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Numerical Modeling of Flow Pattern Changes in Tidal Inlet of TIYAB Port

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Abstract: Inlets are as environments connecting the sea and small water bodies, Commercial and recreational vessels require secure channel in entrance to pass through the sea ports, so inlets can be important. Hydrodynamic characteristics of the inlet are varied. These conditions in relatively simple terms include changes in tidal water level to form a complex in which the combined effects of tides, wind waves and wind stress and fresh water entering the system make certain effects. TIYAB Inlet entrance is located 7 km north-east of the Strait of Hormuz. In this study, using field studies, including changes in water level, velocity and direction of currents, hydrography, boundaries and other required information, the pattern of use of bundle MIKE21 HD models and simulations are discussed 's. Comparison of model outputs with field data shows that the model is highly desirable to be able to simulate the tidal current pattern is in the loch. Sediment at the bottom of the main reasons was worthy of further analysis.

Keywords: Inlet, model of HD, tidal current, TIYAB port

INTRODUCTION

Several methods for evaluating hydrodynamic characteristics of estuaries, bays and lakes are present, analytical methods, numerical and physical models can be used for this purpose, but each of these options, in addition to benefits the disadvantages are that they are challenged to take advantage of them. Need to be versed in all the formulas and theories related to the problem, analytical procedures and problems of scale and ignoring some parameters, physical and laboratory methods, when the cost of economic and mathematical model, in comparison with other methods due to lack some of the problems mentioned above can be justified.

Ever more sophisticated numerical models to simulate the hydraulic and hydrodynamic problems are developed or developing. One of these models is that the MIKE21 Bundle ten years researchers Danish Hydraulic Institute (DHI) is. This model is a powerful tool for the analysis of sea conditions. Under this powerful software application is envisaged that this software is fundamental to other modules, so that the other modules of the software without implementation are not possible. The hydrodynamic module or the HD (Hydrodynamic Module) is called a feature that is capable of all hydraulic and hydro-dynamic problems in various environments such as estuaries, lakes, shallow coastal areas, estuaries, bays and seas the best possible results as time-varying simulation has to offer.

Shafieefar and Taghizadeh (2002) have investigated and analyzed the sediment transport in Khoor region and Genaveh port using Mike21 numerical model. In this study, by using the obtained information, solutions have been proposed to deal with the problem of sedimentation in Khoor region and Genaveh port.

Babu *et al*. (2005) have simulated and investigated tidal current in Kachchh located in southwestern India using hydrodynamic Mike21 mathematical model. These researches have validated the results of their model using field information of the obtained currents in three different times; and the obtained results of the model were in good agreements with the field information of currents.

Azarmsa and Vasel (2006) have examined the process of sediment transport in Pazm gulf using Mike21 software. Thus, the overall pattern of waves and currents has been evaluated before and after breakwater construction in the gulf.

Jamnany and Jahromi (2008) examined the process of sedimentation in tidal channels and strategies to reduce it.

Sadeghi *et al*. (2010) investigated the numerical model for cohesive sediment transport within the Qeshm channel began using MIKE21 model. Sensitivity analysis with respect to wind, wave, tidal effects are the cause of the prophet in the show. The results show higher concentrations of sediments in the west channel. Among the important results of this modeling, defining areas of deposition and erosion is the Qeshm channel.

MATERIALS AND METHODS

Scope of the study: District TIYAB one of the six villages in the province is located in the central part of

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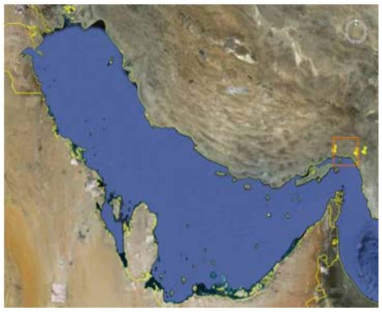

Fig. 1: The TIYAB port range near the city Minab

the city MINAB. Villages of the district center at 21 km West of Port TIYAB MINAB 52° 56´ to 56° 59´ latitude north and 27° 01´ to 27° 16´ longitude east. These villages to the North and East Suburban District, south of the East Village Bndzrk, Gulf of Oman to the south and southwest of the Village of West and Northwest Shamil (the city of Bandar Abbas) is limited. Terrain in the rural areas can be 7 km southwest of the Strait of mangrove forests near the West Village and Village Center cited. Also nearby villages TIYAB beach sediment and sand dunes are composed of a large number of tabs that are contained within an area of about 10 km. TIYAB worthy of including in the vicinity of the North Central District, fit the 2.5 km south of the village center and 5 km South West of Village Creek KOLAHI cited. In Fig. 1 and 2 shows the TIYAB Port range and the path from the dock to the mouth of the estuary TIYAB.

Introduction to model Hydrodynamic Module (HD): MIKE21 HD module system is the foundation for all other modules, so that no preliminary modulus hydrocarbons provide HD basis for performance calculations in the framework of other software modules including MT, AD, WQ, ST.

Status of water level and flow in lakes, estuaries, bays and coastal areas (including the effects of changes in the wind and tide) by this module are modeled. To define some parameters, such as substrate roughness coefficient, friction, wind and all the momentum distribution can be considered as a calibration coefficients and applying the appropriate boundary conditions, to provide data on wind conditions and hydrographic area (points on the network covering the range model) and the profile indicates the water level, the model can be achieved.

Implementation of the hydrodynamic model: Modeling of regional model of the Gulf of Oman to the Persian Gulf port of Chabahar and the entire range is selected. The main reason for choosing this range, as the range of tidal flow modeling, if there is enough space between the boundary of the model range and more reliable information on the boundary model, (Region CHABAHAR) is.

Local model range is selected so that Place TIYAB worthy enough and deep water away from the lateral boundaries and the position of the shoreline in the estuary and beach parties with high accuracy is considered. Range considered for the modeling is shown in Fig. 3.

Models' elements: To increase the accuracy of project and save the time required for the numerical simulation and purposeful use of deep seabed data, Mathematical model used to design a flexible mesh generator capable of benefiting from and the area around the study site

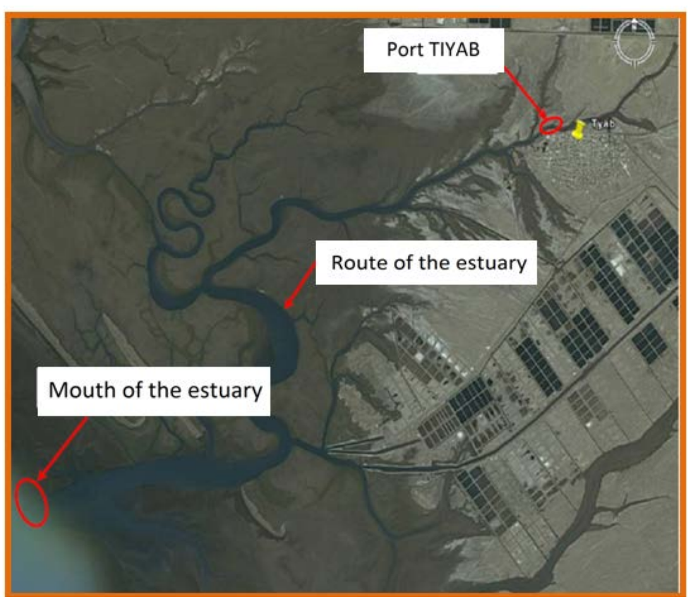

Fig. 2: The path from the dock to the mouth of the estuary TIYAB

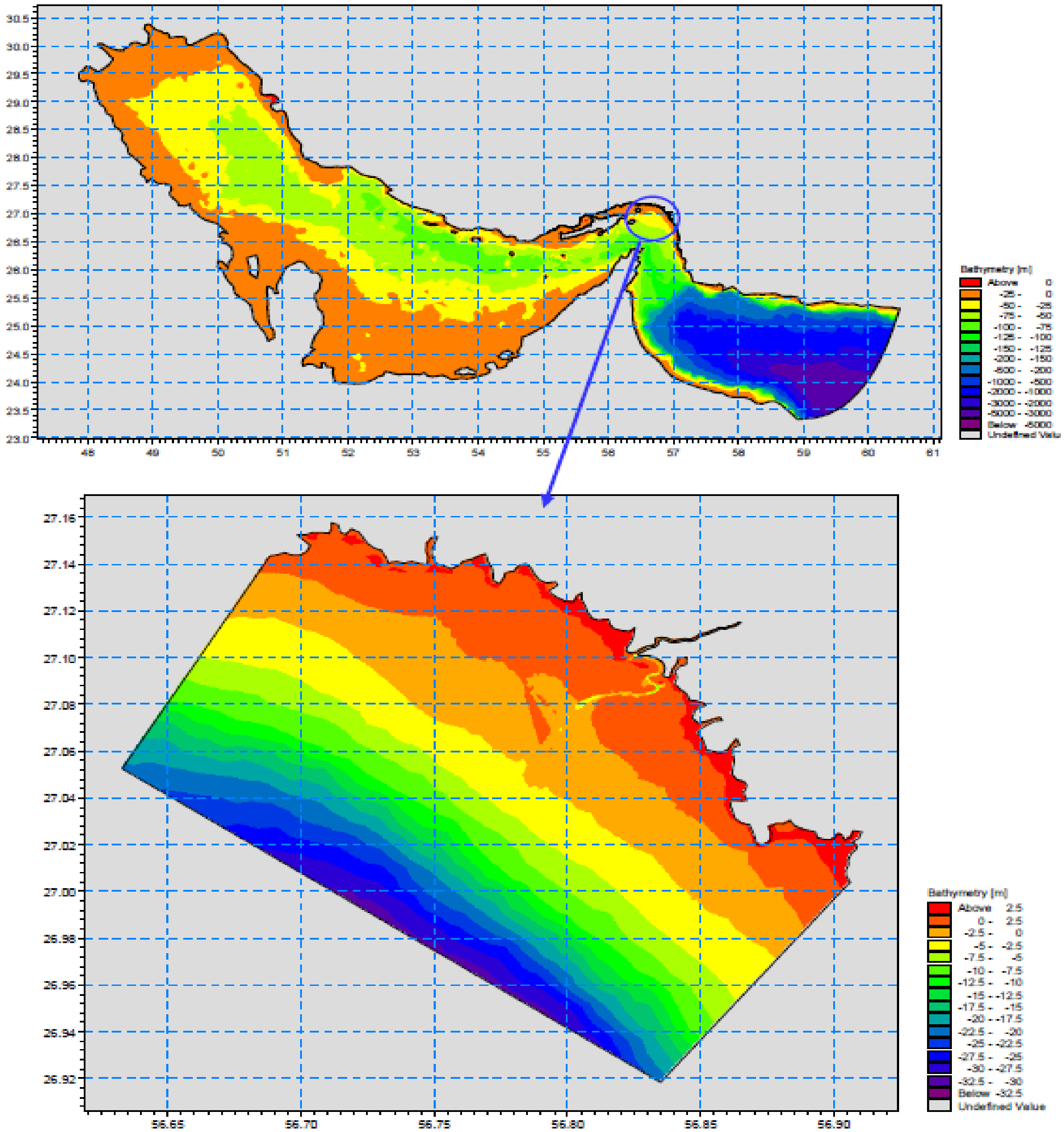

Fig. 3: Model of regional and local

and the coarse mesh size within the range of elements of smaller and more carefully selected.

Pointed at both regional and local TIYAB desired area compared to other areas with finer mesh is selected. Accordingly, the model is meshed with 35,489 elements and 19,448 nodes and computational mesh with 13431 elements and 7079 nodes local model calculation has been performed. It is appropriate to increase the accuracy of the smallest element in the range to 20 m in length and has a local model. Figure 4 shows how the regional and local mesh models are proposed.

Model boundary conditions: Hydrodynamic boundary region is chosen to define the position of the availability of accurate and reliable information on having a sufficient distance from the extracted features and the entire range of the regime's strict tidal currents the plan is possible with good accuracy.

Hence, selecting and testing a variety of situations such as the Strait of Hormuz, CIRIC, Jask and Chabahar as the local model boundary, the position of martyr Beheshti port in Chabahar Bay was chosen as the location of the northern boundary of the model. South Point border location has been chosen so that the

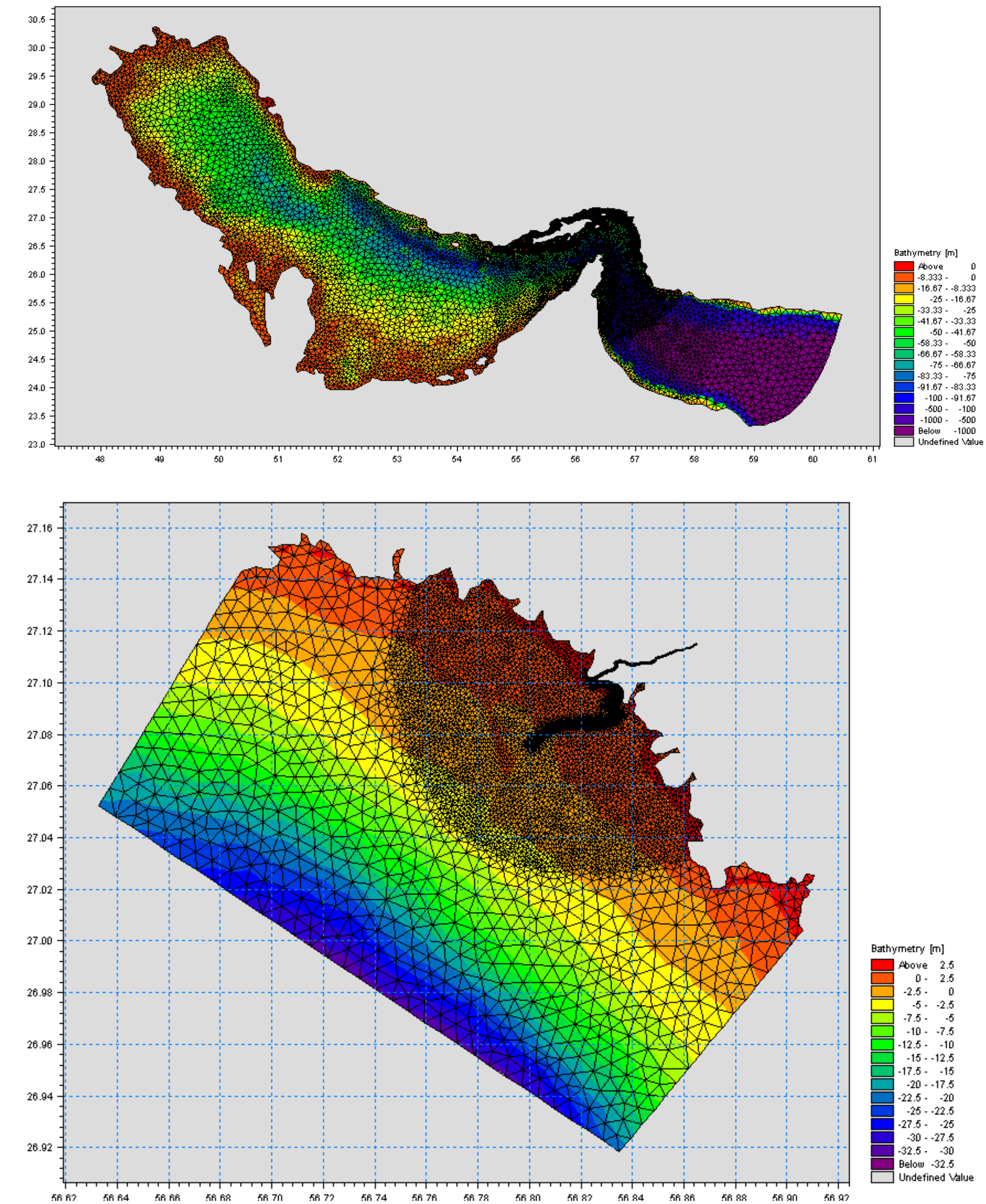

Fig. 4: Regional and local mesh models

boundary model is perpendicular to the direction of tidal currents.

Water level changes in the position to take advantage of the southern boundary of the designated.

And the introduction of boundary conditions, the water level changes along there, but the experience gained from projects conducted in Iran showed that Constant water level changes over time and better

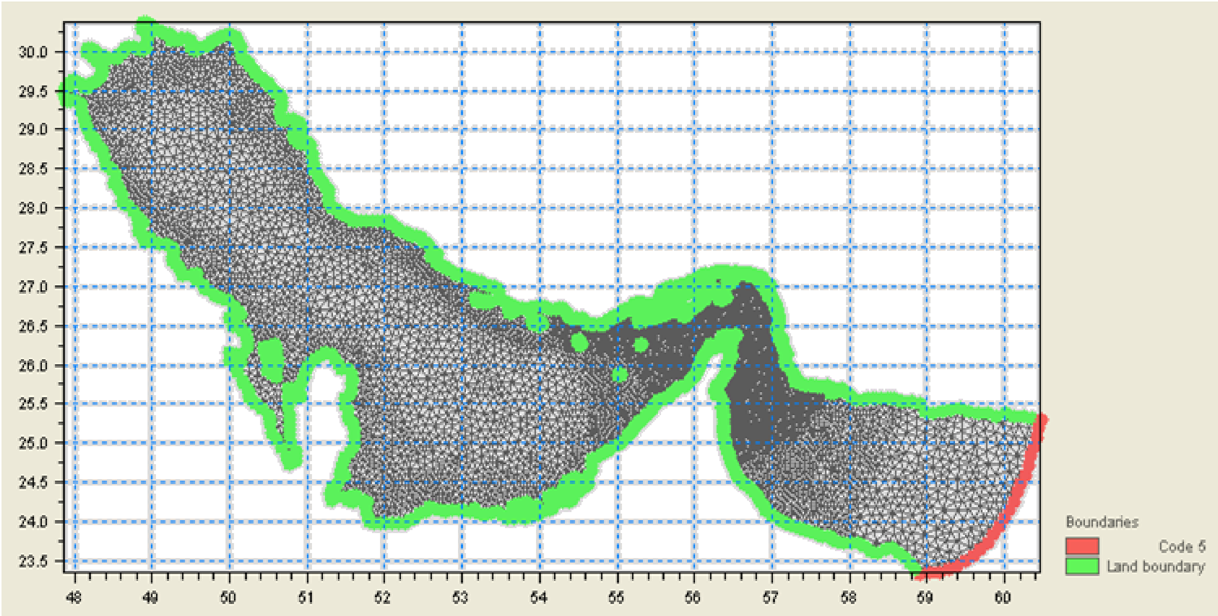

Fig. 5: The model of choice for regional boundary position

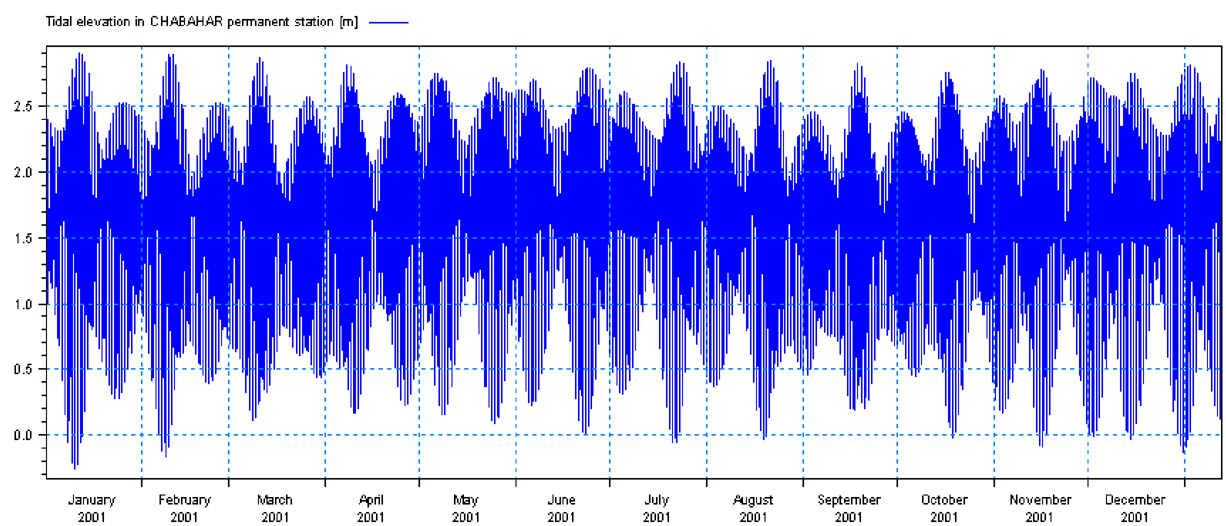

Fig. 6: Time series of tidal elevation martyr Beheshti port of Chabahar (regional model boundary information)

results for the entire border line with reality for Iran's coast offers.

Model of choice for regional boundary position and changes in water level in the tidal information in the form of Chabahar fixed station is shown in Fig. 5 and 6.

Local model boundary conditions are derived from the results of the calibrated model. Choice of location and type of boundary conditions for the local model is shown in Fig. 7.

RESULTS AND DISCUSSION

Model validation: In order to ensure the results of the modeling study, the results of the models to be used for measurements of water level and flow rate control and, if necessary, with appropriate parameters differences between model results and measurements, to reach an acceptable range reaches a minimum. The difference between measured and simulated results can be obtained by modeling the experimental parameters used in this case; select the appropriate value according to the measured data can be greatly relieved of the dispute.

The model was calibrated by varying the roughness coefficient (Manning's coefficient) values in the range of recommendation and implementation of the model for a given time span (January 2001) and compare the results with the results of the model for different roughness values predicted water level at various points in the interval when done.

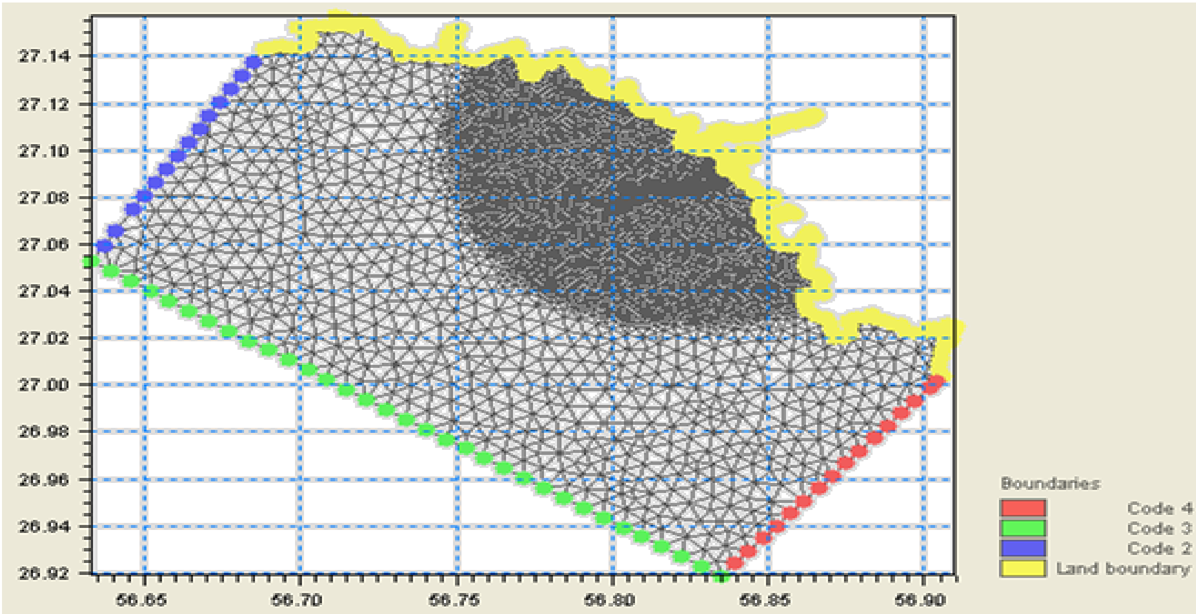

Fig. 7: Location and type of boundary conditions selected for local modeling

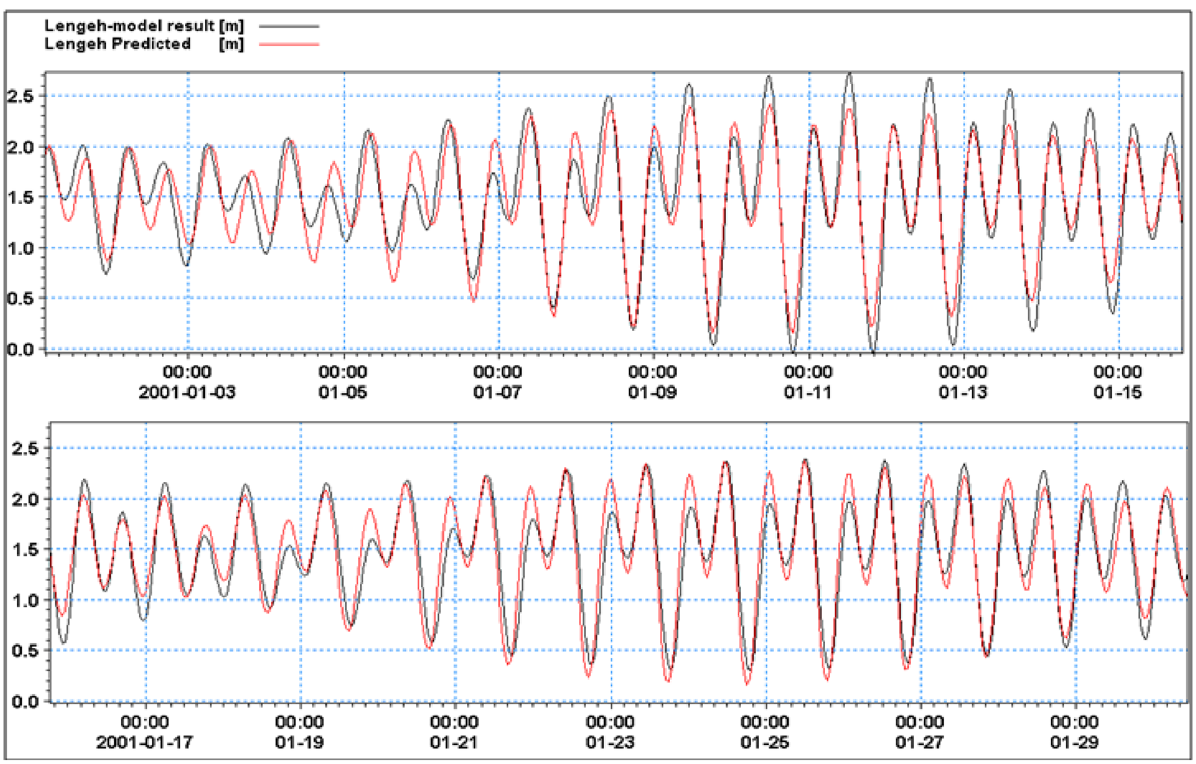

Fig. 8: Comparison of model results and predictions made for the water level station LENGEH

With regard to compliance, the results of the model for different values of the coefficient of bed roughness prediction made the Manning coefficient of 60 for the selected mathematical model designed with the amount of runs. Comparison of model calibration results tidal water levels from the corresponding values predicted by the model and the measurements were taken is presented in Fig. 8 and 9.

Analysis of responses: After calibrating the model tidal area and ensure its accuracy, the model was run. Define the model selected time period is almost over a

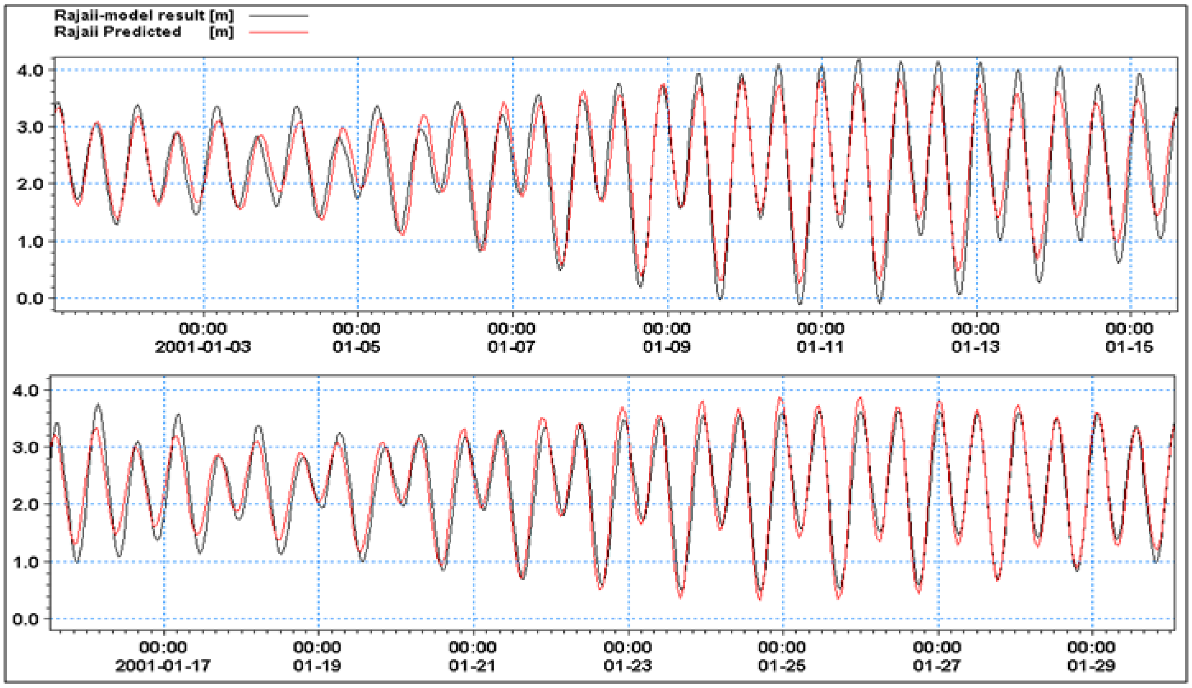

Fig. 9: Comparison of model results and predictions made for the water level station martyr Rajai Port

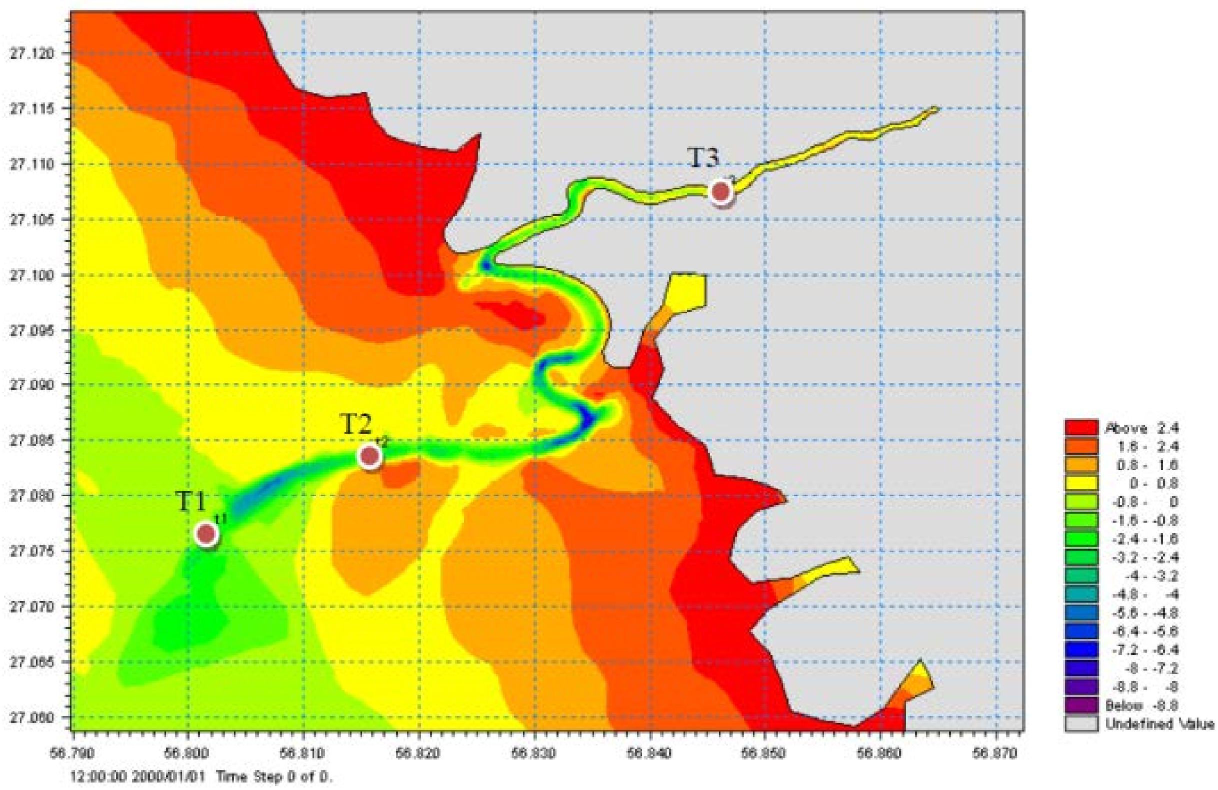

Fig. 10: Location of the estuary to extract modeling results

year, is the largest tidal amplitudes. After running the model, a local model results in a profile of the speed and direction of currents and tidal currents in the whole range of models can be mined locally. The results for samples were collected at a number of locations along the estuary mouth. Status points are extracted to

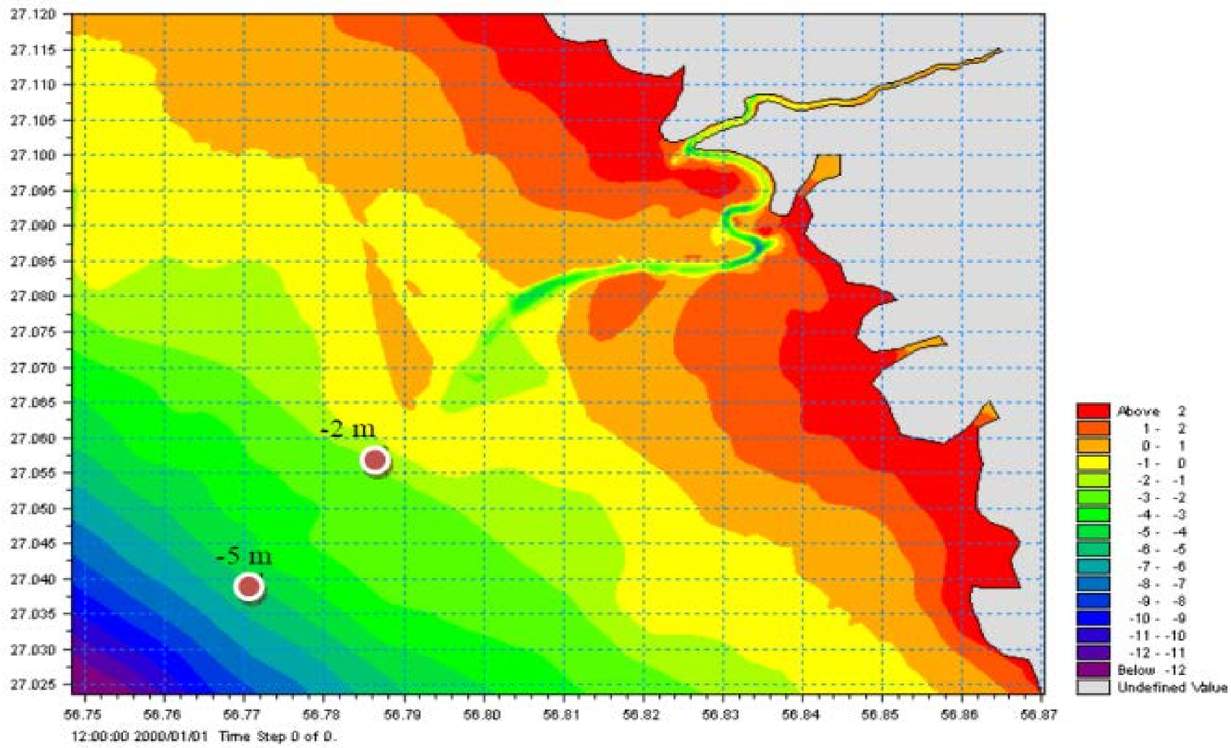

Fig. 11: Results of the fit to extract the desired

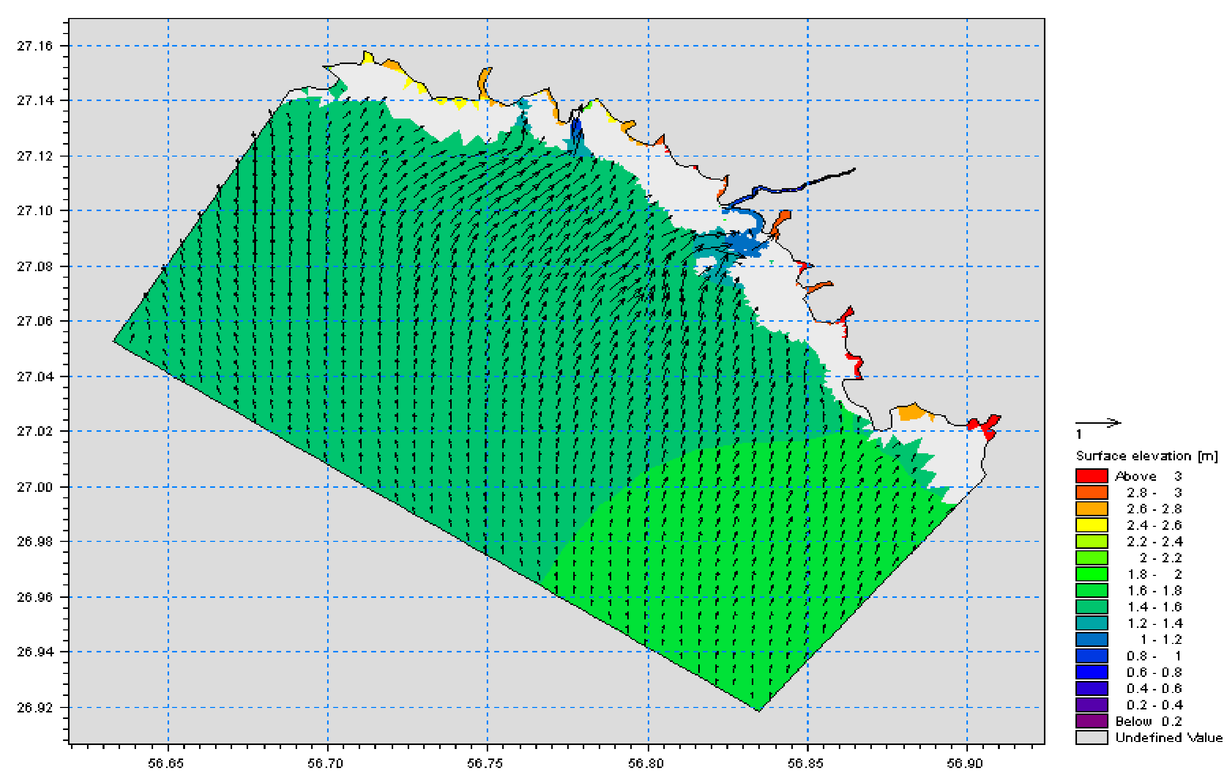

Fig. 12: An example of a two-dimensional model of tidal currents in design area in flood state

provide hydrodynamic modeling results are presented in Fig. 10 and 11.

Tidal currents in the range of two-dimensional template design are shown in Fig. 12 and 13.

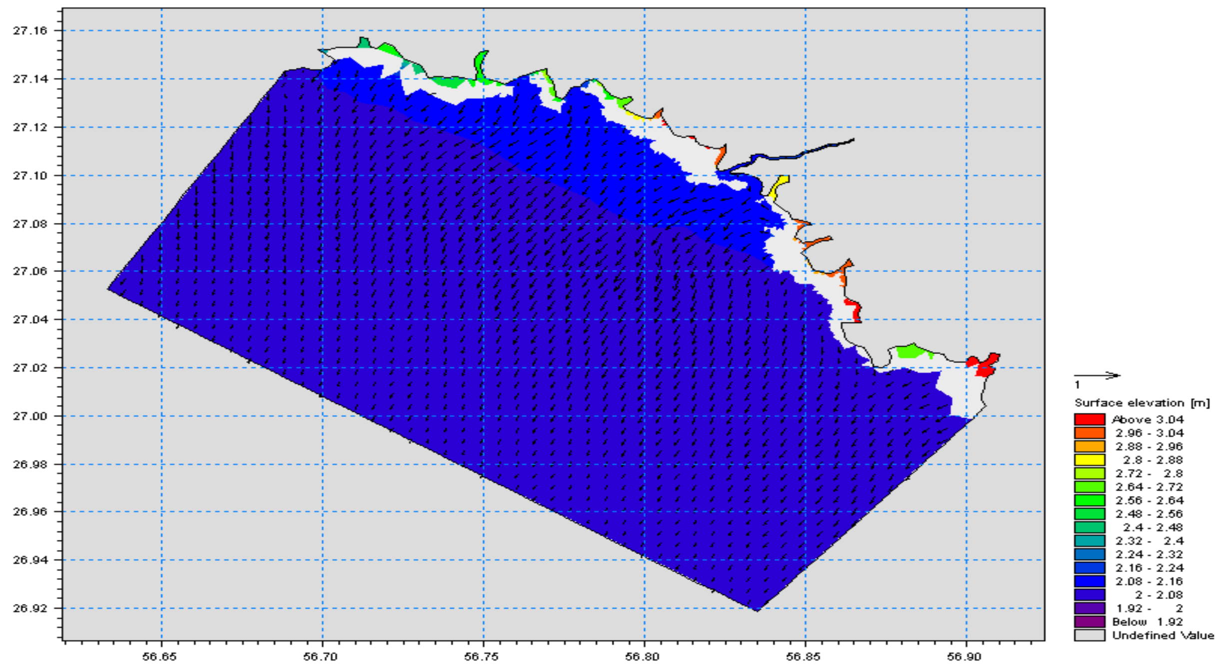

Fig. 13: Example of a two-dimensional model of tidal currents in the ebb range plan

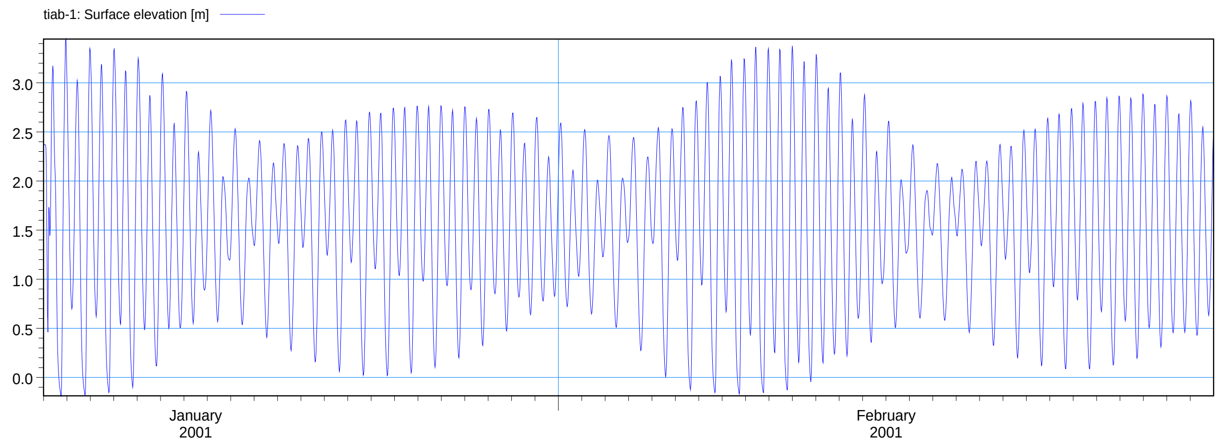

Fig.14: Water level changes in the study area

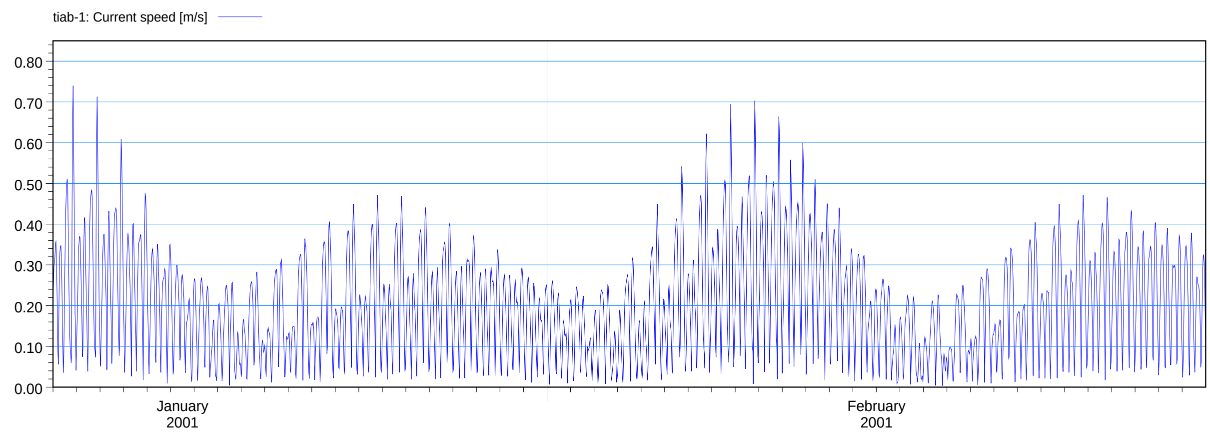

Fig.15: Changes in the estuary of the river flow rate at the beginning (T1)

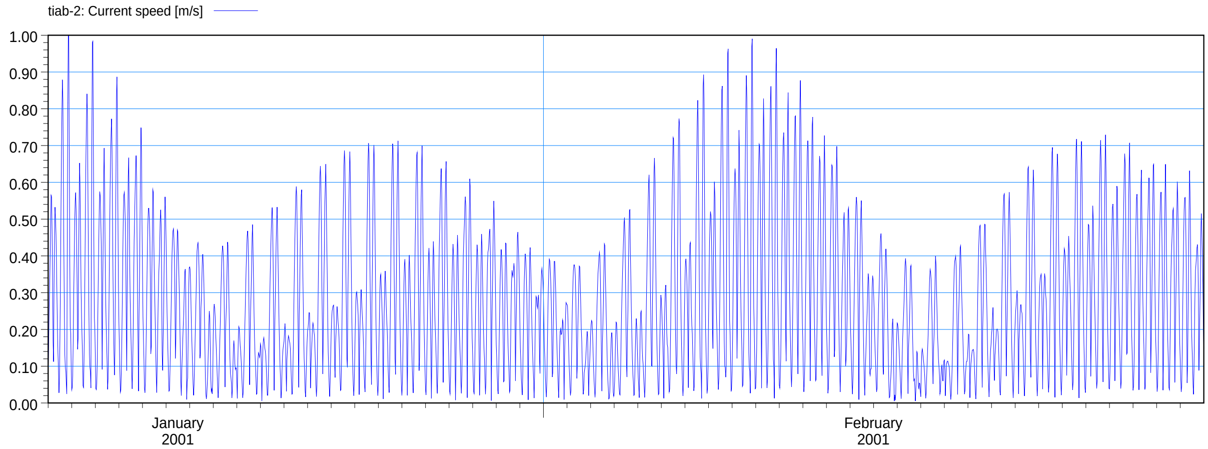

Fig.16: Flow velocity changes in internal point along the estuary near the mouth (T2)

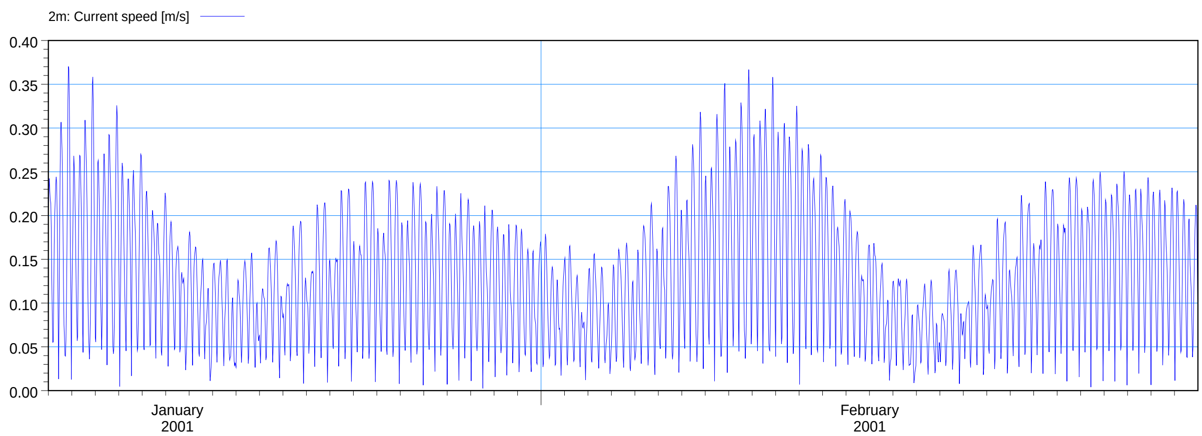

Fig. 17: Flow velocity changes in internal point along the estuary near the mouth (T3)

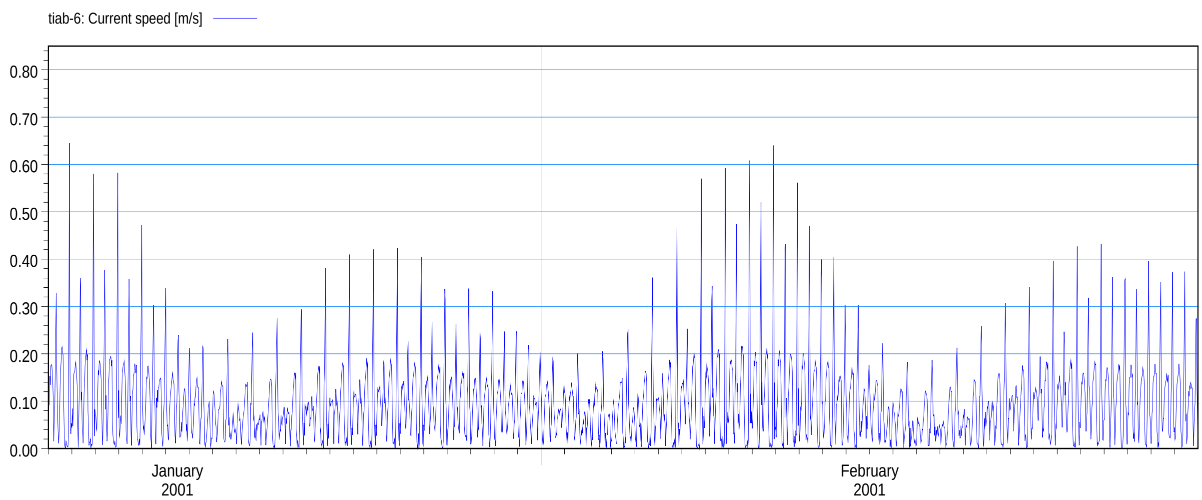

Fig. 18: Changes in the flow rate of the feed point at a depth of-2 m

In Fig. 14 you can see the changes in water level in the study area. Also the flow velocity changes in different parts of the estuary are presented in Fig. 15 to 18.

The results of the modeling of water level variations in different parts of the study area are almost identical up to about 2/3 m reaches the CD. Maximum velocity near the mouth of the estuary approximately

Table 1: Limit values of the flux across the computational model

Point	The maximum flow rate during high tide	The maximum flow rate during low tide
T1	74.0	0.52
T2	01.1	0.89
T3	64.0	0.22
-2 m	37.0	0.33

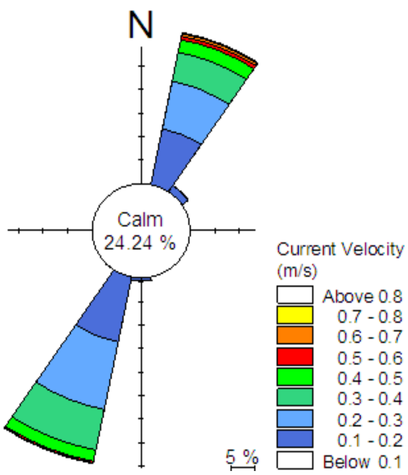

Fig.19: Flow flower creek trailhead (T1)

7m is calculated with the entry into decline due to cross-flow velocity increases and reaches the point T2 of about 1 m/sec. However, this rate will not fit in all places and at different times depending on the depth and width of the estuary varies. Computational flow rate values in some parts of the model are presented in Table 1.

Velocity model of the mouth of the estuary during periods 2 and 5 m deep in the CD are shown in the following figures.

As seen in these figures, the maximum rate of flow out of the estuary at depths of 2 and 5 m, respectively and decreased to about 0.37 and 0.33 m per second, it also can be considered as one of the causes of sedimentation in the estuary entrance.

Mud flows related to defined points in the Fig. 19 to 22 are presented. The goal of the current in the estuary is indicating the direction of the prevailing currents along the route considered. T1 at the estuary of the river is beginning to flow predominantly along the north-east-south-west, which is roughly perpendicular to the shoreline. Approximately 24% of the velocity at this point during the year is less than 0.1 m s.

Out of the mouth of the estuary and in the depths of 2 and 5 m, continues to dominate the

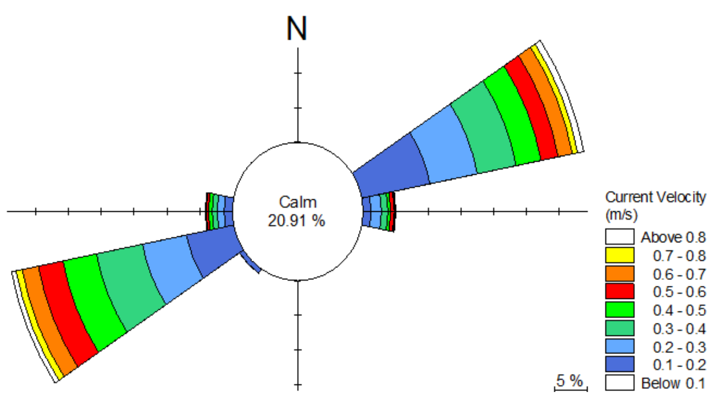

Fig. 20: Flowers in the interior point along the estuary near the mouth (T2)

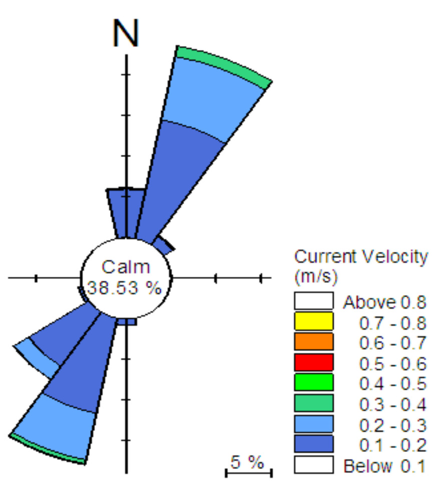

Fig. 21: Flowers in the interior point along the estuary (T3)

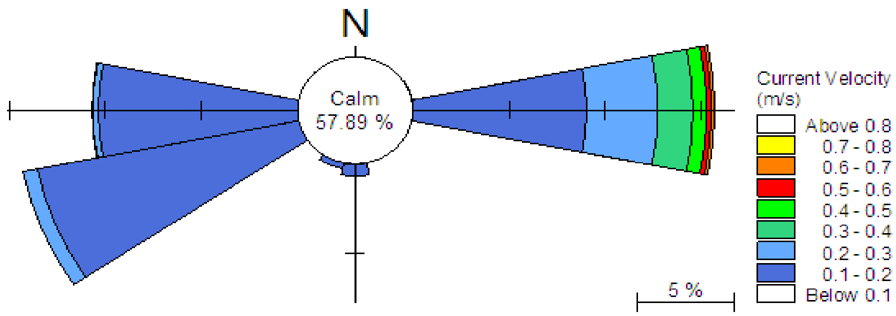

Fig. 22: Flowers in the appropriate spot on the outside with a depth of-2 m

northeast-south-west and is perpendicular to the shoreline. Increasing relaxation time (the speed) on the outside of the inner parts of the estuary about 24 to 40%, which is also confirmed this. In addition to reducing the amount of feed rate of relaxation increased flow velocities that can cause additional fouling and shallow mouth of the estuary.

CONCLUSION

In this study, numerical simulations of the flow in the inlet opening 7 km north-east of the Strait Creek TIYAB using field studies, including changes in water level, flow rate, hydro and other required information within the graph using the HD MIKE21 software package was used.

Comparison of model outputs with field data shows that the model is highly desirable to be able to simulate the tidal current pattern is in the inlet. The results of this study showed that by leaving the estuary area decreased maximal velocity of 5 m deep and 2, respectively, about 0.37 and 0.33 m, this can be considered as one of the causes of sedimentation in the estuary entrance.

Also, out of the mouth of the estuary and in the depths of 2 and 5 m, continues to dominate the northeast-south-west and is perpendicular to the shoreline. Increasing relaxation time (the speed) on the outside of the inner parts of the estuary about 24 to 40%, also confirmed this is a worthy addition to reducing the amount of outside speed of the flow velocities increased comfort Because of the deposition of additional shallow crater that can be considered.

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