



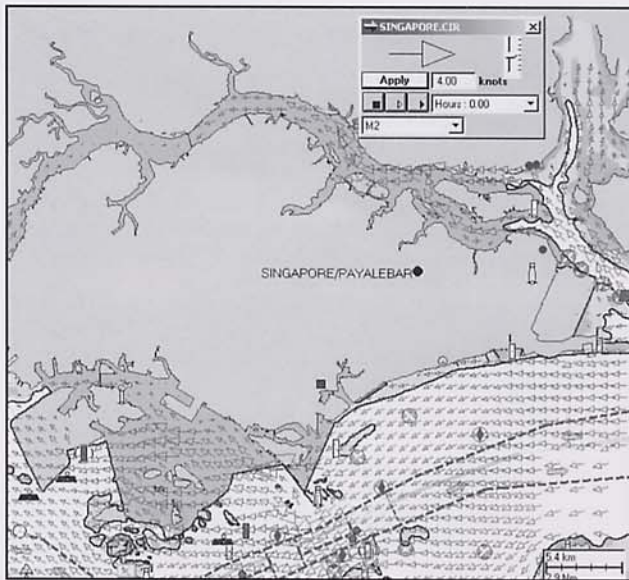
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HYDROMAP: Predicting Global Currents

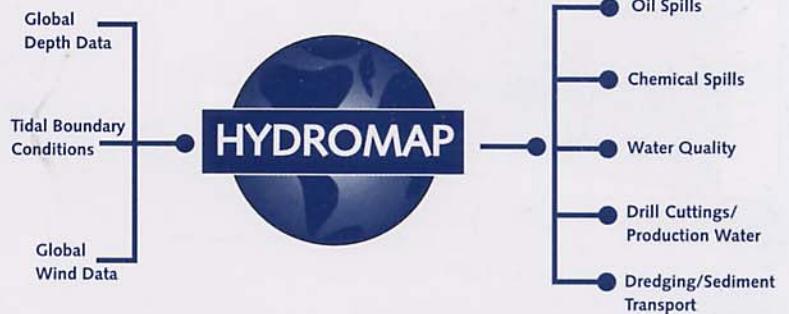
Accurately predicting the movement of oil, chemicals and other pollutants in the ocean requires detailed hydrodynamic flow fields. In the past, ASA has used existing data or developed customized hydrodynamic data by applying location-specific hydrodynamic models to new areas. To simplify this process and reduce the time needed to create high-resolution hydrodynamic data, ASA has developed a globally re-locatable hydrodynamic model, HYDROMAP.



HYDROMAP's Multi-Level Grid System as used in Singapore

Global databases for coastline, bathymetry and wind data are readily available, and automatic gridding tools allow users to very quickly set up and execute the transport models. HYDROMAP is designed to generate reliable predictive current data quickly for any new area.

HYDROMAP is a Windows application with a GIS-based interface, similar to ASA's other map-based applications, and allows the user to easily access and input the required data for the current data simulation. The underlying hydrodynamic model solves the equations of motion for the water movement in a single simulation and outputs current data that may be automatically linked to



OILMAP, CHEMMAP, DREDGEMAP and ASA's other models.

A key feature of HYDROMAP is its novel grid structure, which enables several levels of grid size to be constructed and executed at the same time. Gridding tools within the HYDROMAP system allow the user to create a rectangular grid system and easily select locales within that grid structure for finer grid resolutions. The improvement in gridding strategy permits the complex geometry of a river-estuarine system to be handled simultaneously with the open geometry of the coastal shelf.

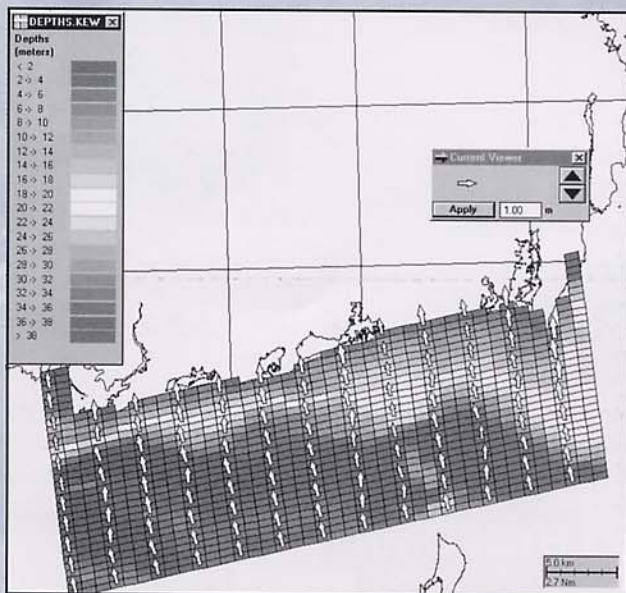
The underlying hydrodynamic model uses continuous profiles to represent the velocity, temperature, and salinity in the vertical. The data required by HYDROMAP to grid and force simulations worldwide are: coastline definition to define the land-water boundary, bathymetry contours or soundings to define the depth of water cells in the grid, tidal elevation constituent harmonic definitions (elevation and phase), and the option of long term wind stress forcing. Publicly available sources for these data are either packaged with HYDROMAP or can be easily accessed through HYDROMAP tools. The example figure shows a detail of a HYDROMAP application to Singapore waters.

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Making Waves With WAVEMAP

Waves entering the coastal environment undergo significant changes as they encounter varying depths, man-made structures, strong currents and changing wind conditions. Wave behavior is very important to coastal managers, developers and landowners studying such topics as beach erosion, growth of offshore sand bars and the construction of break waters and other man-made structures.



Sample model output from WAVEMAP.

To address these issues, ASA has developed WAVEMAP, a wave-modeling software package integrated with a Geographical Information System (GIS). Wave simulation is initiated through the use of interactive forms that allow the user to specify the incident wave properties, direction of propagation, relative angle and other model parameters. The model output can be viewed as scalar contours of wave height, as vectors depicting wave height and direction of travel or as a three-dimensional surface.

WAVEMAP employs the combined refraction-diffraction wave model REF/DIF to predict the progress of an incident monochromatic wave within regions of complex geometry and bathymetry. REF/DIF solves the parabolic approximation of the mild slope equation and has the ability to dissipate wave energy due to several physical mechanisms such as wave breaking, surface films, bottom friction and laminar or turbulent boundary layers. An important feature of WAVEMAP is its ability to simulate wave-current interactions. This is accomplished by defining current fields through a direct linkage to WQMAP, the hydrodynamic model within ASA's water quality and hydrodynamic modeling system.

WAVEMAP allows for the development of grids and associated bathymetry directly on the geographic map. The user simply defines the area of interest using the cursor and then enters the grid dimensions and rotation angle. The grid is automatically generated taking into account bathymetry, landmasses and man-made structures within the specified domain.

The WAVEMAP system enables analysis of the coastal wave environment by engineers, scientists, managers and regulators. Recently ASA applied WAVEMAP to assess the effects that reconfiguration strategies of the Route 78 bridge/causeway over Missisquoi Bay in Lake Champlain would have on the local coastal profile. Applied Technology and Management (ATM) used WAVEMAP to evaluate the impacts of proposed deepening of the Savannah (Georgia) Harbor Navigation Channel and to assess the borrow site dredging impacts on the local wave environment at Indian River County, Florida.

CHEMMAP: A MODEL AND INFORMATION SYSTEM FOR CHEMICAL SPILL RESPONSES



Photo courtesy: NOAA

A tanker carrying 3,000 tonnes of benzene is sending out distress signals reporting a hole in its hull as gale force winds whip up 30-foot seas, sending waves crashing over the bow. On the surface of the water, a sinuous, iridescent trail extends toward the horizon aft of the ship. What will be the fate of these spilled chemical products? ASA has developed CHEMMAP, an integrated response and impact analysis tool for chemical spills, to address questions such as this.

CHEMMAP predicts the trajectory and fate of a wide variety of chemical products, including floating, sinking, soluble and insoluble chemicals and product mixtures. CHEMMAP contains ASA's imbedded Geographic Information System (GIS) and a 3D spill model that predicts the movement of chemicals in the water. The spill model relies on environmental data such as wind and currents, physical data such as the proximity of shorelines, and chemical data that define the chemical's properties.

The chemical database contains data for over 800 chemicals. In addition to the quantitative chemical data available for each chemical, such as density, vapor pressure, solubility and partition coefficients, the chemical database provides extensive qualitative information. There is a description of general behavior that informs the user how the chemical will act upon release. Warnings are provided for potentially hazardous chemicals. A general explanation of the chemical, as well as information about the reactive groups to which it belongs, is included in the CHEMMAP chemical database.

Toxicity data included in the chemical database can be used to produce a hazard quotient (ratio of the predicted environmental concentration to the value of the toxicity parameter of interest) in the CHEMMAP model output display.

Continued on page 4

Personnel



Alivia Ruth Saunders was born to ASA's **Bill Saunders** and his wife Betsy on March 25, 2001. She made her debut a couple of weeks early and spent her first week touring Rhode Island's fine hospitals, but she is now home doing fine and

is getting accustomed to life in the Saunders household. Mom and Dad are napping when they can.

A warm welcome to **Betsy Labonte**, who is replacing Leslie Smith as ASA's Office Manager. Betsy hails from Wakefield, Rhode Island and comes to us from Kent Surgical Associates in Warwick, RI. We wish Leslie the best of luck with her new job and new home in New Hampshire.



Matt Ward delivered and provided training on the latest version of WQMAP to Massachusetts Coastal Zone Management (MCZM). MCZM will be applying a calibrated version of BFHYDRO to study water quality issues within Salem Sound Massachusetts.

In January, **Eoin Howlett** and **Eric Anderson** visited the U.S. Army Corps of Engineers in Vicksburg, Mississippi at the Environmental Research & Development Center. They attended a meeting discussing ERDC's dredging fate models and the associated interfaces that have been developed by ASA.

Deborah French McCay presented two papers at the International Oil Spill Conference March 26-29 in Tampa, Florida. The first, "Quantifying the Scale of Restoration Required to Compensate for the Impacts of the North Cape Oil Spill on Fish and Invertebrates", describes modeling methods for calculating the amount of restoration that would provide equivalent ecological

and human services to those lost because of a spill. The second paper, "Oil Spill Modeling for Contingency Planning and Impact Assessment and Example Application for Florida Power and Light", describes probabilistic modeling for ecological risk assessment.

Eric Anderson presented a paper on the SSFATE (Suspended Sediment FATE) Model at the 16th World Dredging Congress and Exhibition held in Kuala Lumpur, Malaysia on 2-5 April. SSFATE is a system developed for the U.S. Army Corps of Engineers to define the movement of sediments released during dredging operations.

ASA recently delivered the latest version of OILMAP to the Exploration and Production arm of Petronas Carigali (Kirteh), the national oil company of Malaysia. **Roddy Thomas** completed a training program for the new HSE oil spill response and planning team of PC Kirteh.



Daniel Mendelsohn will chair a session at the EnviroExpo 2001 to be held at the World Trade Center, Boston, Mass., Thursday, May 10, 2001, from 1:30 - 5:00. The session is part of Track 3.2 Water Quality and Watershed Analysis: Rules and Practice, titled Tools for TMDL Development and Case Studies. Speakers include Steven Chapra, Tufts Univ.; Ray Wright, Univ. of Rhode Island; Chris Turner, RIDEM and William Saunders, ASA.

Deborah French, seeking consistency between her personal and professional life, is now using her full name Deborah P. French McCay on papers and reports. French is a previous married name, McCay is her new married name, and P is for Perryman, her maiden name (which would have been the wise choice originally!) She responds to any of the above.

Roddy Thomas recently delivered the latest version of OILMAP to the operational HSE department of Chevron, Aberdeen UK. Mrs. Alex Duff, the Environmental Specialist Coordinator, received an initial training course. The model program will be used primarily for planning and emergency response in North Sea waters.

Matt Ward and **Eric Anderson** traveled to Ciudad Carmen, Mexico for a startup meeting for the PEMEX Hurricane Evacuation project on 6-8 March. The project is designed to develop a system to define specific evacuation strategies for the evacuation of PEMEX and contractor personnel from offshore structures under hurricane threat. Miguel Palet, of GDS de Mexico,



ASA's partner in Mexico and Sergio Millan del Rio of PEMEX met with operations and meteorological personnel to coordinate data management issues and refine the needed functionality for the system. Matt, Miguel, and Sergio are shown outside Sergio's office.

March 12-15, **Deborah French McCay** visited Venezuela and provided model training to INTEVEP, the research division of the Venezuelan oil company PDVSA. INTEVEP uses ASA's models SIMAP and CHEMMAP for spill response, contingency planning and ecological risk assessments.



Eoin Howlett visited the Irish Coast Guard (formerly known as the Irish Marine Emergency Services) in Dublin to deliver CHEMMAP and provide training. The Irish Coast Guard use OILMAP, SARMAP, and CHEMMAP.

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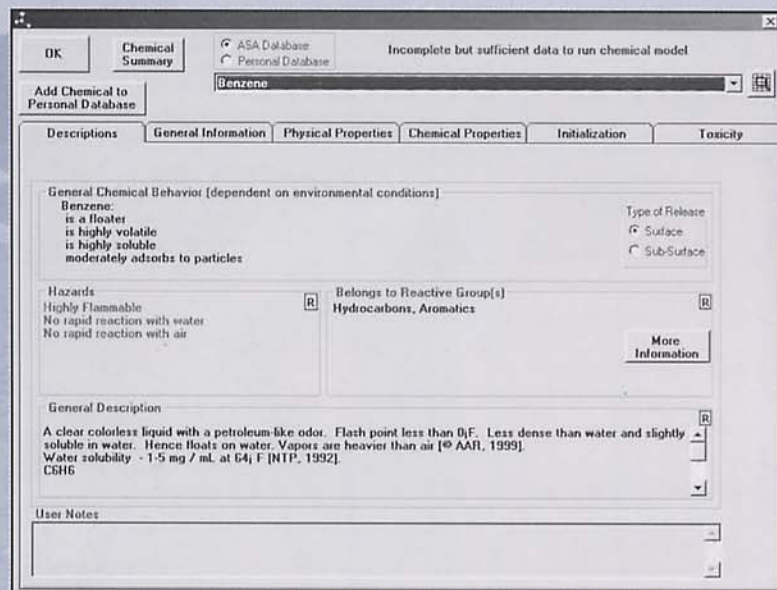
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CHEMMAP CONTINUED

In the hypothetical spill mentioned previously, the user can access the database to determine that benzene will float, evaporate rapidly and is highly soluble. There is no rapid reaction with water or air. CHEMMAP's atmospheric model may then be used to predict the dispersion of the atmospheric plume.



The screenshot shows a software window titled "CHEMMAP" with a "Chemical Summary" tab selected. The chemical name "Benzene" is entered in the search field. The window displays the following information:

- General Chemical Behavior (dependent on environmental conditions):**
 - Benzene: is a floater, is highly volatile, is highly soluble, moderately adsorbs to particles.
 - Type of Release: Surface, Sub-Surface.
- Hazards:** Highly Flammable, No rapid reaction with water, No rapid reaction with air.
- Belongs to Reactive Group(s):** Hydrocarbons, Aromatics.
- General Description:** A clear colorless liquid with a petroleum-like odor. Flash point less than 0°F. Less dense than water and slightly soluble in water. Hence floats on water. Vapors are heavier than air [© AAR, 1999]. Water solubility - 1.5 mg / mL at 64° F [NTP, 1992]. CBHG.
- User Notes:** (Empty field)

CHEMMAP's Database for benzene

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