User Interface For Tide Prediction Model For Kuwait Water

The following files contain source code for the **Kuwait Tide model**:

Kuwait Tide.Vbas -- VisualeBase source code Interface for tide prediction.

Vis-ADMequil. – Fixed input data describing the stations.

Procedure for Stand-Alone Usage of Kuwait Tide model

Kuwait Tide model is an efficient and easy-to-use tide model. Although more advanced features are anticipated to evolve in the future, this version is sufficiently user-friendly and can provide the base information for water elevation for Kuwait Waters. The information provided by this model can be further used to calculate sediment/pollutant transport and to predict the tidal circulation for Kuwait waters. In this section of the report, step-by-step instructions are given for use of **Kuwait Tide model**. The procedure outlined here to run the model, click on (**Kuwait Tide)** icon. Fig.7 will display and option shown as:

Fig. 7. Main Page

1- **Tide Station**.

Option 1, if user chooses the tool bar option.

This option allows the user to select the station name for tide prediction as shown in fig.8. If the user selects any of the station names of the fig.8 list fig.9 will display showing the 24 hours tide for the current day.

Fig. 8. Kuwait Stations List For Tide Prediction

Fig. 9 has a number of options which are:

A- To change the station for tide prediction as shown in fig.10.

B- To change the date for tide prediction as shown in fig.11.

C- To display the 24 hours tide elevation in graphical form as shown in fig.12.

D- To go back to fig. 8.

Fig. 9. Tide Table List For 24 Hours

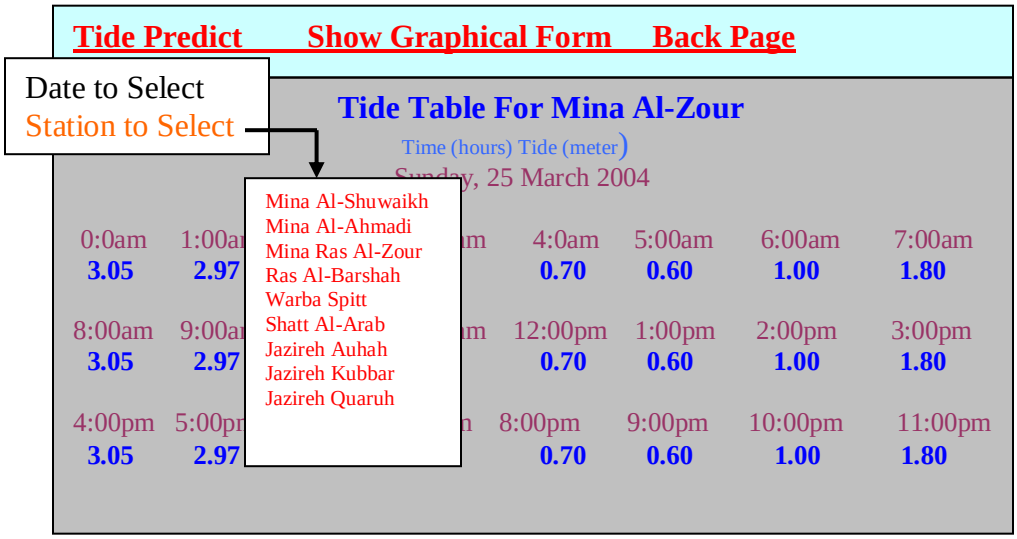

Fig. 10.To Change Station Selection

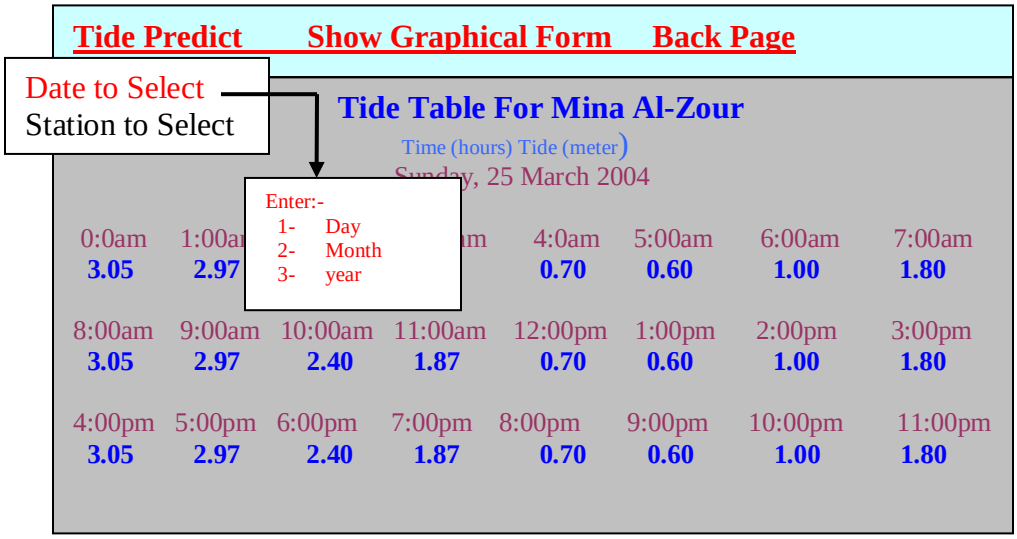

Fig. 11. To Change Prediction Date

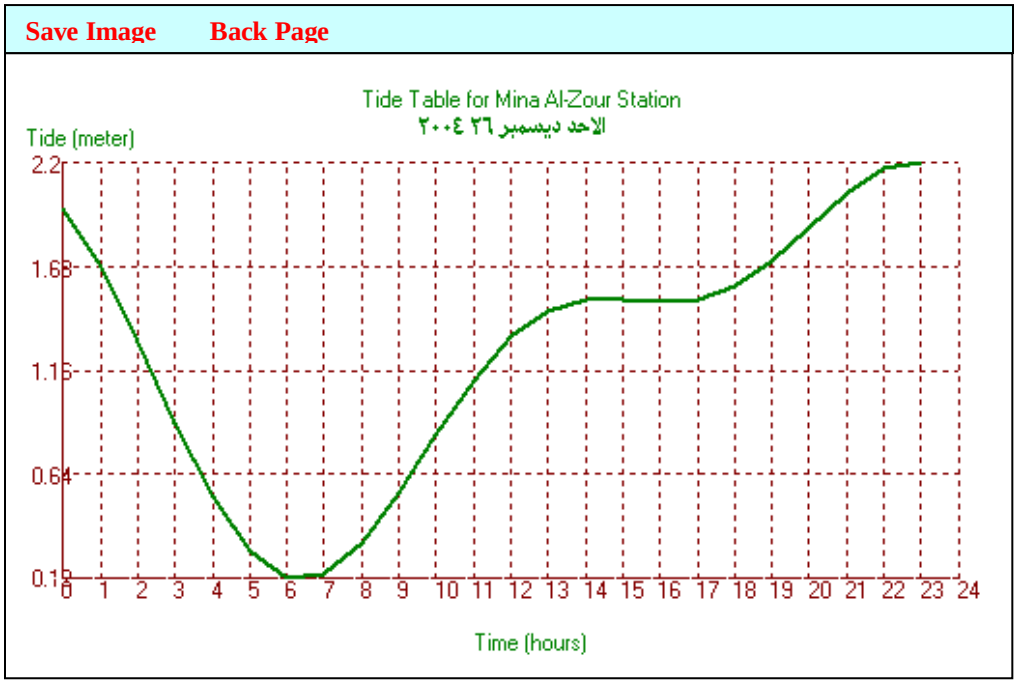

Fig. 12. Plot For 24 Hours tide level

Option 2, if the user clicks on a station name shown in fig.7. Fig. 13 will display some information about the selected station which are:

A- Station water datum level (meter).

B- Station longitude (deg).

C- Station latitude (deg).

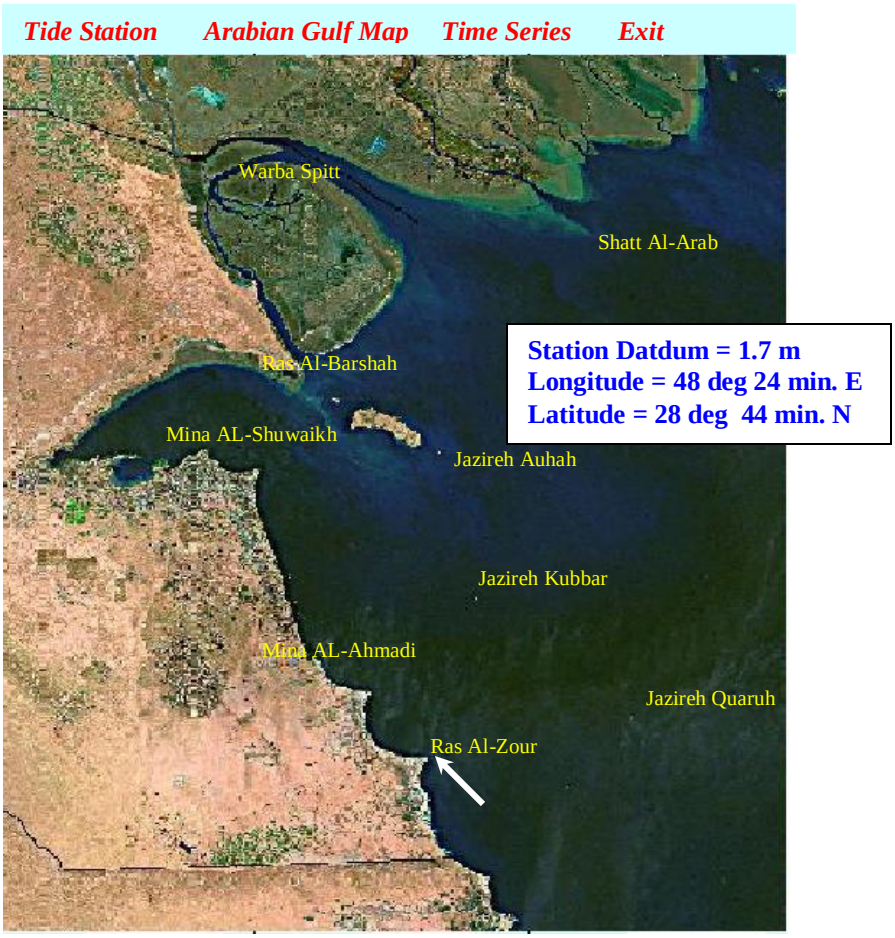

Fig. 13. Option 2 of Tide Station Selection

After the user selects a station by clicking on the station name fig. 9 will display as in option 1.

2- **Arabian Gulf Map**. This option allows the user to display the Arabian gulf map for other gulf stations that can be selected for tide prediction as shown in fig.14.

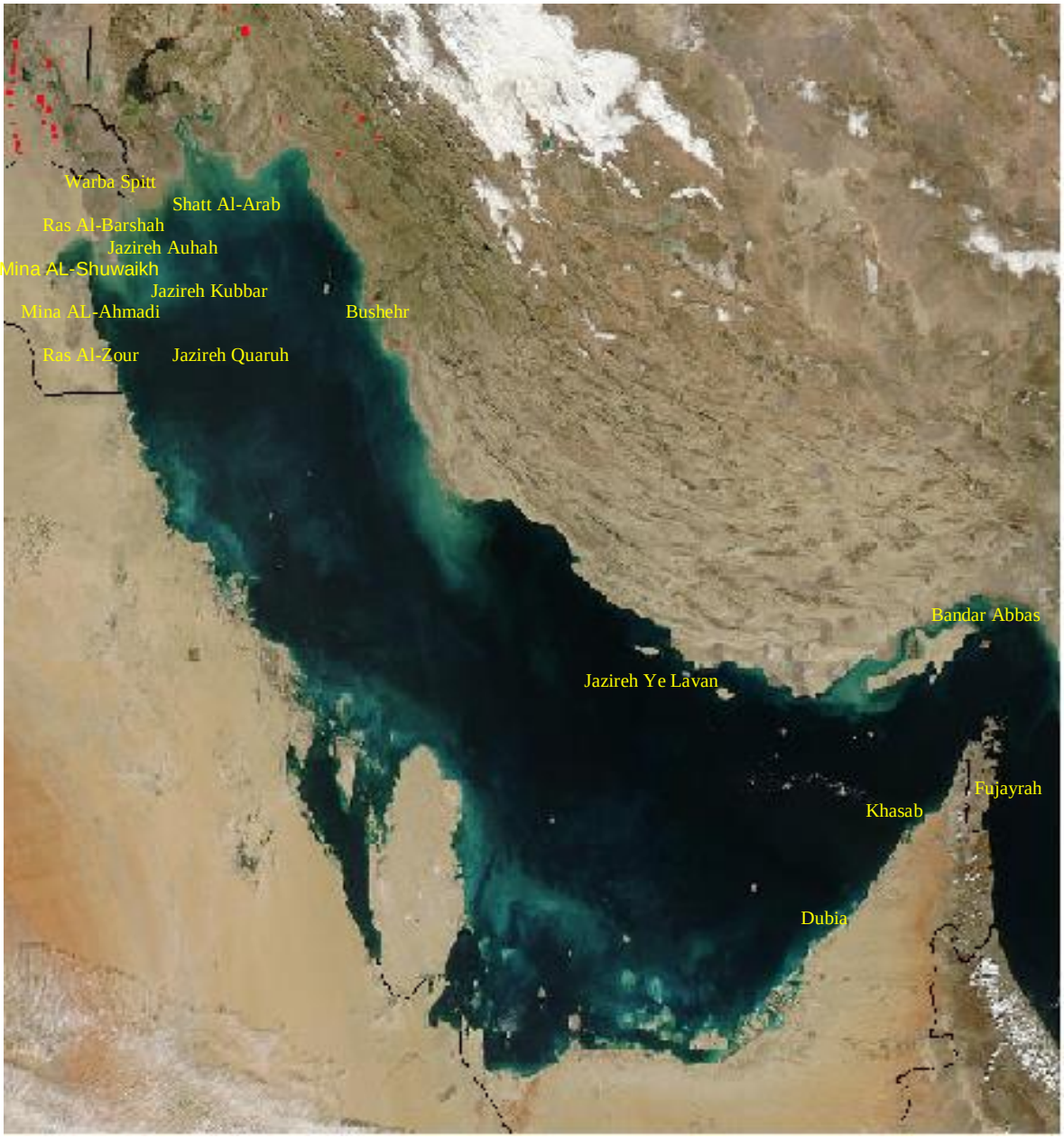

Fig. 14. The Arabian Gulf Stations List

3- **Time Series**. This option allows the user to generate time series for tidal data for any listed station as shown in fig 15. After time series of tide data is created using the Run option in fig.15 then click on Plot Tide option in fig.15 to display the tide data graphically as shown in fig 16.

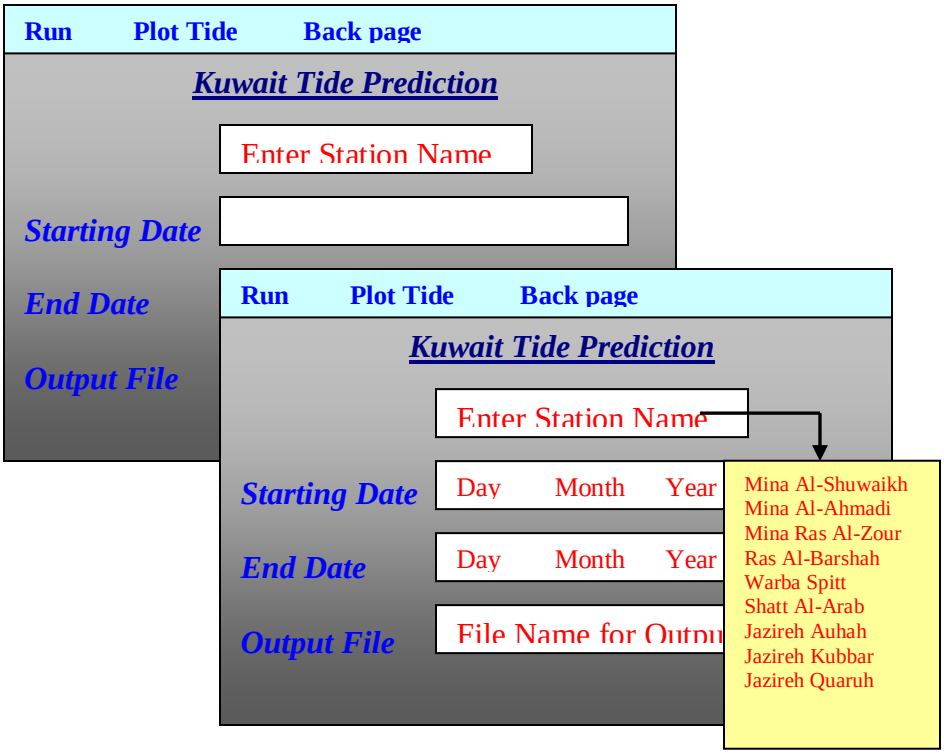

Fig. 15. Stations List for Time Series Option of Tide Prediction

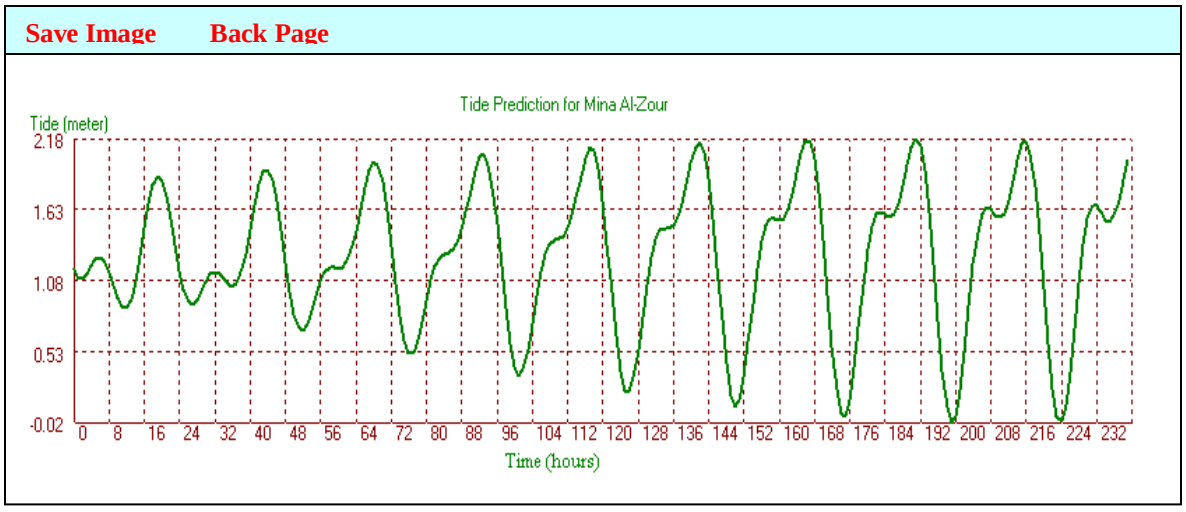

Fig. 16. Time Series Plot Option for 10 Days Tide Prediction

4- **Exit**. This option to end the model

Validation of the Tide Prediction Model

A number of these applications are presented here both to validate Kuwait Tide Model and to demonstrate its ability for tide prediction.

Case 1. Mina Al-Shuwaik Port located at longitude (47 deg 55 min E) and latitude (29 deg 21 min N) with station datum's of 2.35 m. Figs 17,18 shows a comparison between tidal data predicted from Kuwait Tide and the TideCalc model. Close results can be observed for 24 hour and 10 days tide data.

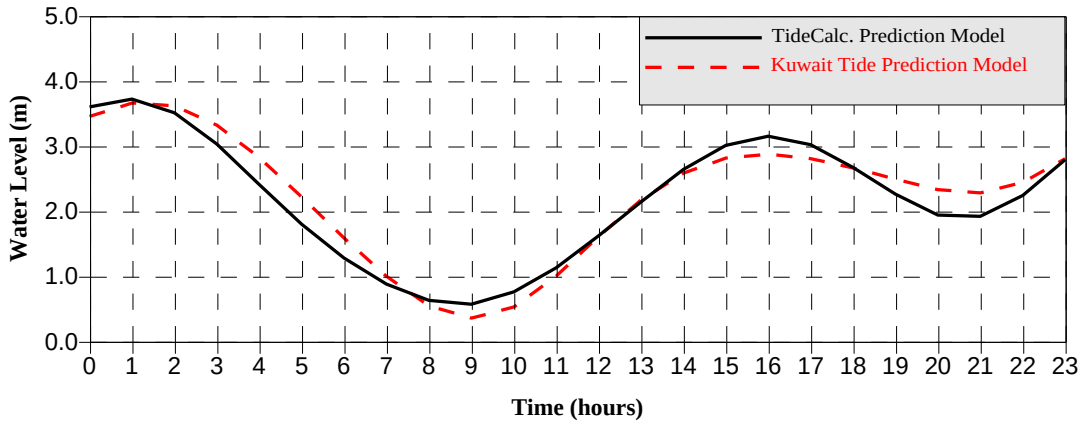

Fig 17. 24 Hours of Water Level At Mina Al-Shuwaik Predicted from Kuwait Tide Model and TideCalc Model at December 1,2004.

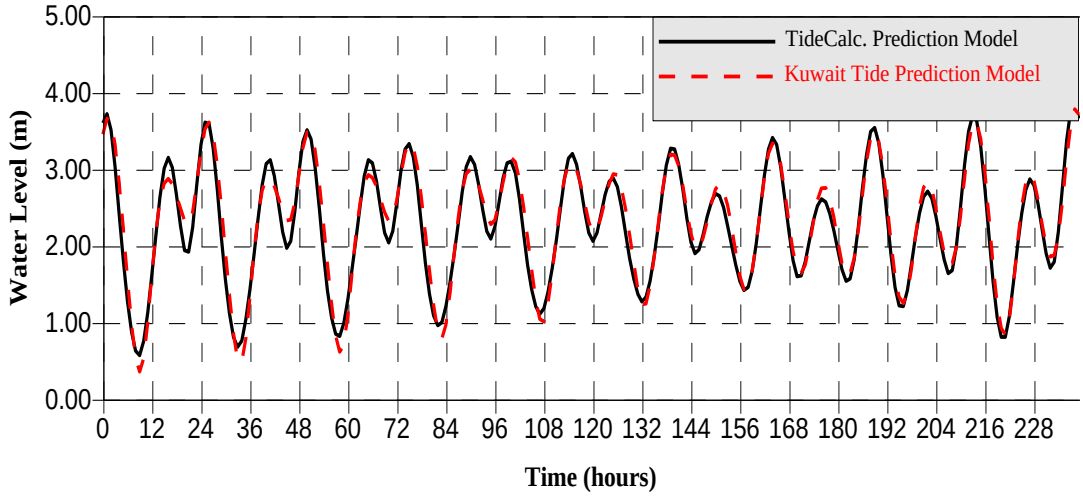

Fig 18. 10 days of Water Level At Mina Al-Shuwaik Predicted from Kuwait Tide Model and TideCalc Model at December 1 to 10,2004.

Case 2. Mina Al-Ahmadi Port located at longitude (48 deg 10 min E) and latitude (29 deg 4 min N) with station datum's of 1.52 m. Figs19,20 show the tidal data predicted from the Kuwait Tide and the TideCalc model at Al-Ahmadi Port. Close results were also provided for 24 hour and 10 days tide data.

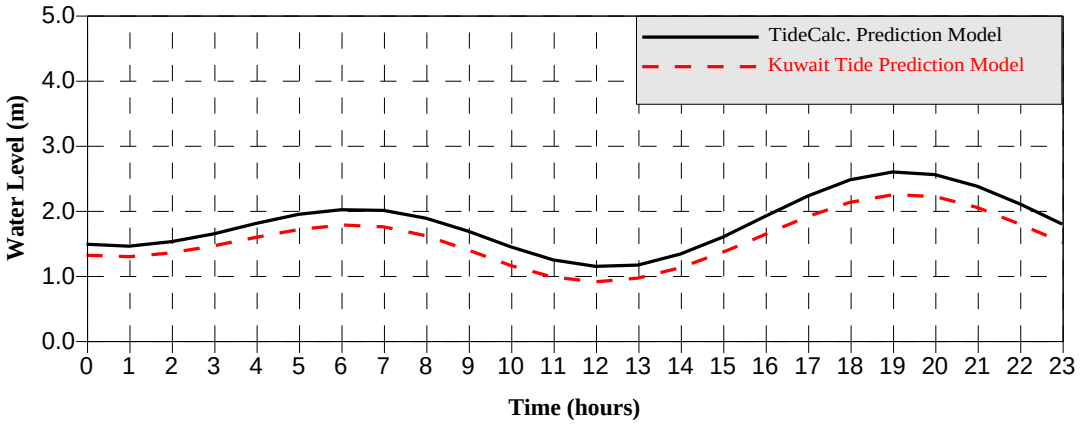

Fig 19. 24 Hours of Water Level At Mina Al-Ahmadi Predicted from Kuwait Tide Model and TideCalc Model at January 1,2004.

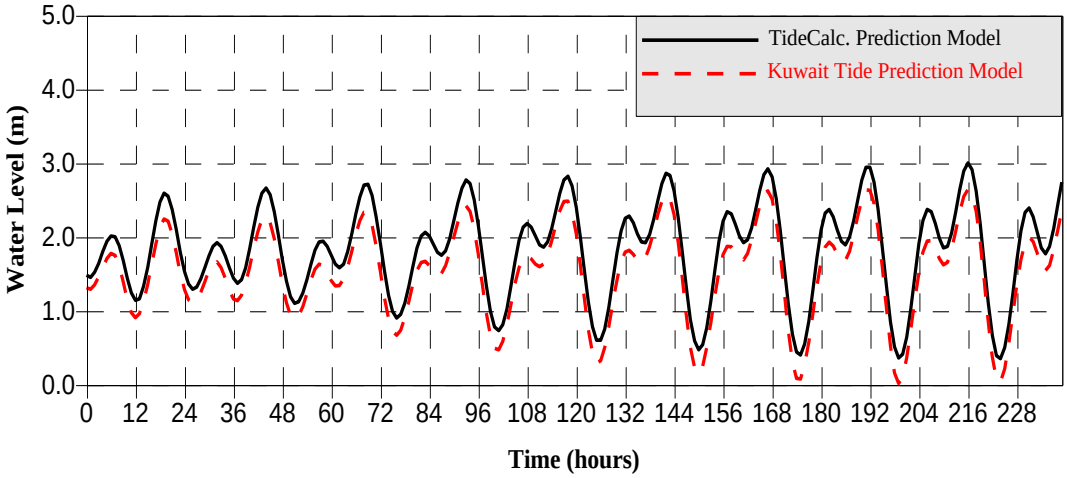

Fig 20. 10 days of Water Level At Mina Al-Ahmadi Predicted from Kuwait Tide Model and TideCalc Model at January 1 to 10,2004.

Case 3. Mina Al-Zour Port located at longitude (48 deg 24 min E) and latitude (28 deg 44 min N) with station datum's of 1.27 m. Figs 21,22 show a comparison between Kuwait Tide and the TideCalc models, with quit good agreement for 24 hour and 10 days tide data.

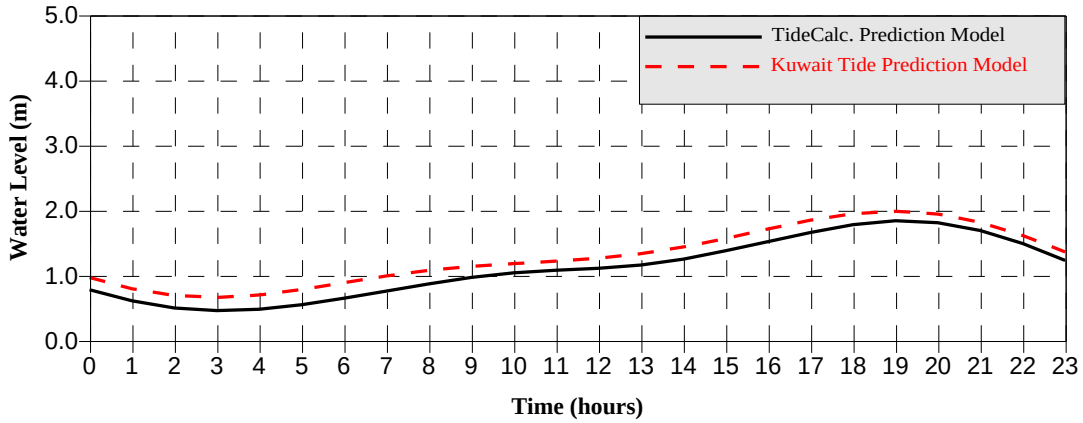

Fig 21. 24 Hours of Water Level At Mina Al-Zour Predicted from Kuwait Tide Model and TideCalc Model at February 1,2004.

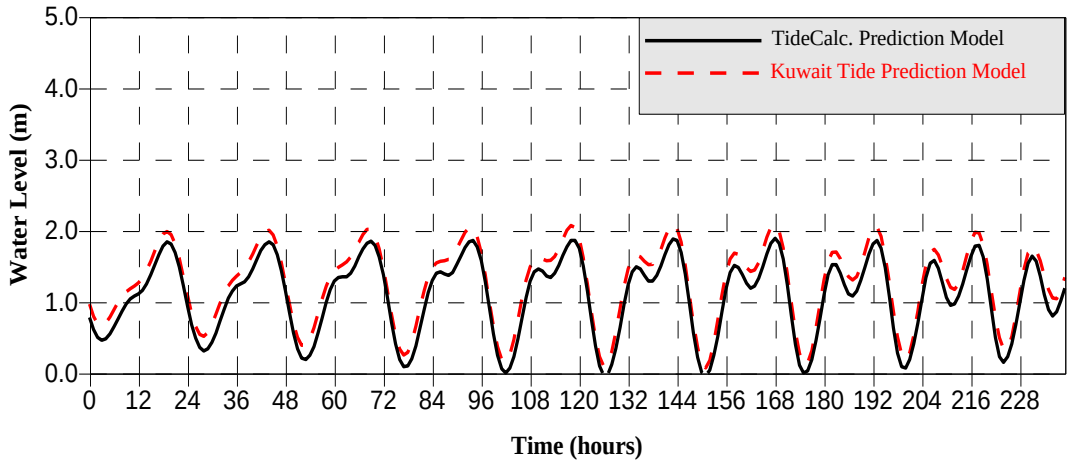

Fig 22. 10 days of Water Level At Mina Al-Zour Predicted from Kuwait Tide Model and TideCalc Model at February 1 to 10,2004.

Case 4. Water Level Recorded at offshore of AL-Khiran from Nov.1 to Nov. 26, 1999 using Aanderaa Water Level Sensor. Fig. 23 shows a comparison between measured tidal and those predicted by the Kuwait Tide mode for Al-Zour Station. The field measurements were taken offshore of Al-Khiran just south of AlZour. The model provides good results as shown in Fig. 23**.**

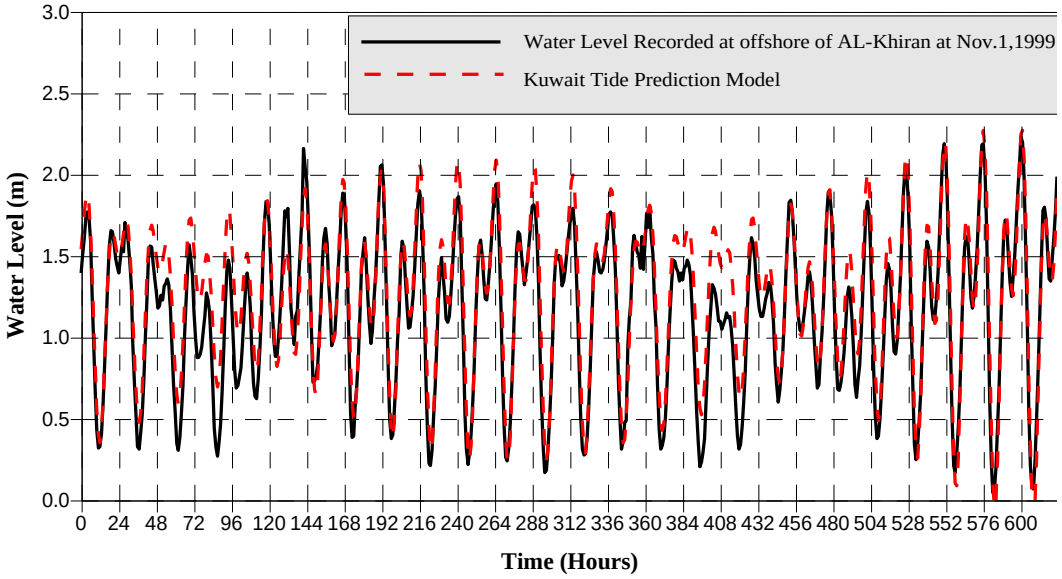

Fig 23. 26 Days of Water Level Predicted from Kuwait Tide Model and Water Level Recorded at Offshore of AL-Khiran using (Aanderaa Water Level Sensor) at November 1 to 26,2004.

CONCLUSIONS AND RECOMMENDATIONS

A tide Prediction model for Kuwait was developed to provide a useful tool for the generation of tides within the Kuwaiti territorial waters. The Kuwait Tide Model is a general-purpose, state-of-the-art water levels prediction model. It is capable of estimating the water level at a number of stations in Kuwait waters. The Kuwait Tide prediction model was

shown to provide good estimates for water levels variations as compared to results using other models and as compared to field measurements.

The following recommendations will help improve the model:

1- More Station should be added.

2- Extend the Kuwait Tide Prediction model to the Arabian Gulf Stations for tide Prediction (some stations have been included).

In conclusion, it could be said that the numerical model postulated (that was validated by the results of other study and models), the analytical methodology followed in this work and the results obtained so far, are very satisfactory for the implementation of this model for tide prediction on short-term and long-term.

Appendix

Table 3. Station constituents List

	Mina AL-Ahmadi	Mina Al-Zour	Mina AL-Shuwaikh	Ras AL-Barshah	Warba Spitt	Shatt Al-Arab	Jazireh Auhah	Jazireh Kubbar	Jazireh Qauruh	Khasab, Hormoz	Al-Fujayrah	Dubia (U.A E)	Bushehr, Iran	Jazireh Ye Lavan , Iran	Bandar Abbas, Iran
M2'	0.627	336	0.9463	0.905	1.262	0.841	0.662	0.662	0.662	0.662	0.67	0.268	0.337	0.33	1
S2'	0.168	34	0.339	0.339	0.43	0.286	0.262	0.262	0.262	0.262	0.25	0.088	0.123	0.12	0.36
K1'	0.429	305	0.5197	0.515	0.661	0.497	0.2121	0.2121	0.2121	0.2121	0.44	0.137	0.307	0.3	0.338
O1'	0.287	259	0.3368	0.365	0.314	0.298	0.1742	0.1742	0.1742	0.1742	0.18	0.116	0.204	0.16	0.207
SA'	0	0	0.0902	0	0	0	0	0	0	0	0	0	0.105	0	0
'SSA'	0	0	0.02982	0	0	0	0	0	0	0	0	0	0	0	0
MM'	0	0	0.0198	0	0	0	0.0705	0.0705	0.0705	0.0705	0.07	0	0	0	0
MSF'	0	0	0.0301	0	0	0	0.0578	0.0578	0.0578	0.0578	0.02	0	0	0	0
MF'	0	0	0.0204	0	0	0	0	0	0	0	0	0	0	0	0
S1'	0	0	0.049	0.071	0	0	0	0	0	0	0	0	0	0	0
Q1'	0	239	0.0493	0.049	0	0	0.0488	0.0488	0.0488	0.0488	0.05	0	0.04	0.02	0
P1'	0.142	301.6	0.13897	0.164	0	0	0.0718	0.0718	0.0718	0.0718	0.15	0.045	0.102	0.099	0.112
N2'	0.122	316	0.19895	0.181	0	0	0.176	0.176	0.176	0.176	0.17	0.067	0.073	0.08	0.219
NU2'	0.024	318.7	0.04757	0.031	0	0	0.042	0.042	0.042	0.042	0.033	0.013	0.014	0.016	0.042
K2'	0.046	38.7	0.1099	0.082	0	0	0.064	0.064	0.064	0.064	0.07	0.024	0.033	0.033	0.098
L2'	0.017	356	0.0378	0.0465	0	0	0.051	0.051	0.051	0.051	0.02	0.01	0.01	0.011	0.031
2N2'	0.016	296	0.019	0.02	0	0	0.01	0.01	0.01	0.01	0.02	0.009	0.01	0.011	0.029
MU2'	0.015	-82	0.0304	0.01	0	0	0.01	0.01	0.01	0.01	0	0.006	0.008	0.008	0.024
T2'	0.01	31.7	0.0279	0.012	0	0	0.0215	0.0215	0.0215	0.0215	0.015	0.005	0.007	0.007	0.021
M4'	0.021	0	0.0397	0.03	0	0	0.0179	0.0179	0.0179	0.0179	0.01	0.024	0.007	0.01	0.037
MS4'	0.009	0	0.031	0.03	0	0	0.019	0.019	0.019	0.019	0.01	0.027	0.007	0.01	0.03
'2MS6'	0	0	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0

Table 4. The Tidal Period List for the Station constituents

	Mina AL-Ahmadi	Mina Al-Zour	Mina AL-Shuwaikh	Ras AL-Barshah	Warba Spitt	Shatt Al-Arab	Jazireh Auhah	Jazireh Kubbar	Jazireh Qauruh	Khasab, Hormoz	Al-Fujayrah	Dubia (U.A E)	Bushehr, Iran	Jazireh Ye Lavan , Iran	Bandar Abbas, Iran
M2'	335	336	343.22	330.54	343.3	308.4	320.07	320.07	320.07	320.07	302	10	211	73	298
S2'	42	34	45.55	35.31	57.4	8.6	345.06	345.06	345.06	345.06	313	70	265	111	334
K1'	308	305	310.49	300.83	306.3	295.4	78.15	78.15	78.15	78.15	46	179	279	145	64
O1'	257	259	261.15	254.81	263.8	247.1	74.72	74.72	74.72	74.72	62	165	238	114	52
SA'	0	0	139.91	0	0	0	0	0	0	0	0	0	142	0	0
'SSA'	0	0	242.36	0	0	0	0	0	0	0	0	0	0	0	0
MM'	0	0	100.64	0	0	0	248.33	248.33	248.33	248.33	233	0	0	0	0
MSF'	0	0	255.92	0	0	0	348.47	348.47	348.47	348.47	9	0	0	0	0
MF'	0	0	7.03	0	0	0	0	0	0	0	0	0	0	0	0
S1'	0	0	68.73	133.68	0	0	0	0	0	0	0	0	0	0	0
Q1'	0	239	242.38	227.64	0	0	77.92	77.92	77.92	77.92	70	0	220	88	0
P1'	304.2	301.6	301.39	315.61	0	0	77.67	77.67	77.67	77.67	46	178	275.9	142.7	63.1
N2'	311	316	311.54	288.72	0	0	299.12	299.12	299.12	299.12	294	335	183	44	280
NU2'	314.2	318.7	308.55	289.14	0	0	307.41	307.41	307.41	307.41	295.1	-20.3	186.8	47.9	282.4
K2'	47.4	38.7	31.6	34.3	0	0	349.09	349.09	349.09	349.09	313	74.9	269.4	114.1	336.9
L2'	359	356	14.16	333.23	0	0	352.89	352.89	352.89	352.89	269	45	239	102	316
2N2'	287	296	256.83	250.47	0	0	283.39	283.39	283.39	283.39	237	-60	155	15	262
MU2'	-92	-82	98.09	66.02	0	0	3.6	3.6	3.6	3.6	0	-50	157	35	262
T2'	39.3	31.7	53.52	218.39	0	0	358.53	358.53	358.53	358.53	312.6	67.6	262.8	109.5	332.6
M4'	50	0	178.9	224.47	0	0	217.84	217.84	217.84	217.84	164	6	327	1	156
MS4'	185	0	272.14	280.43	0	0	270.72	270.72	270.72	270.72	212	46	26	48	246
'2MS6'	0	0	71.32	7.18	0	0	0	0	0	0	0	0	0	0	0