Release Notes for
SutraPlot Version 2D3D.1

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Summary of release

These Release Notes describe a major revision to the U.S. Geological Survey (USGS) **SutraPlot** code (Souza, 1987). This version of **SutraPlot** has been updated to conform to SUTRA Version 2D3D.1 file format specifications. It provides three-dimensional (3D) functionality in addition to the original two-dimensional (2D) plotting capabilities and enhanced graphical output options. In addition, this version includes a graphical user interface.

Graphical options for 2D **SUTRA** simulations include: drawing the 2D finite-element mesh, mesh boundary, and velocity vectors; plotting of contours for pressure, saturation, concentration, and temperature within the model region; 2D finite-element-based gridding and interpolation; and exporting of 2D gridded data files.

Graphical options for 3D **SUTRA** simulations include: drawing the 3D finite-element mesh (limited functionality); plotting of contours for pressure, saturation, concentration, and temperature in 2D sections of the 3D model domain; 3D finite-element-based gridding and interpolation; drawing selected regions of velocity vectors (projected on principal coordinate planes); and exporting of 3D gridded data files.

Documentation of **SutraPlot** *Version 2D3D.1* consists of these Release Notes, on-line Help files, and a detailed report (Souza, 1999), all of which are included in this release. This documentation is only available in electronic form.

The distribution package for **SutraPlot** *Version 2D3D.1* contains Windows™ executables, this informational file, the documentation report, and input and output files for a 3D simulation example problem. In this release, **SutraPlot** is distributed as an executable code compiled with Digital® Fortran Version 6.6 and linked to the GINO® Version 4.2 and GINOSURF® Version 3.2 graphics libraries, and GINOMENU® Version 4.0 GUI that runs under Microsoft Windows® NT/2000 or 95/98/XP operating systems.

Software Release Notice

SutraPlot is public-domain software and is released to you cost-free by USGS for any purposes you choose. This is a general public release.

The user assumes all risk for any damages whatsoever resulting from loss of use, data, or profits arising in connection with the access, use, quality, or performance of this software.

USGS much appreciates your support in reporting any problems that may occur so that the codes can be improved.

General Instructions

Except where stated otherwise, the following instructions assume that **SutraPlot** has been installed into the default directory recommended during the installation process, c:\SutraSuite\SutraPlot_2D3D_1. If a directory other than the default directory was selected, \SutraSuite will not be located directly under c:\, but the directory structure below \SutraSuite will remain as described below.

Instructions that involve mouse clicks refer to clicking on file names or icons displayed under the Windows Explorer file manager. For example, to "double-click on *file.txt*", use Windows Explorer to display the contents of the directory (folder) that contains the file *file.txt*, then click twice (in rapid succession) on the file name *file.txt* or its corresponding icon using the left mouse button. To "right-click", click once using the right mouse button.

Installation

Installation of **SutraPlot** uses the same procedure as the **SUTRA** release package. If **SUTRA** has been installed on your system into the directory recommended by the installation software, there will be directory named c:\SutraSuite. After the **SutraPlot** release package file (*Version 2D3D.1*) is installed, most of the associated files will be in a new subdirectory, c:\SutraSuite\SutraPlot_2D3D_1. This ***ReleaseNotes.doc*** file is in the same directory; it is in Word format. Within this directory there are also four subdirectories: \source, which contains the Fortran source files; \examples, which contains example datasets; \documentation, which contains the most recent documentation; and \bin, which contains the **SutraPlot** executable file, *sutraplot_2D3D_1.exe*. A shortcut to the executable file has been automatically installed to the desktop.

Running SUTRAPLOT

To run **SutraPlot**, either place a shortcut to *sutraplot_2D3D_1.exe* into the desired working directory, or use the one already on the Windows desktop. To start **SutraPlot**, double-click on the shortcut.

Please note that shortcut supplied with this release is setup with an executable "Target" of c:\SutraSuite\SutraPlot_2D3D_1\sutraplot_2D3D_1.exe, and a "Start in" directory of c:\SutraSuite\SutraPlot_2D3D_1 to conform to the SutraSuite standard directory structure. The c:\SutraSuite\SutraPlot_2D3D_1 directory contains all required files, libraries, and dll's to run **SutraPlot**.

Note: If the user modifies the **SutraSuite** directory structure, the working directory of the shortcut must be set as follows. Right-click on the shortcut, select "Properties", select the "Shortcut" tab, enter the correct path to the **SutraPlot** executable file (*sutraplot_2D3D_1.exe*) in the "Target:" box, enter the directory that contains *sutraplot_2D3D_1.exe* in the "Start in:" box, then click "OK". This allows the shortcut to find the **SutraPlot** executable file, libraries, and dll's.

For proper program execution, it is required that the **SutraPlot** executable file and **all** associated files be kept together in one directory.

3D example

The example 3D simulation used is the Burnett-Frind problem provided in the **SUTRA** release package in the directory, SutraSuite\Sutra\examples\3d. The example files may also be separately downloaded from the **SutraPlot** website. Three step-by-step sample sessions, using this example, are described in the **SutraPlot** documentation (Souza, 1999).

The files are for the ***BF*** example described just below. Included are ***BF.inp*** (**SUTRA** main input file), ***BF.nod*** (nodewise results file), and ***BF.ele*** (elementwise results file). Start **SutraPlot** as described just above and then follow the step-by-step instructions given in the documentation.

Example 3D SUTRA simulation, BF

This is a *steady-state flow and steady-state transport* simulation that represents a simple diving plume from a localized surface source of solute. The fluid has constant density, and all hydrologic properties are constant. It is similar to a problem considered by Burnett and Frind (1987) and shown in their Figure 9b. While the original 1987 top boundary condition was a ¼ cosine-shaped specified head, BF instead has a constant areal recharge specified over the entire top. An equivalent approximate recharge rate was given by Burnett and Frind (1987). The vertical outflow face (at x=200. m) has a specified head of zero, and all other sides of the 3D domain are closed to flow. The top surface is a plane with a slight dip that roughly follows the water table. The original problem considered transient transport, while this example simulates steady-state transport.

The dimensions of the domain (with z vertically upward) are:
in x: 200. m
in y: 30. m
in z: 21. m at x=0, and 20. m at x=200. m

The main parameter values are:

Hydraulic conductivity	1.0 m/d (1.16×10^{-5} m/s)
Porosity	0.35
Solute diffusivity	1.0×10^{-9} m^2/s
Longitudinal dispersivity	3.0 m
Transverse dispersivity	0.1 m
Recharge	0.3 m/yr = 9.5×10^{-9} (m^3/s)/ (m^2 of top surface)

The mesh consists of 24000 evenly-spaced elements (40 in x, 30 in y, and 20 in z).

References

Burnett, R.D., and Frind, E.O., 1987, Simulation of contaminant transport in three dimensions 2. dimensionality effects, Water Resources Research, 23(4), 695-705.

Provost, A.M., 2002, **SutraPrep**, a pre-processor for SUTRA, a model for ground-water flow with solute or energy transport: U.S. Geological Survey Open-File Report 02-376, 43 p. http://water.usgs.gov/nrp/gwsoftware/sutra.html

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Souza, W.R., 1999, **SutraPlot**, a graphical post-processor for SUTRA, a model for ground-water flow with solute or energy transport: U.S. Geological Survey Open-File Report 99-220, 30 p. http://water.usgs.gov/nrp/gwsoftware/sutra.html

Voss, C. I., 1984, **SUTRA**, A finite-element simulation model for saturated-unsaturated fluid density-dependent ground-water flow with energy transport or chemically-reactive single-species solute transport, U.S. Geological Survey Water-Resources Investigations Report 84-4369, 409 p.

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