ASA | Applied Science Associates, Inc.
70 Dean Knauss Drive
Narragansett, RI 02882-1143
U.S.A.
Tel: 401-789-6224
Fax: 401-789-1932
asa@asascience.com
www.asascience.com

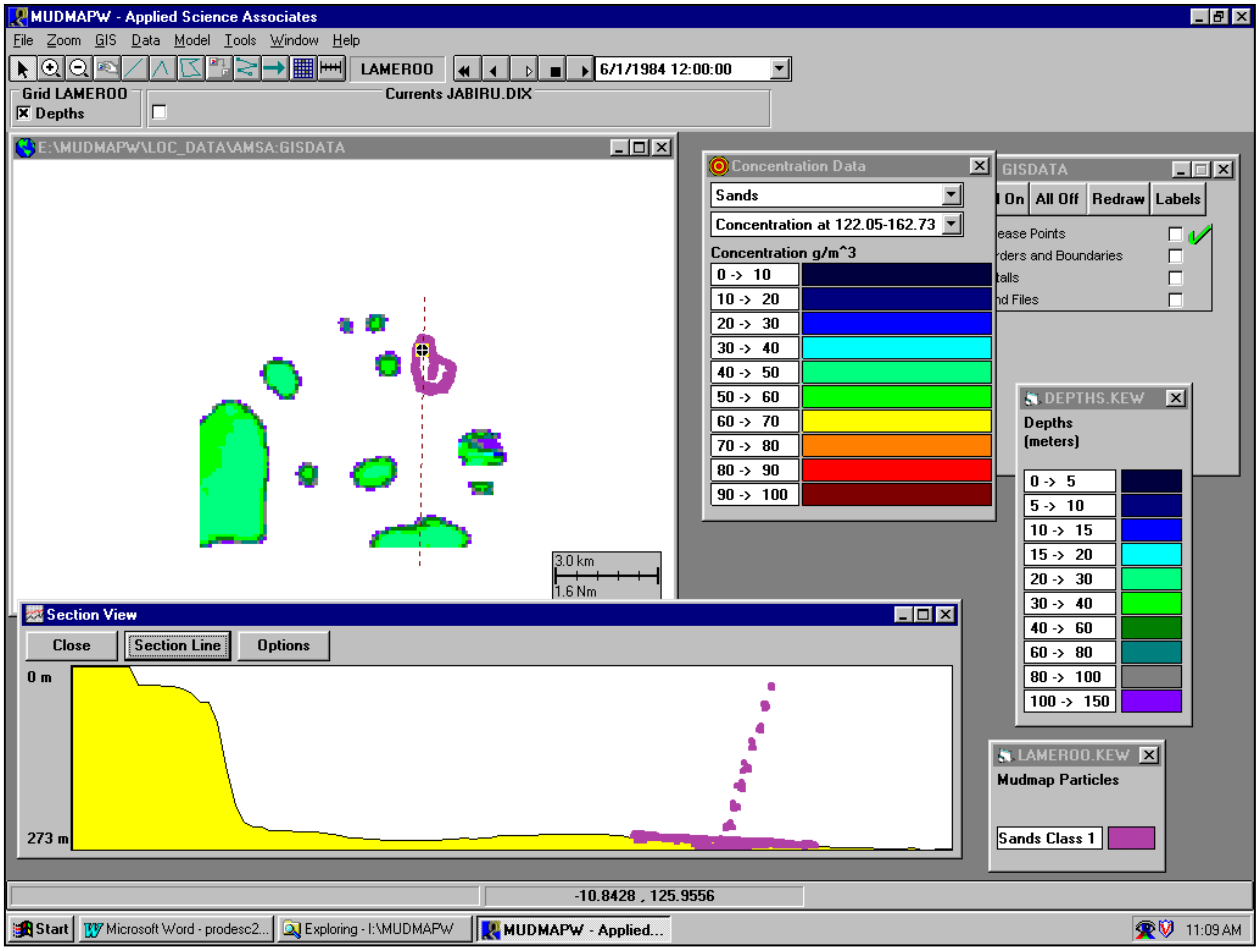
MUDMAP™
Software Description

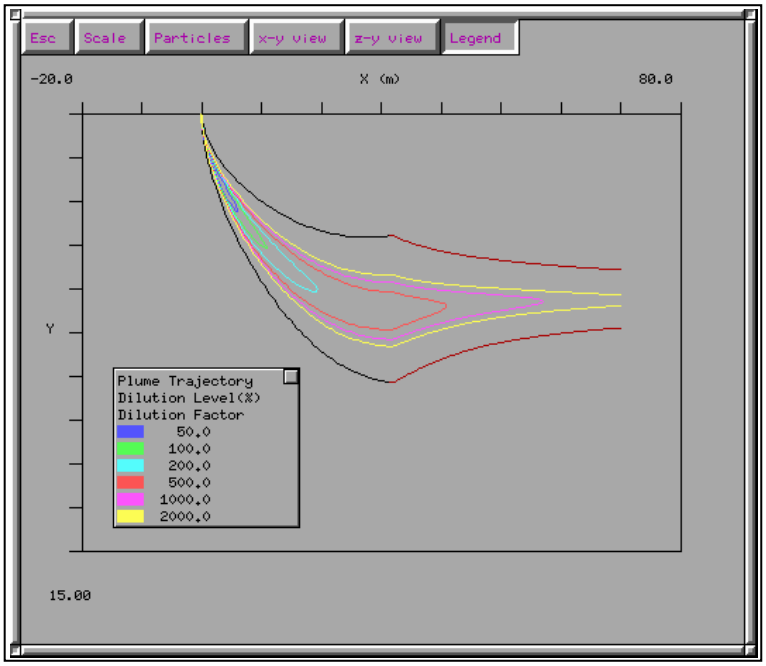
MUDMAP is a personal computer model that predicts the transport, dispersion, and seabed deposition of **drilling muds** and **produced water** derived from drill cuttings. MUDMAP includes detailed models that account for the three stages of movement:

- the free fall of the consolidated mass of mud and cuttings (i.e., convective descent phase)
- the collapse of the consolidated mass as it hits the seafloor (i.e., dynamic collapse phase)
- the subsequent diffusion and deposition of the mud and individual cuttings.

MUDMAP is controlled through an interactive Graphic User Interface (GUI) that integrates the model with a geographic information system (GIS), environmental data management tools, automatic grid generation tools, and associated input/output interfaces.

The unique integration of the MUDMAP model within a GIS framework allows users to efficiently create applications for any geographic location in the world. An extensive array of mapping and analysis tools allows the user to archive, manipulate, and display important geo-referenced data (e.g., biological resources, drilling sites, current observation data, etc.). Data may also be imported directly into the MUDMAP system from other GIS systems (e.g., ArcInfo, MAPINFO, etc.). The user enters data necessary for the MUDMAP model through the GIS interface such as release location, settling velocities, drill fluid composition, density / salinity profiles, currents.
MUDMAP provides the user with various output options. Model predicted water column concentrations are displayed on a user-selected cross section. Deposition of the discharged materials on the seafloor is viewed as color contours in the GIS system. The plan and section concentration views can be animated to show how the behavior changes in time.





MUDMAP is fully compatible with ASA's widely used oil spill model, OILMAP; hydrodynamic models, HYDROMAP; water quality model, WQMAP; and mild slope equation wave model, WAVEMAP.

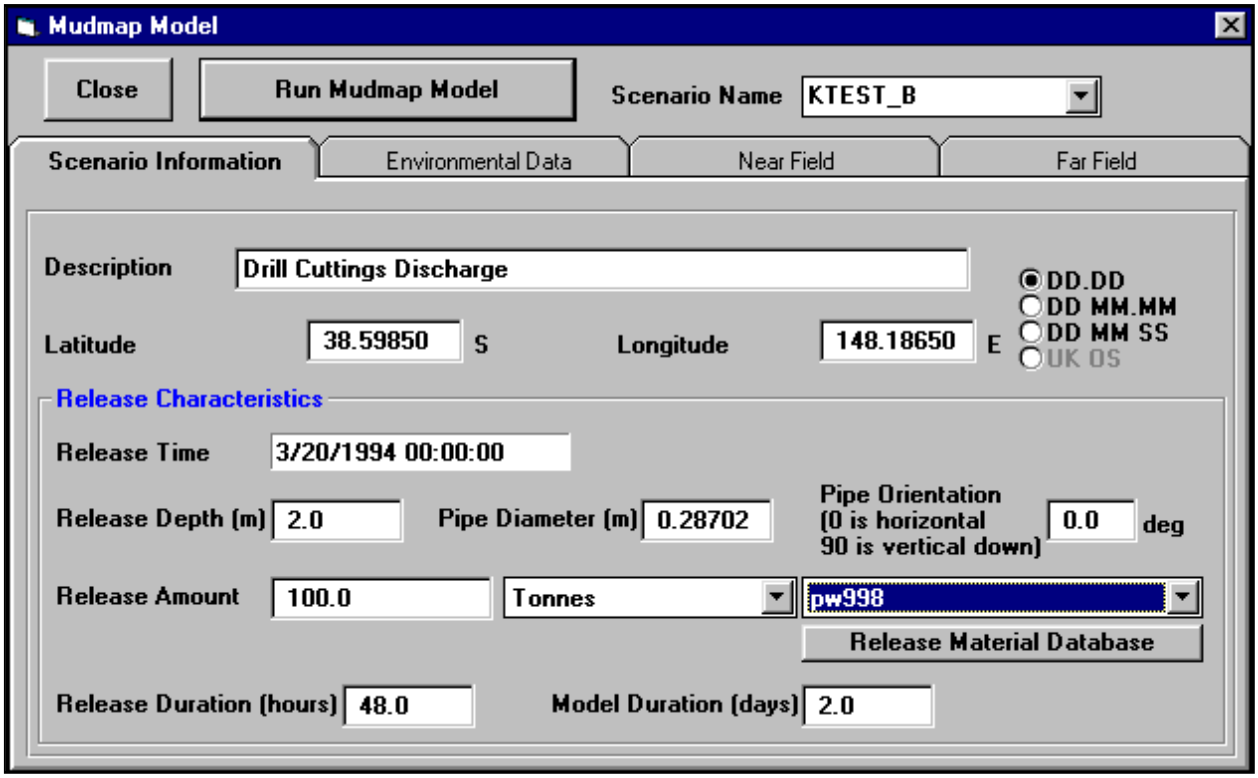
MUDMAP BASIC SYSTEM

The basic system includes the near field and far field models, the user interface, the GIS system, one location base map and documentation.

Model Description

MUDMAP's near field model, following Koh and Chang (1973) and CSA (1985) predicts the transport and dilution of drill fluid through convective jet and dynamic collapse phases. Model input includes a definition of drill fluid density and composition (settling velocity versus percent mass fraction); release location, rate, and duration; and the current and hydrographic fields. Model output (dilution, plume center location/width, trapping depths, contaminant concentration, thickness and deposition) can be displayed. These outputs are also used as inputs for the far field model.

A particle-based model predicts the far field transport and fate of the discharge, using a random walk procedure. The particle model allows the user to predict the transport and fate of dissolved and settling/buoyant particles from single or multiple sources. A detailed description of application and verification of the model is given in Kolluru and Spaulding (1993). Additional validation studies for produced water application are presented in King, McAllister & Hubbert (1998).

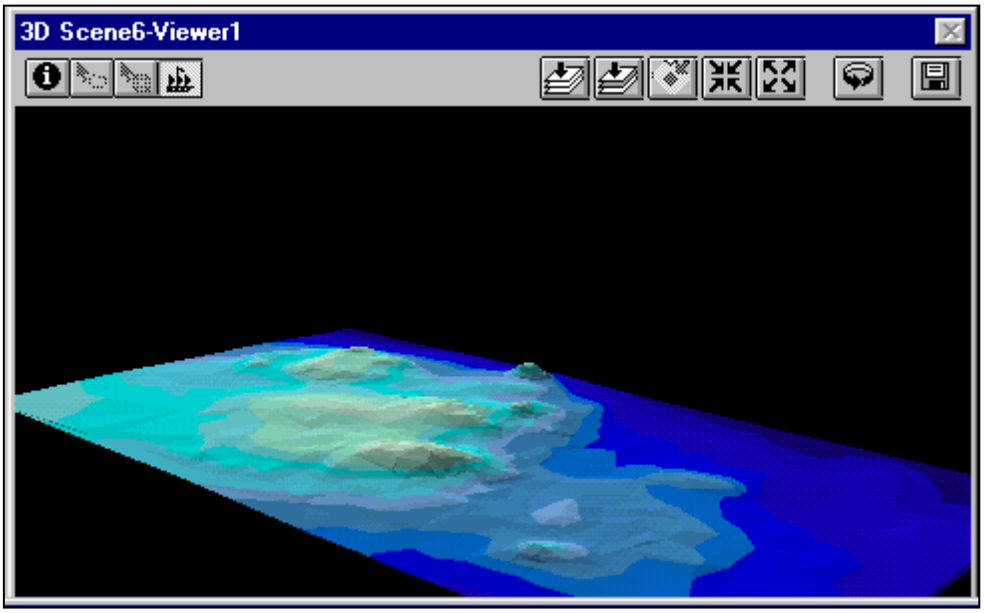


Geographic Information System (GIS)

The embedded GIS allows the user to input, store, manipulate, and analyze geographically referenced information. The simplified GIS have been designed to be user friendly, interactive and fast. GIS data is not be required as input to MUDMAP, but is helpful in analyzing and interpreting model predictions.

The GIS allows an unlimited number of geographic databases to be created each with individual layers of data. Typical uses of the GIS include storing location names, biological resources (bird colonies, fish spawning areas), industrial facilities, and environmental data.

Additional information about geographically referenced data can be linked to any GIS object. These link files might include charts, graphics, tables, tutorials, bibliographies, text, photographs, or animations. Examples of data which might be stored in the GIS for a typical problem include: contaminant source strengths versus time for the discharge, details of outfall location and configuration, water column and sediment (core/grab sample) contaminant distributions, distribution and abundance of biota including shellfish, fish, birds, and marine mammals.



Data may be shared with commercial GIS applications such as ArcView and MapInfo. Tools such as ArcView's 3d Analyst may be used to perform complete 3D analyses.

Documentation
The system is delivered with the MUDMAP user's manual and selected literature describing the development, application, and validation of the integrated models.

ENVIRONMENTAL DATA PRODUCTS AND SERVICES

Custom Data Preparation

- **Base Maps**

MUDMAP can be set up for operation anywhere in the world. A geographic location for MUDMAP may be of any size and resolution. Please contact us for details. ASA can immediately prepare coastlines for anywhere in the world from the CIA, Digital Chart of the World (DCW), or World Vector Shoreline (WVS) databases. In addition, geo-referenced raster maps may also be used. Alternatively, base maps may be digitized from fine scale charts, or imported from existing GIS applications.

- **GIS Data Layers**

Locations of sensitive resources such as critical biological habitats, water intakes, industrial sites, and archaeological sites may be supplied in a GIS database. These data may already be available in ASA archives, or we can readily rather and provide this data on an individual basis. The user may view, edit and update this database using MUDMAP's embedded GIS.

- **Hydrodynamic Data**

Models of water movement in oceans, estuaries, lakes, and rivers represent a fundamental component of many environmental assessment problems. Such models provide the basis for physical transport of drill muds in the water.

ASA maintains several hydrodynamic models:

- Open channel network flow
- 2-D finite difference
- 3-D boundary fitted
- 3-D finite difference (horizontal)
- vertically layered
- continuous vertical representation

MUDMAP may also integrate current meter data, seasonal atlas based current fields, or import data from hydrodynamic models. We work with a number of institutes and universities throughout the world to be able to provide the best possible data for any area.

SOFTWARE UPGRADES AND MAINTENANCE

ASA will provide assistance in the use and application of the model and trouble-shooting, during normal business hours. An 800 number will be provided. In addition, all upgrades of the software will be provided as they become available.

Training

ASA offers a training course in the theoretical foundation, structure and operation of MUDMAP, including extensive hands-on experience. The course lasts 2 days and is given at ASA's office. On site training can be arranged at the client's request.