HYDROmap™

Integrated Hydrodynamic Modeling System

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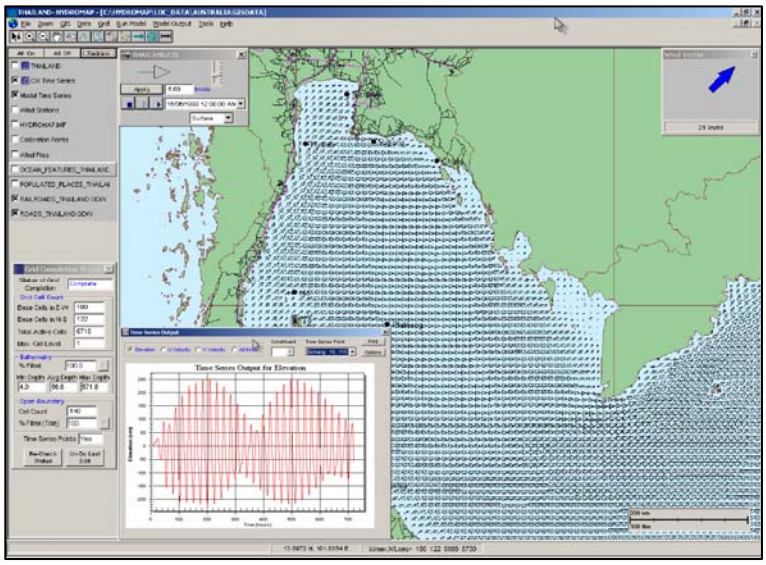
Introduction



HYDROMAP is a globally re-locatable hydrodynamic model. It generates reliable current predictions for any location on the globe. HYDROMAP is designed to compute water circulation for the management and operation of both simple and complex ocean/coastal sea systems.

HYDROMAP is a user-friendly, fully dynamic, 3D modeling system featuring an intuitive graphical user interface under Microsoft Windows™. It is controlled by a variety of pull down and point and click operations, which allow the user to construct simulations without writing any formal code.

Currents generated by HYDROMAP can be automatically linked to number of ASA specialized software products to assess a variety of environmental impact (i.e. oil spills, chemical spills, search & rescue, dredge spoil).

Applications of HYDROMAP:

- Currents for complex coastline geometry, river-estuarine system and coastal shelf simultaneously.
- Current data files for other ASA models.
- Hindcast/forecast current simulations.
- Educational purposes.

HYDROMAP has been used to generate currents for many parts of the globe including: Caspian Sea, Hong Kong, Singapore, West Coast of Africa, West and East Coast of the United States, Trinidad, Sakhalin (Russia), South America and Australia.

HYDROMAP was also used to generate currents for the Gulf of Thailand, as input into ASA's discharge model, MUDMAP. The two systems were used to predict the settlement of drill cuttings and drilling muds from a proposed exploration well in the Gulf as part of the exploration permit process.

Features

Geographic Information System (GIS)

The GIS uses the Microsoft Access™ Database to store information for each GIS object. The GIS engine supports display of ARCVIEW/ARCINFO shape files directly, as well as HYDROMAP Native GIS formats, and provides import tools for MAPINFO (MIF/MID) export formats.

Digital Maps

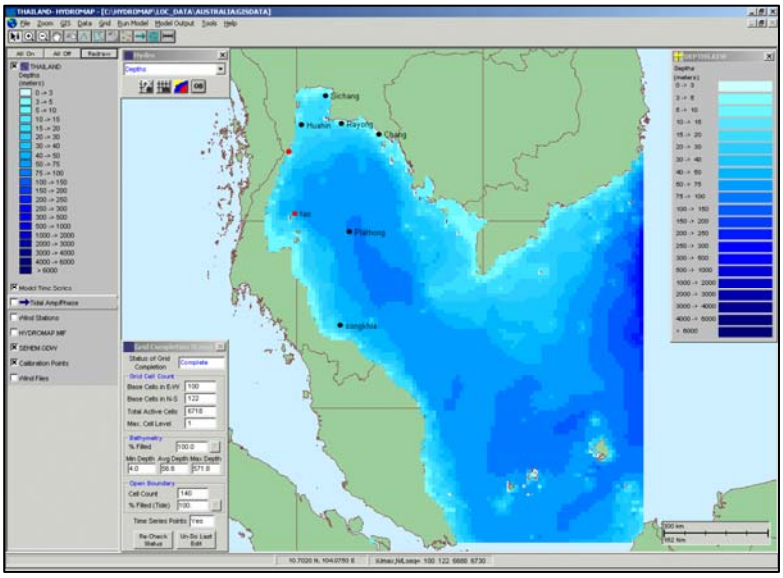
Versions of HYDROMAP are also available that support commercial nautical charts including:

- ArcView (shape files)
- MapInfo (mif/mid files)
- BSB NOAA Charts
- MapTech Charts
- NDI Charts
- NOS Charts
- British Admiralty (ARCS) Charts
- S57 Electronic Navigation Charts (ENC)

HYDROMAP may also be provided with a global map database CD. This allows users to immediately set up new areas anywhere in the world from the Digital Chart of the World (DCW), the World Vector Shoreline (WVS), or NOAA's medium resolution coastline (US only).

Depth Data

The HYDROMAP system is supplied with two world depth databases varying in resolution:
Etopo5 Depth Database – worldwide gridded data set with a grid spacing of 5 minutes latitude by 5 minutes longitude.



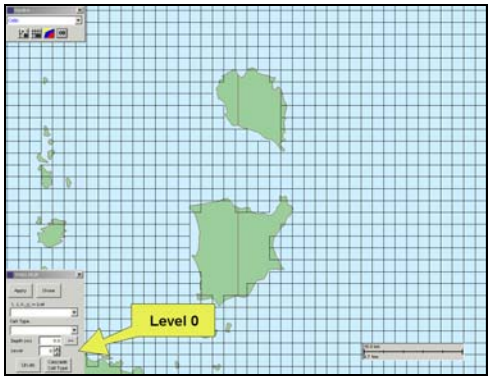
Etopo2 Depth Database – worldwide gridded data set with a grid spacing of 2 minutes latitude by 2 minutes longitude.

HYDROMAP is also equipped with tools for importing and editing bathymetric (depth) data available as random or regular depth readings (ASCII format). Tools are also provided to blend data sets from different sources that vary in resolution.

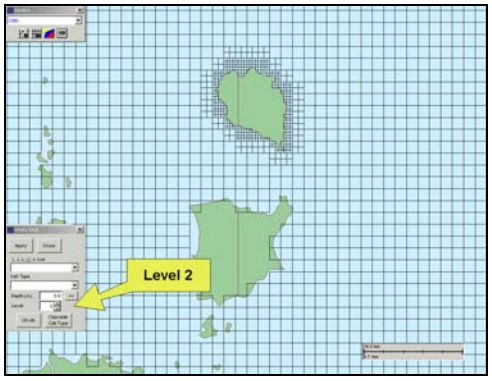
Gridding Method

HYDROMAP's unique gridding system allows the user to refine the resolution of the grid to incorporate complex coastal and river-estuarine system to be handled simultaneously with interaction from various ocean openings. The variable mesh gridding feature that is capable of managing the reduction in cell sizes in a consistent integer-stepped manner for up to six levels of resolution. This feature allows the user to simulate large areas of widely differing spatial scales addressed within one consistent model application.

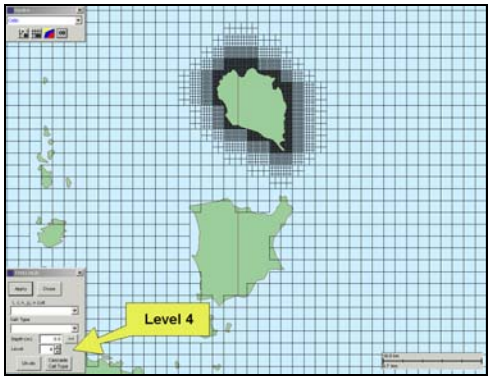
The following are examples of the variable mesh feature (levels 0, 2 & 4 shown) to resolve the coastal influence around an island in the Gulf of Thailand:



Level 0 mesh.



Level 2 mesh.



Level 4 mesh.

Data Package

The data required by HYDROMAP to grid and force simulations worldwide are: coastline definition, to define the land-water maps; bathymetry data, to define the depth of water cells in the grid; and open boundary forcing conditions.

Open Boundary Conditions

The HYDROMAP system provides the user with a number of options to assign open boundary conditions for a tidally-forced hydrodynamic simulation. These include: user prescribed input, input from a global tidal database, output from a previous HYDROMAP simulation and combining external circulation data.

User Prescribed Input

The user can manually enter or edit the amplitude and phase for eight of the major tidal constituents (M2, S2, K1, O1, N2, P1, K2, Q1, MF) for each open boundary cell.

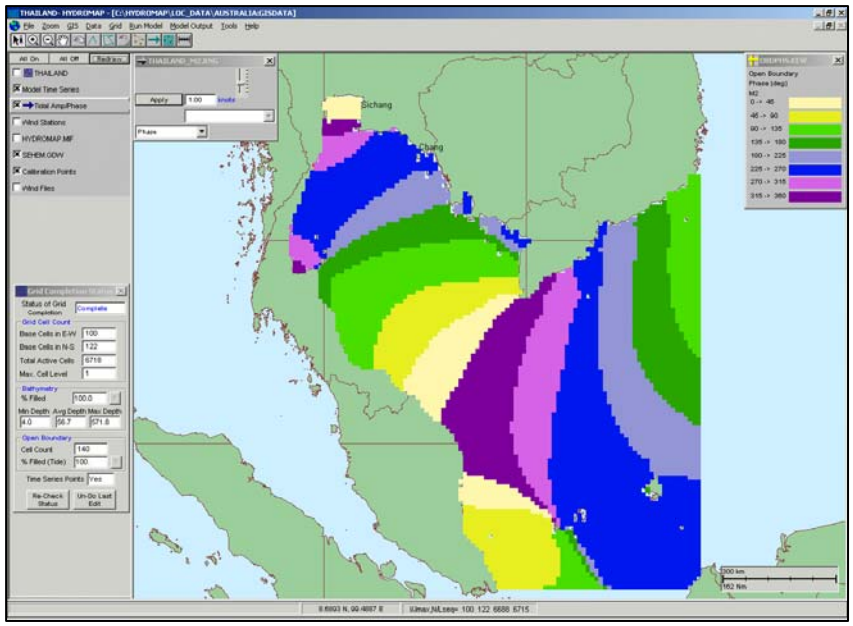
Global Database Input

The user can assign tidal amplitudes and phases from either the latest Schwiderski Global tidal constituents or Topex Poseidon (TPXO5.1) satellite data. By selecting either of the global databases, HYDROMAP will automatically assign the constituents to the grid (9 constituents for Schwiderski, 8 constituents for TPXO5.1) in order to calculate sea heights over time at the open boundaries of the model. Changes in sea heights are used, in turn, to calculate the propagation of tidal currents through the model region.

Schwiderski's global tidal model – worldwide estimates of the nine dominant tidal constituents (M2, S2, K1, O1, N2, P1, K2, Q1, MF) at a horizontal scale of 1 degree.

TPXO5.1 Satellite Data – worldwide estimates of the 8 dominant tidal constituents

(M2, S2, K1, O1, N2, P1, K2, Q1) at a spatial resolution of ½ degree between latitudes of 85.75 degrees South and 81.75 degrees North.



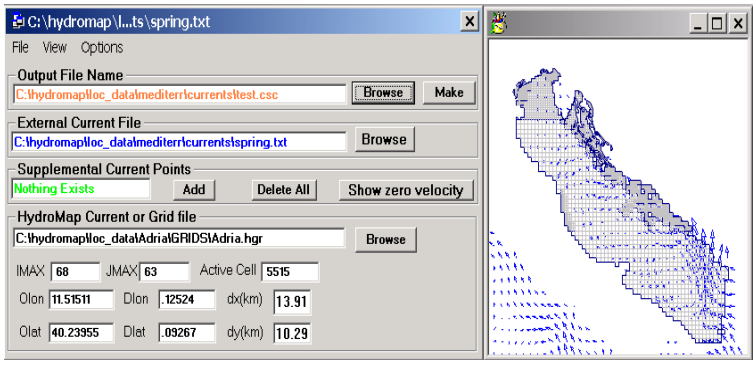
Using Previous Output

The HYDROMAP system also allows the user to assign open boundary conditions from a simulation covering a larger geographic area. By simply selecting the HYDROMAP scenario and the available tidal constituent to use, the user may create a smaller grid and increase the grid resolution closer to the area of focus, while still taking into account the larger scale oceanic circulation.

Combining external circulation data

A user may combine external circulation data from a number of sources, which are then concatenated with the tidal current predictions from HYDROMAP. This feature allows the user to account for non-tidal circulation, such as large-scale oceanic currents (e.g. East Australian Current, Leeuwin Current, The Indonesian Throughflow etc.).

HYDROMAP Spatial Resolution & Geographical Resolution

HYDROMAP has the capability of operating at a spatial resolution of 1 meter for each of the open boundary cells. The spatial resolution of the model during a given application is only limited by the resolution of the available bathymetric and tidal data sets and the geographic coverage that is required for the output

Publicly available sources of data can be either packaged with HYDROMAP or easily accessed through HYDROMAP tools.