8	5:08	0.96
MO	10:38	1.66	TU	11:17	1.74	TH	11:32	1.63	FR	12:31	1.62	FR	11:18	1.59
	17:23	1.36		17:23	1.27		18:08	1.21		18:53	1.06		17:41	1.06
	23:28	1.67		23:45	1.74		23:52	1.63					23:27	1.59
													18:29	0.94
9	5:08	1.05	24	5:49	0.98	9	6:01	1.01	24	0:30	1.59	9	5:45	0.98
TU	11:09	1.66	WE	12:02	1.71	FR	12:11	1.62	SA	7:00	1.06	SA	12:00	1.58
	18:00	1.34		18:20	1.24		18:42	1.18		13:19	1.56		18:20	1.03
	23:53	1.67								19:40	1.05		19:11	0.95
													19:11	0.95
10	5:39	1.06	25	0:20	1.71	10	0:23	1.6	25	1:08	1.51	10	0:03	1.57
WE	11:45	1.66	TH	6:34	1.02	SA	6:39	1.05	SU	7:46	1.13	SU	6:23	1.02
	18:36	1.33		12:50	1.67		12:53	1.6		14:12	1.51		12:44	1.55
				19:14	1.21		19:23	1.15		20:30	1.06		19:02	1.01
													19:54	0.97
11	0:20	1.65	26	0:55	1.65	11	0:57	1.56	26	1:54	1.43	11	0:41	1.53
TH	6:15	1.08	FR	7:20	1.09	SU	7:21	1.1	MO	8:41	1.2	MO	7:07	1.08
	12:23	1.65		13:44	1.62		13:40	1.56		15:10	1.45		13:32	1.51
	19:12	1.31		20:08	1.19		20:10	1.14		21:23	1.07		19:50	1.01
													20:41	0.99
12	0:49	1.61	27	1:37	1.58	12	1:40	1.51	27	3:15	1.36	12	1:27	1.47
FR	6:55	1.11	SA	8:09	1.16	MO	8:08	1.16	TU	9:52	1.24	TU	7:54	1.14
	13:07	1.62		14:48	1.57		14:32	1.52		16:10	1.41		14:23	1.46
	19:53	1.3		21:06	1.17		21:06	1.13		22:22	1.08		20:44	1.01
													21:36	1.02
13	1:22	1.57	28	2:30	1.49	13	2:40	1.45	28	6:27	1.34	13	2:27	1.42
SA	7:41	1.15	SU	9:07	1.23	TU	9:05	1.22	WE	11:04	1.26	WE	8:53	1.19
	13:54	1.6		15:55	1.53		15:41	1.47		17:18	1.37		15:25	1.42
	20:42	1.27		22:06	1.16		22:11	1.12		23:23	1.08		21:50	1.02
													22:36	1.03
14	2:05	1.53	29	3:53	1.43	14	4:40	1.43	29	7:28	1.37	14	4:31	1.39
SU	8:34	1.21	MO	10:16	1.29	WE	10:17	1.27	TH	12:08	1.26	TH	10:12	1.23
	14:54	1.57		17:00	1.5		17:23	1.45		18:50	1.37		16:51	1.39
	21:40	1.25		23:07	1.15		23:25	1.09					23:03	1.01
													23:36	1.02
15	3:17	1.49	30	6:20	1.41	15	6:10	1.46	15	6:01	1.42	15	6:01	1.42
MO	9:36	1.25	TU	11:22	1.32	TH	11:33	1.29	FR	11:32	1.24	SA	12:53	1.17
	16:37	1.54		18:13	1.47		18:54	1.46		18:21	1.39		19:02	1.31
	22:46	1.22											19:02	1.31
													00:29	0.99
													08:04	1.38
													13:35	1.15
													19:49	1.34

Source: Hydrographic Department Royal Thai Navy, 1996: 121.

Table 8 (continue)

Ku Nu (Songkhla)												year 1996			
July			August			August			September			September			
Date	time	HT	Date	time	HT	Date	time	HT	Date	time	HT	Date	time	HT	
1	2:36	0.89	16	4:52	0.88	1	4:23	0.86	16	5:12	0.87	1	5:53	0.79	
MO	9:58	1.25	TU	10:32	1.2	TH	11:02	1.32	FR	10:57	1.24	SU	11:46	1.38	
	15:37	0.61		16:26	0.62		17:00	0.52		17:00	0.65		18:13	0.71	
	21:47	1.3		22:28	1.17		23:05	1.32		22:52	1.23				
													11:17	1.4	
													17:37	0.83	
													23:43	1.4	
2	3:26	0.9	17	5:24	0.88	2	5:21	0.83	17	5:42	0.86	2	0:17	1.36	
TU	10:44	1.29	WE	11:05	1.21	FR	11:38	1.33	SA	11:20	1.25	MO	6:40	0.77	
	16:24	0.58		16:56	0.62		17:46	0.54		17:30	0.66		12:25	1.34	
	22:32	1.32		22:51	1.17		23:51	1.3		23:23	1.24		18:58	0.78	
													6:08	0.85	
													11:53	1.4	
													18:14	0.87	
3	4:27	0.9	18	5:53	0.88	3	6:14	0.8	18	6:13	0.84	3	1:08	1.31	
WE	11:25	1.32	TH	11:33	1.21	SA	12:14	1.32	SU	11:47	1.25	TU	7:30	0.76	
	17:12	0.56		17:24	0.62		18:32	0.58		18:02	0.68		13:08	1.28	
	23:18	1.32		23:14	1.17								19:49	0.86	
													0:27	1.38	
													6:48	0.84	
													12:32	1.37	
													18:55	0.92	
4	5:34	0.9	19	6:23	0.88	4	0:39	1.27	19	0:01	1.24	4	2:05	1.26	
TH	12:05	1.33	FR	11:57	1.21	SU	7:07	0.77	MO	6:45	0.82	WE	8:20	0.77	
	17:50	0.56		17:54	0.63		12:53	1.28		12:18	1.24		13:59	1.21	
				23:43	1.17		19:20	0.64		18:36	0.71		20:48	0.93	
													1:16	1.35	
													7:34	0.84	
													13:16	1.33	
													19:44	0.99	
5	0:05	1.3	20	6:54	0.87	5	1:36	1.23	20	0:42	1.23	5	3:08	1.22	
FR	6:33	0.88	SA	12:22	1.19	MO	7:59	0.74	TU	7:21	0.8	TH	9:14	0.79	
	12:42	1.32		18:25	0.65		13:36	1.22		12:53	1.21		15:23	1.14	
	18:48	0.58					20:13	0.71		19:15	0.76		22:03	0.98	
													2:10	1.3	
													8:26	0.85	
													14:13	1.29	
													20:47	1.05	
6	0:58	1.27	21	0:10	1.16	6	2:44	1.19	21	1:30	1.2	6	4:12	1.18	
SA	7:29	0.85	SU	7:27	0.86	TU	8:53	0.73	WE	8:03	0.79	FR	10:11	0.81	
	13:21	1.28		12:49	1.17		14:30	1.14		13:35	1.17		18:13	1.14	
	19:39	0.62		18:59	0.67		21:14	0.76		20:01	0.82		0:38	1	
													3:24	1.27	
													9:27	0.87	
													16:10	1.26	
													22:13	1.09	
7	2:04	1.23	22	0:59	1.14	7	3:54	1.16	22	2:27	1.17	7	5:23	1.15	
SU	8:25	0.82	MO	8:01	0.84	WE	9:51	0.72	TH	8:53	0.78	SA	11:11	0.82	
	14:04	1.23		13:21	1.13		15:50	1.08		14:30	1.13		19:31	1.17	
	20:36	0.68		19:38	0.71		22:25	0.85		21:00	0.88				
													4:47	1.25	
													10:38	0.87	
													17:45	1.29	
													23:42	1.1	
8	3:22	1.21	23	1:49	1.12	8	5:00	1.13	23	3:52	1.14	8	1:34	0.99	
MO	9:23	0.79	TU	8:40	0.82	TH	10:51	0.72	FR	9:53	0.78	SU	6:38	1.15	
	14:59	1.16		14:00	1.09		18:05	1.05		16:22	1.11		12:14	0.83	
	21:39	0.74		20:26	0.75		23:49	0.88		22:17	0.92		20:03	1.2	
													6:03	1.26	
													11:49	0.86	
													18:50	1.35	
9	4:32	1.19	24	2:55	1.1	9	6:08	1.11	24	5:14	1.13	9	2:09	0.98	
TU	10:23	0.76	WE	9:27	0.79	FR	11:53	0.71	SA	11:01	0.76	MO	7:38	1.17	
	16:13	1.1		14:59	1.05		19:34	1.07		17:56	1.14		13:19	0.82	
	22:49	0.8		21:25	0.8					23:38	0.95		20:30	1.23	
													7:12	1.3	
													12:56	0.83	
													19:40	1.41	
10	5:34	1.17	25	4:29	1.09	10	1:50	0.89	25	6:32	1.14	10	2:38	0.97	
WE	11:25	0.73	TH	10:24	0.77	SA	7:13	1.1	SU	12:12	0.74	TU	8:23	1.2	
	17:52	1.08		16:48	1.05		13:05	0.71		19:06	1.19		14:09	0.8	
				22:36	0.83		20:18	1.1		0:44	0.95		20:56	1.26	
													1:39	1.05	
													8:05	1.35	
													13:57	0.81	
													20:23	1.47	
11	0:03	0.84	26	5:37	1.09	11	2:36	0.89	26	7:43	1.18	11	3:02	0.96	
TH	6:34	1.15	FR	11:28	0.74	SU	8:08	1.11	MO	13:19	0.7	WE	9:00	1.24	
	12:30	0.7		18:05	1.08		14:10	0.69		19:58	1.25		14:47	0.79	
	19:21	1.08		23:46	0.86		20:50	1.13		1:39	0.94		21:19	1.29	
													2:25	1.01	
													8:48	1.41	
													14:53	0.8	
													21:05	1.51	
12	1:44	0.86	27	6:47	1.1	12	3:12	0.89	27	8:36	1.23	12	3:28	0.95	
FR	7:33	1.14	SA	12:34	0.7	MO	8:53	1.13	TU	14:19	0.65	TH	9:29	1.28	
	13:38	0.68		19:09	1.13		14:55	0.67		20:43	1.31		15:21	0.78	
	20:15	1.1					21:19	1.15		2:31	0.92		21:36	1.31	
													3:11	0.96	
													9:28	1.47	
													15:41	0.8	
													21:46	1.54	
13	2:46	0.87	28	0:46	0.87	13	3:45	0.88	28	9:19	1.29	13	3:57	0.94	
SA	8:26	1.14	SU	8:00	1.13	TU	9:33	1.17	WE	15:12	0.62	FR	9:52	1.31	
	14:32	0.65		13:37	0.65		15:31	0.66		21:24	1.36		15:53	0.78	
	20:53	1.12		20:06	1.										

B. Data structure

The data from the tide tables in Pattani and Songkhla provinces in 1996 are provided by Hydrographic department, Royal Thai Navy. This data are kept in Microsoft Access database file called *tides.mdb* and consists of 3 tables (tide at Pattani, cal and tide at Songkhla). The data in *table tide at Pattani* and *tide at Songkhla* are comprised of 6 fields (*index, day, month, time, height and level*) as follows.

index	day	month	time	height	level
1	1	1	5:34	0.95	high
2	1	1	11:05	0.84	low
3	1	1	18:25	1.09	high
4	2	1	1:10	0.78	low
5	2	1	6:43	0.95	high
6	2	1	12:14	0.84	low
7	2	1	19:23	1.1	high
8	3	1	2:08	0.72	low
9	3	1	7:48	0.97	high
10	3	1	13:06	0.83	low
.
.
.

The data in *table cal* is comprised of 3 fields (*month, ndays and monthname*) as follows.

month	ndays	monthname
1	0	January
2	31	February
3	60	March
4	91	April
5	121	May
6	152	June
7	182	July
8	213	August
9	244	September
10	274	October
11	305	November
12	335	December

A query was used to create the data of the successive high and low tides in Pattani and Songkhla Provinces. For example, the data of the successive high tide at Pattani can be obtained by this SQL command.

```

SELECT DISTINCTROW [tides at Pattani].height
FROM [tides at Pattani]
WHERE (([tides at Pattani].llevel="high"));

```

and the result is as follows.

```

heightt
0.95
1.09
0.95
1.1
0.97
1.11
1
.
.
.

```

The data of the successive low tide at Pattani and the data of the successive high and low tides at Songkhla are created by the same method. After that these data are transferred to the notepad (*highpat.num*, *lowpat.num*, *highsong.num* and *lowsong.num*) to analysis the successive high and low tides at Pattani and Songkhla.

Queries were used to create the table of time delay from high to next high tide, high to next low tide and low to next low tide of each location to get data as follows.

Index	H-H	H-L Pat	L-L Pat	H-H	H-L	L-L
1	771	331	845	750	338	776
2	738	405	664	762	364	720
3	760	331	834	734	322	772
4	745	405	658	749	360	714
5	752	318	832	741	325	768
6	738	398	645	735	352	714
7	750	305	838	749	331	762
8	728	393	633	722	344	723
9	751	298	843	756	345	749
10	720	390	627	711	338	740
.
.
.

After that these data are transferred to datafile *patsong.num* in the notepad for use to analysis time of occurrence.

C. Programming preliminary result and statistical modelling

Figure 8 to plot the direct observation data every 15 minutes at Pattani River Mouth on 25 May and 1 June, 1996 by using matlab together with functions (getfile, getnum, putnum, setvar, putfn, track, title) in the ASP (McNeil et al 1997) package, the following program is used.

Figure 8

```

system_dependent(14,'on')
getfile bay1.num
num=getnum;
num(1:101,1)=(num(1:101,1)+7)/100;
num(102:202,1)=num(102:202,1)/100;
num(:,2) = 9+(num(:,2)-3)/12;
putnum(num)
setvar y=1 x=2:4
putfn(str2mat('height in m','hour after midnight',' ','high/low'));
track size=12
title('Height of tide in metres at Pattani River Mouth: 1= 25 May 1996 2=1 June
1996');
ylabel('heights (m)')

```

Figure 9, graph of the direct observation compare with the data from the tide tables on 25 May and 1 June, 1996 by using matlab together with functions (getfile, getnum, putnum, setvar, putfn, track, title) in the ASP (McNeil et al 1997) package, the following program is used.

Figure 9

```

system_dependent(14,'on')
getfile bay2.num
num=getnum;
num(1:5,1)=num(1:5,1)/100;

```

```

num(6:106,1)=(num(6:106,1)+7)/100;
num(107:212,1)=num(107:212,1)/100;
num(:,2) = 9+(num(:,2)-3)/12;
putnum(num)
setvar y=1 x=2:4
putfn(str2mat('height in m','hour after midnight','','high/low'));
track size=12
title(' ')
title('Height of tide in metres at Pattani River Mouth: 1= 25 May 1996 2=1 June
1996');
ylabel('heights (m)');

```

Figures 10 and 11, graph of comparison of high and low tides in Pattani and Songkhla in the first two month of 1996, by using matlab together with functions (getfile, getnum, putnum, setvar, putfn, track, title) in the ASP (McNeil et al 1997) package, the following programs are used.

Figure 10

```

system_dependent(14,'on')
getfile pattani.num
num=getnum;
y= [num(1:116,:); num(708:822,:)] ;
putnum(y);
setvar y=1 x=2:4
putfn(str2mat('heights',tide record','','high/low'));
track size=12
title(' ')
title('Heights of high and low tide (metres) at Pattani in January - February 1996:
1=high 2=low')
ylabel('heights (m)')

```

Figure 11

```

system_dependent(14,'on')
getfile songkla.num
num=getnum;
y= [num(1:116,:); num(708:822,:)] ;
putnum(y);
setvar y=1 x=2:4
putfn(str2mat('heights',tide record','','high/low'));
%putlab(['3,1 Heights of high and low tide(metres) at Songkla in January - Februáry
1996: 1=high 2=low'],3)
track size=12
title(' ')
title('Heights of high and low tide (metres) at Songkhla in January - February 1996:
1=high 2=low');
ylabel('heights (m)');

```

Figures 12 and 13, graph of comparison of high and low tides in Pattani and Songkhla for the whole of 1996, by using the same method, the following programs are used.

Figure12

```

system_dependent(14,'on')
getfile pattani.num
setvar y=1 x=2:4
putfn(str2mat('heights',tide record','','high/low'));
putlab(['3,1 Height of high and low tide(metres) at Pattani in 1996: 1=high 2=low'],3)
track size=12
title('Height of high and low tide(metres) at Pattani 1996')
title(' ')
ylabel('heights (m)');

```


Figure 13

```

system_dependent(14,'on')
getfile songkla.num
setvar y=1 x=2:4
putfn(str2mat('heights','tide record',' ','high/low'));
putlab(['3,1 Height of high and low tide(metres) at Songkhla in 1996: 1=high
2=low'],3)
track size=12
title('Height of high and low tide(metres) at Songkhla 1996')
title(' ')
ylabel('heights (m)');

```

Figures 14 and 15, graph of comparison of times of occurrence of high and low tides in Pattani and Songkhla in 1996, by using matlab together with functions (getfile, getnum, cumsum, rem, plot, xloc, yloc, text, axis, xlabel, title) in the ASP (McNeil et al 1997) package, the following programs are used.

Figure 14

```

system_dependent(14,'on')
getfile patsong.num
y = getnum;
index = [1 ; 1+y(:,1)];
hi2hi = [0 ; y(:,2)/60];
lo2lo = [0 ; y(:,4)/60];
hi1 = 3+34/60;
lo1 = 9+5/60;
hi = hi1+cumsum(hi2hi);
lo = lo1+cumsum(lo2lo);
lunarhitime = rem(hi,24.8412)-3.27;
lunarlotime = rem(lo,24.8412)-3.27;
odd = rem(index,2)~=1;

```

```

even = rem(index,2)==0;
lunarhi1time = lunarhitime(odd);
lunarhi2time = lunarhitime(even);
lunarlo1time = lunarlotime(odd);
lunarlo2time = lunarlotime(even);
data=[lunarhi1time(1:353,:) lunarhi2time lunarlo1time(1:353,:) lunarlo2time];
n=length(data);
dataok=[(1:n)' data];
plot(dataok(:,1),dataok(:,2),'w-')
hold on
plot(dataok(:,1),dataok(:,3),'r-')
hold on
plot(dataok(:,1),dataok(:,4),'c-')
hold on
plot(dataok(:,1),dataok(:,5),'m-')
plot([0 353],[0 0],'w:')
plot([0 353],[6.21 6.21],'w:')
plot([0 353],[12.42 12.42],'w:')
plot([0 353],[18.63 18.63],'w:')
xloc = [360;360;360;360];
yloc = [0;6.2;12.4;18.6];
label = str2mat('low','high','low','high');
text(xloc,yloc,label)
axis([-5 385 -3.5 25.5])
xlabel('lunar day');
ylabel('time (hour)');
title('Time of occurrence during lunar day: High and Low tides at Pattani in 1996');

```

Figure 15

```

system_dependent(14,'on')
getfile patsong.num
y = getnum;
index = [1 ; 1+y(:,1)];
hi2hi = [0 ; y(:,5)/60];
lo2lo = [0 ; y(:,7)/60];
hi1 = 4+19/60;
lo1 = 9+57/60;
hi = hi1+cumsum(hi2hi);
lo = lo1+cumsum(lo2lo);
lunarhitime = rem(hi,24.8412)-3.27;
lunarlotime = rem(lo,24.8412)-3.27;
odd = rem(index,2)==-1;
even = rem(index,2)==0;
lunarhi1time = lunarhitime(odd);
lunarhi2time = lunarhitime(even);
lunarlo1time = lunarlotime(odd);
lunarlo2time = lunarlotime(even);
data=[lunarhi1time(1:353,:) lunarhi2time lunarlo1time(1:353,:) lunarlo2time];
n=length(data);
dataok=[(1:n)' data];
plot(dataok(:,1),dataok(:,2),'w-')
hold on
plot(dataok(:,1),dataok(:,3),'r-')
hold on
plot(dataok(:,1),dataok(:,4),'c-')
hold on
plot(dataok(:,1),dataok(:,5),'m-')
plot([0 353],[0 0],'w:')

```

```

plot([0 353],[6.21 6.21],'w:')
plot([0 353],[12.42 12.42],'w:')
plot([0 353],[18.63 18.63],'w:')
xloc = [360;360;360;360];
yloc = [0;6.2;12.4;18.6];
label = str2mat('low','high','low','high');
text(xloc,yloc,label)
axis([-5 385 -3.5 25.5])
xlabel('lunar day');
ylabel('time (hour)');
title('Time of occurrence during lunar day: High and Low tides at Songkhla in 1996');

```

Figures 16-23, show the result of fitting the model to the series of times of occurrence of successive high and low tides at Pattani and Songkhla during 1996, by using matlab together with functions (getfile, getnum, cumsum, rem, putnum, putfn, putdn, setvar, tsplot) in ASP (McNeil et al 1997) package, the following programs are used.

Figure 16

```

system_dependent(14,'on')
getfile patsong.num
y = getnum;
index = [1 ; 1+y(:,1)];
hi2hi = [0 ; y(:,2)/60];
hi1 = 3+34/60;
hi = hi1+cumsum(hi2hi);
lunarhitime = rem(hi,24.8412)-3.27;
odd = rem(index,2)==1;
even = rem(index,2)==0;
lunarhi1time = lunarhitime(odd);
lunarhi2time = lunarhitime(even);

```

```

data=[index(odd),lunarhi1time];
n=length(data);
data1=[(1:n)' data(:,2)];
putnum(data1)
putfn(str2mat('lunar day','hour of lunar day'));
putdn('First low tide at Pattani')
setvar x=1 y=2
tsplot pg=3 cf=-1 'harm=12 13 24 25 26' 'ar=1 2' new=0;

```

Figure 17

```

system_dependent(14,'on')
getfile patsong.num
y = getnum;
index = [1 ; 1+y(:,1)];
lo2lo = [0 ; y(:,4)/60];
lo1 = 9+5/60;
lo = lo1+cumsum(lo2lo);
lunarlotime = rem(lo,24.8412)-3.27;
odd = rem(index,2)==1;
even = rem(index,2)==0;
lunarlo1time = lunarlotime(odd);
lunarlo2time = lunarlotime(even);
data=[index(odd),lunarlo1time];
n=length(data);
data1=[(1:n)' data(:,2)];
putnum(data1)
putfn(str2mat('lunar day','hour of lunar day'));
putdn('First high tide at Pattani')
setvar x=1 y=2
tsplot pg=3 cf=-1 'harm=12 13 24 25 26' 'ar=1 2' new=0;

```

Figure 18

```

system_dependent(14,'on')
getfile patsong.num
y = getnum;
index = [1 ; 1+y(:,1)];
hi2hi = [0 ; y(:,2)/60];
hi1 = 3+34/60;
hi = hi1+cumsum(hi2hi);
lunarhitime = rem(hi,24.8412)-3.27;
odd = rem(index,2)~=1;
even = rem(index,2)~=0;
lunarhi1time = lunarhitime(odd);
lunarhi2time = lunarhitime(even);
data=[index(even),lunarhi2time];
n=length(data);
data1=[(1:n)' data(:,2)];
putnum(data1)
putfn(str2mat('lunar day','hour of lunar day'));
putdn('Second low tide at Pattani')
setvar x=1 y=2
tsplo t pg=3 cf=-1 'harm=12 13 24 25 26' 'ar=1 2' new=0;

```

Figure 19

```

system_dependent(14,'on')
getfile patsong.num
y = getnum;
index = [1 ; 1+y(:,1)];
lo2lo = [0 ; y(:,4)/60];
lo1 = 9+5/60;
lo = lo1+cumsum(lo2lo);

```

```

lunarlotime = rem(lo,24.8412)-3.27;
odd = rem(index,2)~=1;
evcn = rem(index,2)==0;
lunarlotime = lunarlotime(odd);
lunarlotime = lunarlotime(even);
data=[index(even),lunarlotime];
n=length(data);
data1=[(1:n)' data(:,2)];
putnum(data1)
putfn(str2mat('lunar day','hour of lunar day'));
putdn('Second high tide at Pattani')
setvar x=1 y=2
tsplot pg=3 cf=-1 'harm=12 13 24 25 26' 'ar=1 2' new=0;

```

Figure 20

```

system_dependent(14,'on')
getfile patsong.num
y = getnum;
index = [1 ; 1+y(:,1)];
hi2hi = [0 ; y(:,5)/60];
hi1 = 4+19/60;
hi = hi1+cumsum(hi2hi);
lunarhitime = rem(hi,24.8412)-3.27;
odd = rem(index,2)~=1;
even = rem(index,2)==0;
lunarhitime = lunarhitime(odd);
lunarhitime = lunarhitime(even);
data=[index(odd),lunarhitime];
n=length(data);
data1=[(1:n)' data(:,2)];

```

```

putnum(data1)
putfn(str2mat('lunar day','hour of lunar day'));
putdn('First low tide at Songkhla')
setvar x=1 y=2
tsplo t pg=3 cf=-1 'harm=12 13 24 25 26' 'ar=1 2' new=0;

```

Figure 21

```

system_dependent(14,'on')
getfile patsong.num
y = getnum;
index = [1 ; 1+y(:,1)];
lo2lo = [0 ; y(:,7)/60];
lo1 = 9+57/60;
lo = lo1+cumsum(lo2lo);
lunarlotime = rem(lo,24.8412)-3.27;
odd = rem(index,2)==1;
even = rem(index,2)==0;
lunarlotime = lunarlotime(odd);
lunarlotime = lunarlotime(even);
data=[index(odd),lunarlotime];
n=length(data);
data1=[(1:n)' data(:,2)];
putnum(data1);
putfn(str2mat('lunar day','hour of lunar day'));
putdn('First high tide at Songkhla')
setvar x=1 y=2
tsplo t pg=3 cf=-1 'harm=12 13 24 25 26' 'ar=1 2' new=0;

```


Figure 22

```

system_dependent(14,'on')
getfile patsong.num
y = getnum;
index = [1 ; 1+y(:,1)];
hi2hi = [0 ; y(:,5)/60];
hi1 = 4+19/60;
hi = hi1+cumsum(hi2hi);
lunarhitime = rem(hi,24.8412)-3.27;
odd = rem(index,2)==1;
even = rem(index,2)==0;
lunarhi1time = lunarhitime(odd);
lunarhi2time = lunarhitime(even);
data=[index(even),lunarhi2time];
n=length(data);
data1=[(1:n)' data(:,2)];
putnum(data1)
putfn(str2mat('lunar day','hour of lunar day'));
putdn('Second low tide at Songkhla')
setvar x=1 y=2
tsplo pg=3 cf=-1 'harm=12 13 24 25 26' 'ar=1 2' new=0;

```

Figure 23

```

system_dependent(14,'on')
getfile patsong.num
y = getnum;
index = [1 ; 1+y(:,1)];
lo2lo = [0 ; y(:,7)/60];
lo1 = 9+57/60;
lo = lo1+cumsum(lo2lo);

```

```

lunarlotime = rem(lo,24.8412)-3.27;
odd = rem(index,2)==1;
even = rem(index,2)==0;
lunarlo1time = lunarlotime(odd);
lunarlo2time = lunarlotime(even);
data=[index(even),lunarlo2time];
n=length(data);
data1=[(1:n)' data(:,2)];
putnum(data1);
putfn(str2mat('lunar day','hour of lunar day'));
putdn('Second high tide at Songkhla')
setvar x=1 y=2
tsplot pg=3 cf=-1 'ar=2 3' 'harm=11 12 13 14 24 25 26' new=0 font=8;

```

Figures 24-31, show the result of fitting the model to the series of heights of successive high and low tides at Pattani and Songkhla during 1996, by using matlab together with functions (getfile, getnum, putnum, putfn, putdn, setvar, tsplot) in ASP (McNeil et al 1997) package, the following programs are used.

Figure 24

```

system_dependent(14,'on')
getfile('highpat.num');
y=getnum;
n=length(y);
y=[(1:n)' y];
odd=2*(1:354)-1;
yodd=y(odd,:);
n1=length(yodd);
yok=[(1:n1)' yodd(:,2)];
putnum(yok);
setvar('x=1','y=2');

```

```

putdn('Pattani: January 1 - December 31, 1996');
putfn(str2mat('lunar day','First high tide'));
tsplot pg=3 cf=-1 'harm=1 2 11 13 14 25' 'ar=1 2' new=0;

```

Figure 25

```

system_dependent(14,'on')
getfile('lowpat.num');
y=getnum;
n=length(y);
y=[(1:n)' y];
odd=2*(1:354)-1;
yodd=y(odd,:);
n1=length(yodd);
yok=[(1:n1)' yodd(:,2)];
putnum(yok);
sctvar('x=1','y=2');
putdn('Pattani: January 1 - December 31, 1996');
putfn(str2mat('lunar day','First low tide'));
tsplot pg=3 cf=-1 'harm=1 2 11 13 14 25' 'ar=1 2' new=0;

```

Figure 26

```

system_dependent(14,'on')
getfile('highpat.num');
y=getnum;
n=length(y);
y=[(1:n)' y];
even=2*(1:353);
yeven=y(even,:);
n1=length(yeven);
yok=[(1:n1)' yeven(:,2)];

```

```

putnum(yok);
setvar('x=1','y=2');
putdn('Pattani: January 1 - December 31, 1996');
putfn(str2mat('lunar day','Second high tide'));
tsplot pg=3 cf=-1 'harm=1 2 11 13 14 25 ' 'ar=1 2' new=0;

```

Figure 27

```

system_dependent(14,'on')
getfile('lowpat.num');
y=getnum;
n=length(y);
y=[(1:n)' y];
even=2*(1:353);
yeven=y(even,:);
n1=length(yeven);
yok=[(1:n1)' yeven(:,2)];
putnum(yok);
setvar('x=1','y=2');
putdn('Pattani: January 1 - December 31, 1996');
putfn(str2mat('lunar day','Second low tide'));
tsplot pg=3 cf=-1 'harm=1 2 11 13 14 25 ' 'ar=1 2' new=0;

```

Figure 28

```

system_dependent(14,'on')
getfile('highsong.num');
y=getnum;
n=length(y);
y=[(1:n)' y];
odd=2*(1:354)-1;
yodd=y(odd,:);

```

```

n1=length(yodd);
yok=[(1:n1)' yodd(:,2)];
putnum(yok);
setvar('x=1','y=2');
putdn('Songkhla: January 1 - December 31, 1996');
putfn(str2mat('lunarday','First high tide'));
tsplot pg=3 cf=-1 'harm=1 2 11 13 14 25 ' 'ar=1 2' new=0;

```

Figure 29

```

system_dependent(14,'on')
getfile('lowsong.num');
y=getnum;
n=length(y);
y=[(1:n)' y];
odd=2*(1:354)-1;
yodd=y(odd,:);
n1=length(yodd);
yok=[(1:n1)' yodd(:,2)];
putnum(yok);
setvar('x=1','y=2');
putdn('Songkhla: January 1 - December 31, 1996');
putfn(str2mat('lunar day','First low tide'));
tsplot pg=3 cf=-1 'harm=1 2 11 13 14 25 ' 'ar=1 2' new=0;

```

Figure 30

```

system_dependent(14,'on')
getfile('highsong.num');
y=getnum;
n=length(y);
y=[(1:n)' y];

```

```

even=2*(1:353);
ycven=y(even,:);
n1=length(yeven);
yok=[(1:n1)' yeven(:,2)];
putnum(yok);
setvar('x=1','y=2');
putdn('Songkhla: January 1 - December 31, 1996');
putfn(str2mat('lunar day','Second high tide'));
tsplot pg=3 cf=-1 'harm=1 2 11 13 14 25 ' 'ar=1 2' new=0;

```

Figure 31

```

system_dependcnt(14,'on')
getfile('lowsong.num');
y=getnum;
n=length(y);
y=[(1:n)' y];
even=2*(1:353);
yeven=y(even,:);
n1=length(yeven);
yok=[(1:n1)' yeven(:,2)];
putnum(yok);
setvar('x=1','y=2');
putdn('Songkhla: January 1 - December 31, 1996');
putfn(str2mat('lunar day','Second low tide'));
tsplot pg=3 cf=-1 'harm=1 2 11 13 14 25 ' 'ar=1 2' new=0;

```