

# Hydrodyn - POLSOFT



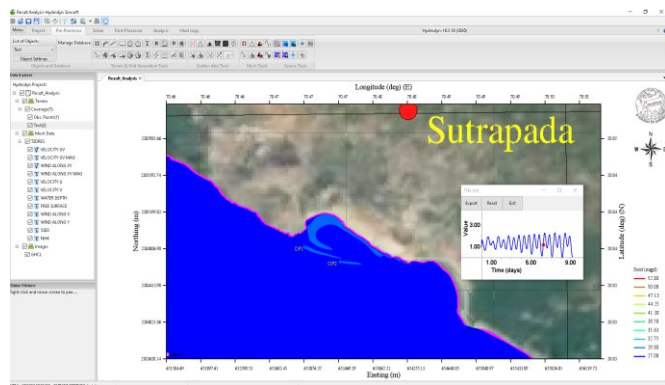
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*AD 2000+ Technology towards BC 2000 Nature*

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Water quality is closely linked to the surrounding environment and land use. The presence of contaminants and the characteristics of water are used to indicate the quality of water.

**Hydrodyn-POLSOFT** is an advanced software package, with a Graphical User Interface(GUI) consisting of pre-processor, multiple solvers and post processor that can simulate water quality parameter dispersion in oceans, rivers, seas and coastal waters of estuarial systems in a complex geometry with high precision using higher order numerical schemes.



POLSOFT provides rapid predictions of the pollutant dispersion in any meteorological and hydrological conditions. It includes user friendly graphical interface for entering both wind and hydrological data.

It also includes many specialized features of graphics and menu driven pre/post processor for setting up the input, running the calculation, and selecting and obtaining graphical output from the analysis, animation facilities etc. It allows fast, flexible creation and modification of computational models to reduce the possibility of errors in the input. It is available for Unix/Linux and Windows operating systems.

## GRAPHICAL USER INTERFACE FEATURES

Hydrodyn-POLSOFT provides interactive Graphical User Interface (GUI) which guides the user for defining topography, boundary locations, defining meteorological data options and preparing data base for ports, bridges and jetty constructions, selecting options for grid generation, specifying model parameters, selecting physical models, properties, boundary conditions and solvers, initialising the solver parameters, setting up solution controls, running the solvers, animation facilities, hard copy utilities and extensive on-line help facilities.

Post Processor assists the user for display of solver output results graphically. GUI options are available for plotting of contour maps and color maps of model properties, simulation results such as water elevations, pollutant concentrations, flux variation at different locations, plotting of flow velocity vectors, computational grid, residual velocities, time history plots, spill trajectory plots, animation facilities, setting background colors of pre and post processor screens etc. GUI's Hard copy utilities helps the user to save the image pictures in standard formats. Online Help facility is also available in the GUI. This guides the user to help out in various stages in the preparation of input data and setting up the software.

## GEOMETRY AND MESH SYSTEM

Hydrodyn-POLSOFT interface is built on Triangular grid generation module based on Advanced Front Technique which contains a logical menu interface that guides the user to generate the grid for complex domain shapes. The user can control the grid spacing in selected regions of the domain of study. Constant grid spacing, and spatially varying grid spacing options are also available while generating mesh.

## SOLVER FEATURES

Hydrodyn-POLSOFT uses Finite Element Method to solve the Navier-Stokes and scalar advective-diffusive equations on Triangular grid system for prediction of hydrodynamic and pollutant variables. POLSOFT has both explicit/implicit solvers for solving the basic governing equations of flow and pollutant transport in a coupled way. Various modules including hydrodynamic, pollutant transport model, salinity and temperature models have been integrated into POLSOFT.

**Hydrodyn-POLSOFT** uses Lagrangian discrete parcel algorithm to solve the governing equations of water quality transport.

- ◆ Uses the Finite Element approach, which allows modeling in 1, 2 or 3 dimensions
- ◆ Solves equations for conservation of mass, momentum and energy for flow and water quality dispersion
- ◆ Solves pollutant distribution in open surface flows and includes models for density variation
- ◆ Uses 3D triangular grid to perform the simulation for any arbitrary shaped topography of flow domains
- ◆ Has its own Grid Generator, which is based on Advanced Front Technique
- ◆ Uses sigma-coordinate system vertically, so that the irregular domain topography can be studied accurately
- ◆ The user can select the boundary conditions at any location and select any type of boundary condition
- ◆ Pre-processor is integrated to the model to define the required model inputs graphically
- ◆ Various objects, i.e. bathymetric depth contours, islands, dykes, coastlines, ports, bridges, piles, jetties etc. are represented by different colors to identify the objects easily
- ◆ Interactive GIS data management system
- ◆ The solver performs the pollutant computations after converging the flow or both flow and pollutant
- ◆ The observation points can be selected at any location in the computational domain to monitor the output
- ◆ It can display the dispersion of water quality parameter at any time during the computation
- ◆ It is capable of handling various type of reaction terms in prediction of water quality dispersion in open waters
- ◆ Comprehensive water quality reaction database, Specify effluent occurrence scenarios
- ◆ Input winds time series. Display GIS resources affected by the water quality parameter dispersion
- ◆ The GIS utility is highly interactive and allows the user to enter, or import from external GIS sources, a variety of geographic data such as response resources, environmentally sensitive areas, and key coastal features.
- ◆ It has animation facility for output results of various file formats i.e. Bitmap, JPG, PNG
- ◆ Dispersant effectiveness and over-flight update tools



## SOFTWARE CAPABILITIES

- ◆ This software is flexible and can be used for any geographical locations in the world.
- ◆ It can be used to simulate effluent dispersion in tidal and non-tidal flow domains.
- ◆ It uses a 3D triangular grid to model with generalized flow boundary conditions.
- ◆ The model can be used for either continuous or instantaneous effluent discharges and the model takes into consideration various processes including advection, mechanical spreading, horizontal turbulent diffusion.
- ◆ It includes many specialized features pre/postprocessor for setting up the inputs.
- ◆ It performs fast computations, while greatly reducing the possibility of errors in the input.
- ◆ It can be used to predict the pollutant spread to analyse the impact of pollutants into water.

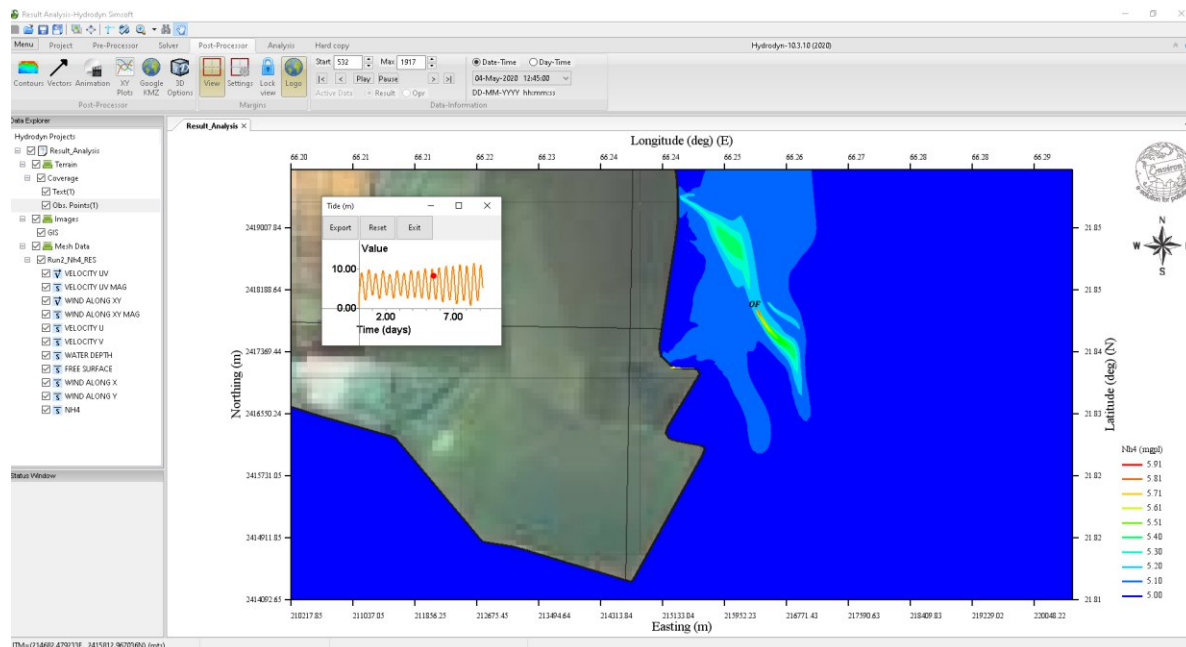
### Some of the core features are mentioned below

- ◆ Digitization of the raster images using .dxf files and .xyz files
- ◆ Drawing the coastal boundaries, triangular mesh generation with mesh refinement in selective region
- ◆ Applying the bathy using scatter points
- ◆ Saving the domain in binary format which reduces the size of memory compared to ascii format files
- ◆ Defining the boundary conditions and applying the tides and wind for boundary condition
- ◆ Finite Element Method solving technics which involves fast computation and produces more accurate results
- ◆ Displays the contours, vectors while simulation goes on, saving the flow and water quality result
- ◆ Loading of huge result files takes less time compared to loading of ASCII files
- ◆ Plotting, extracting and saving of Time dependent results at selected observation points
- ◆ Capable of producing results in PNG format and saving
- ◆ Plotting of water quality parameter dispersion
- ◆ Producing animation of velocity contours and vectors

## SOFTWARE APPLICATIONS

Hydrodyn-POLSOFT covers the following model applications

- ◆ Either as a real-time basis to predict the effluent dispersion or as a scenario model to analyse the possible impact on marines
- ◆ It generates multiple stochastic simulations for various locations using statistical or historical wind time series
- ◆ It can be run to determine most likely on a monthly, seasonal, or annual basis
- ◆ Output includes maps showing effluent dispersion
- ◆ Predict the probability of key areas being affected a given site (stochastic)
- ◆ Allow over-flight update predictions
- ◆ Provide first order guidelines in the use of dispersant and help develop dispersion strategies around coastline
- ◆ Perform risk assessments for important resources e.g. beaches, fisheries, marine life etc
- ◆ Resource management
- ◆ Environmental impact assessments
- ◆ Protection and prevention strategies
- ◆ Environmental Audits
- ◆ Training courses
- ◆ Equipment review and recommendations
- ◆ Equipment commissioning, Exercise delivery
- ◆ Optional capability to customize a resource and cost management system



## OUR SCIENTIFIC SOFTWARE PRODUCTS

**AIRSOFT** : Simulation of pollutants spread in atmosphere.

**FLOSOFT** : Simulation of flow

**STMSOFT** : Simulation of Solute transport, Biodegradation, chemical Reaction processes in Ground Water flow system

**NSPSOFT** : Simulation of Noise Pollution

**OILSOFT** : Simulation of fate and trajectory of oil spills

**POLSOFT** : Simulation of Conservative and Non- Conservative Pollutant Transport

**SURGSOFT** : Simulation of surges due to cyclones

**SEDOSOFT** : Simulation of Cohesive and non- Cohesive Sediment Transport

**AHDSOFT** : Analysis of Hydrographic Data For Tidal Management Practice

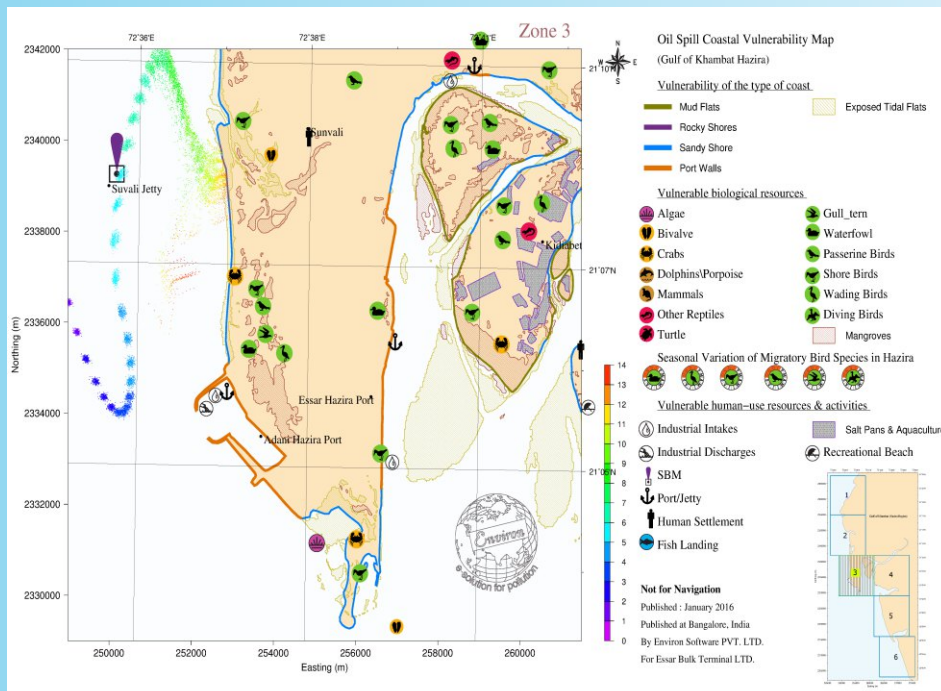
**LIBSOFT** : Library Management System

**e-Institute** : institutional Management System Software

**e-Breeze** : Office Automation Software

## SOME OF OUR CLIENTS

- ❖ Adani Port Limited, Hazira
- ❖ Bharat Petroleum Corporation Limited, Mumbai.
- ❖ British Gas Mumbai
- ❖ Cairn India Limited, Noida
- ❖ Cairn Lanka Pvt Ltd (CLPL), Sri Lanka
- ❖ Chennai Petroleum Corporation Ltd., Chennai
- ❖ Coastal Energen Pvt Ltd (Energen), Chennai
- ❖ Department of Ocean Development (DOD), Chennai
- ❖ Dhabol Power Corporation, Dhabol
- ❖ DMCC Oil Terminals (Navalakh) limited, Gujarat
- ❖ Dubai port, Mina, Jabal Ali, United Arab Emirates
- ❖ Eco Chem Sales and Services-Surat, Gujarat
- ❖ Essar Oil Limited, Refinery Division, Jamnagar
- ❖ Gujarat Maritime Board, Gujarat
- ❖ Gujarat State Pollution Control Board, Gujarat.
- ❖ Gujarat Adani Ports, Katch, Gujarat
- ❖ Hindustan Petroleum Corporation Limited, Visakhapatnam
- ❖ IOCL, Port Blair, Andaman, Kolkata
- ❖ Indian Oil Corporation, Vadinar
- ❖ IPSHEM, Oil and Natural Gas Commission(ONGC), GOA
- ❖ Indian Oil Corporation Limited, Pipelines Division, NOIDA
- ❖ Jindal Shipyard Limited, Mumbai
- ❖ Lift and Shift Private Limited, Mumbai
- ❖ Reliance Industries Limited, Mumbai
- ❖ National Institute of Oceanography (NIO), GOA and its Regional Centers in Mumbai, Cochin and Visakhapatnam
- ❖ National Institute of Ocean Technology(NIOT), Chennai
- ❖ Surat Municipal Corporation, Surat
- ❖ Terra Firma Pvt. Ltd., Goa
- ❖ Trimex Heavy Minerals Pvt Ltd., Srikakulam, AP
- ❖ Vadinar Oil Terminal Limited, (VOTL), Jamnagar
- ❖ Vimta Labs, Hyderabad
- ❖ Walchandnagar Industries Limited, Dahej.
- ❖ Indian Institute of Technology (IIT), Delhi



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