Development of tidal current analysis and visualization software

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Present development consists tidal current analysis software for current data visualization in more précised and desired format. This software provides facility to generate report and records of current data for various marine and coastal research studies. Software is generic, user friendly and platform independent, developed in Visual Basic Dot Net Framework (VB.Net). It can be used as a first hand tool for research studies in marine and coastal environment like navigation, waste and sewage disposal, accidental releases and dye experiment.

Keywords: Tidal current, Visual interpretation, Software, Costal management

Introduction

Tidal current data is important in regulating the distribution of marine species, designing of marine structure and also for the generation of electric power as a renewal source of energy. Tidal current data is vital in coastal management including delineation of coastal boundaries and framing guideline for save fishing, sea-sports and marine ecological management.

Many of the available softwares developed for tidal data analysis and management, are complex to handle and platform dependent. The existing tools and software are also not capable to visualize the movement of current (direction) during low and high tide in a proper understandable manner and format. Present software provides single window interface for drawing the current magnitude as well as its direction for better understanding and analysis in simple format. Visualization is of particular importance to analyze the drawn information regarding tidal current pattern over a period of time. Present software is developed in Visual Basic Dot Net Framework (VB.Net) in user interactive and platform independent way. Software analyses tidal current data through graphical representation in the form of sine wave for velocity and direction vector for current direction. Graphical representation can be saved in image format. The software also generates report to keep records of current data in the text format. Software is generalized and could be utilized for current data analysis of any coastal region.

Materials and Methods

Software Operation

The overall flow of information and software operation is presented in data flow diagram as shown in Fig 1. The software comprises of the following modules:

1. User registration and login
2. Data input
3. Analysis and visual interpretation
4. Report generation

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Fig. 1—Data flow diagram
User registration and login
The software checks for user authorization, as it is started. Registered user provide username and password and could proceed for further processes, otherwise user.

Data input
This module provides a facility to browse current data stored in the computer system either in excel or text formats (Fig. 2). After selection of particular current data, the information is displayed in software worksheet.

Results and Discussion
Analysis and visual interpretation
Software provides facility to process and visualized the current data in graphical format. Graph represents information of current data with respect to current velocity and direction along with other details namely study area, latitude and longitude of current measurement location and scale of the graph. Direction of current is represented in degrees taking north as zero degree through direction vector. Graph represents the time on x-axis and velocity of the tidal current on the y-axis (Fig. 3). User can view the current velocity and its direction anywhere on the plot by clicking on respective location at zoom level (Fig. 4). Software also facilitates customization of scale, graph color and line thickness as per user requirements. For example, user can change the background color by clicking on ‘change color’ option from “Graph” menu. User can also change the colour and thickness of line by right clicking for better representation of the graphical output. Generated graphs can be exported in user desired image formats like jpeg, tiff etc.

Report generation
Software provides facility to keep track of previous current data through generating reports in customized format (Fig. 5). Report comprises of velocity, direction, time, date and geographical location of current measurement.
Fig. 3—Visualization of current velocity and direction

Fig. 4—Current velocity and direction at zoom level (point a and b).
Conclusion

Present software is a platform independent and user friendly tool for current analysis. It provides visual interpretation of current data over a period of time which could otherwise be difficult to analyze in textual format. Software visualizes the current velocity and direction in a single window for better understanding of current data. It is also possible to integrate the software application with some tidal current monitoring device, so that it could analysis current velocity and direction in real time scenario. Software has been tested at various location in the west coast of Mumbai for current data analysis and visualization. Visual interpretation of current analysis software can serve as a first hand tool for research studies in marine and coastal environment like navigation, waste and sewage disposal, accidental releases and dye experiment.

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