POLLUTE

Version 8

Example 13: Comparison with Analytical Method

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Printed: September 2021 in Canada.

Description

In this example the results of POLLUTE are compared to those obtained by the analytical solution given by TDAST. TDAST is a computer program for 2-D plane dispersion in an infinitely deep porous media, developed by Javandel et al. (1984). An infinitely thick layer is considered, however for comparison purposes the calculations will be restricted to the first 10 m. Below the layer the bottom boundary is assumed to extend to infinity and have the same properties as the layer above.

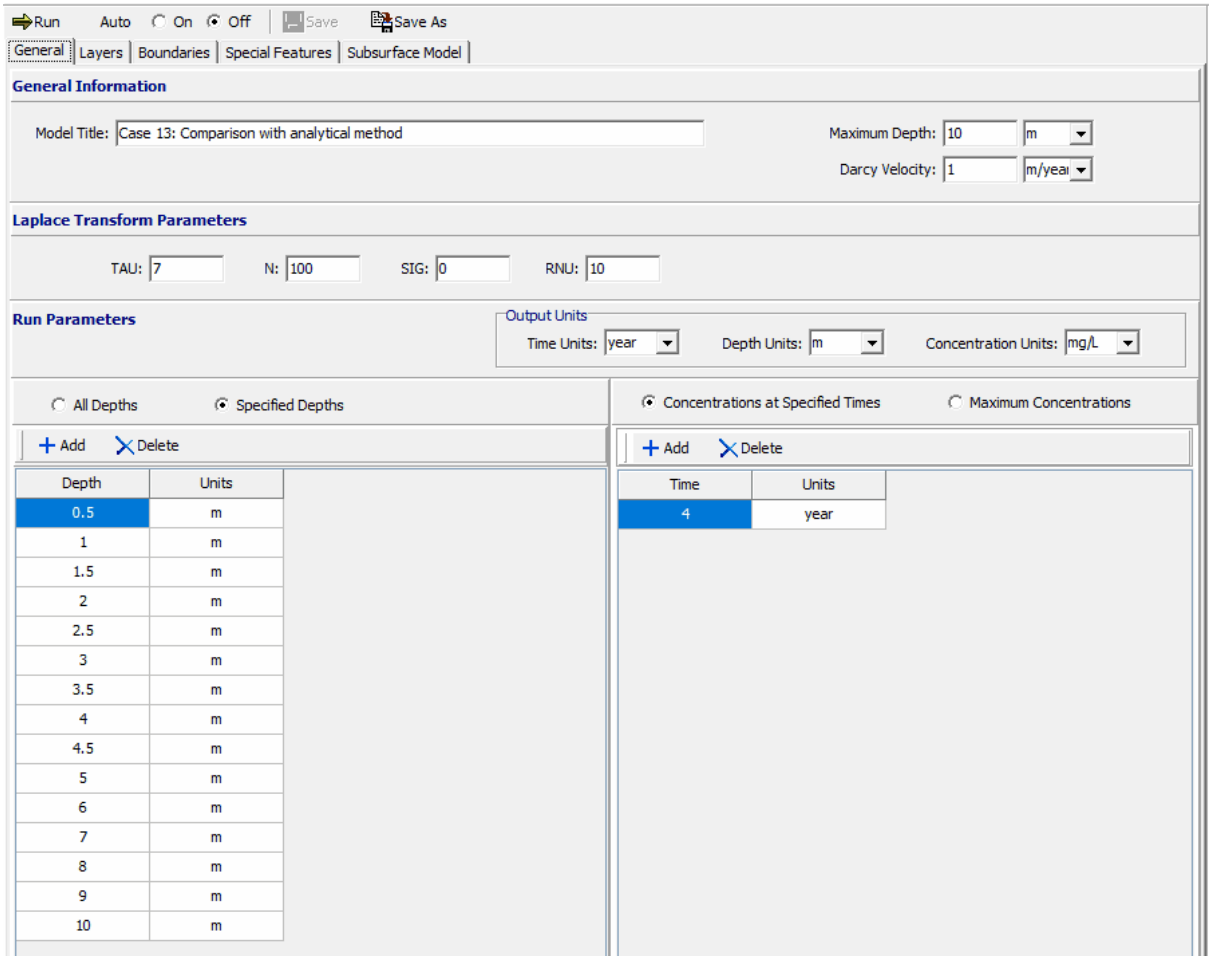
The following parameters are assumed for the example:

Property	Symbol	Value	Units
Darcy Velocity	v_a	1.0	m/a
Diffusion Coefficient	D	0.01	m^2/a
Distribution Coefficient	K_d	0	cm^3/g
Soil Porosity	n	1	-
Dry Density		0	g/cm^3
Soil Layer Thickness	H	10	m
Number of Sub-layers		20	-
Source Concentration	c_0	1	g/L
Times of Interest		4	a

Data Entry

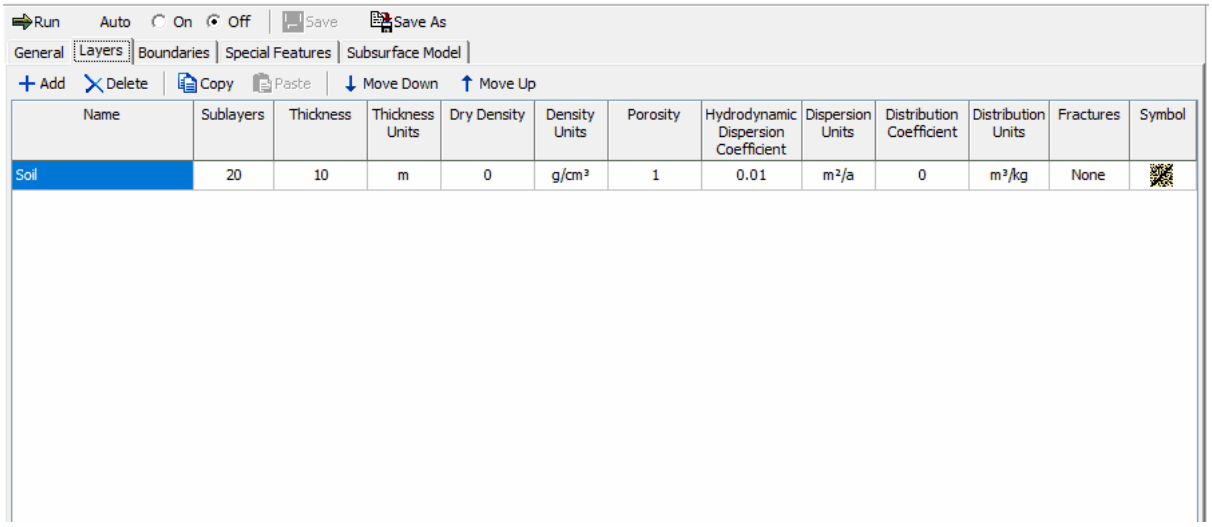
Open the Examples project and open Case 13.

General Tab



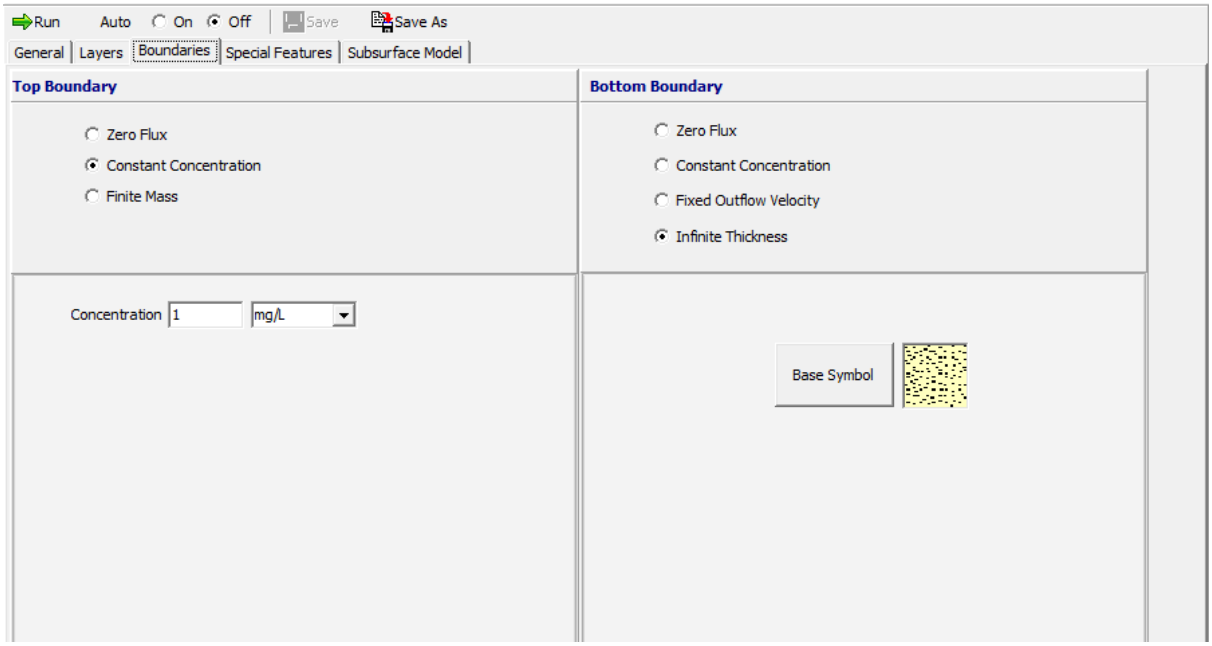
The general data for this example can be specified on the General tab. In this example there is one layer and the Darcy velocity is 1 m/a. The times and depths to calculate the concentrations can be specified at the bottom of this tab. menu. In this
example the concentrations will be calculated at 4 years and at 14 depths from 0.5 to 10 m.

Layers Tab



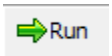
The layer data for the layer can be specified on the Layers tab. When there is no sorption (i.e., the distribution coefficient is zero) the dry density is not used and can be specified as zero.

Boundaries Tab



The boundary conditions for the model can be specified on the Boundaries tab. In this example, the top boundary has a constant concentration and the bottom boundary is represented by a layer of infinite thickness.

Model Execution



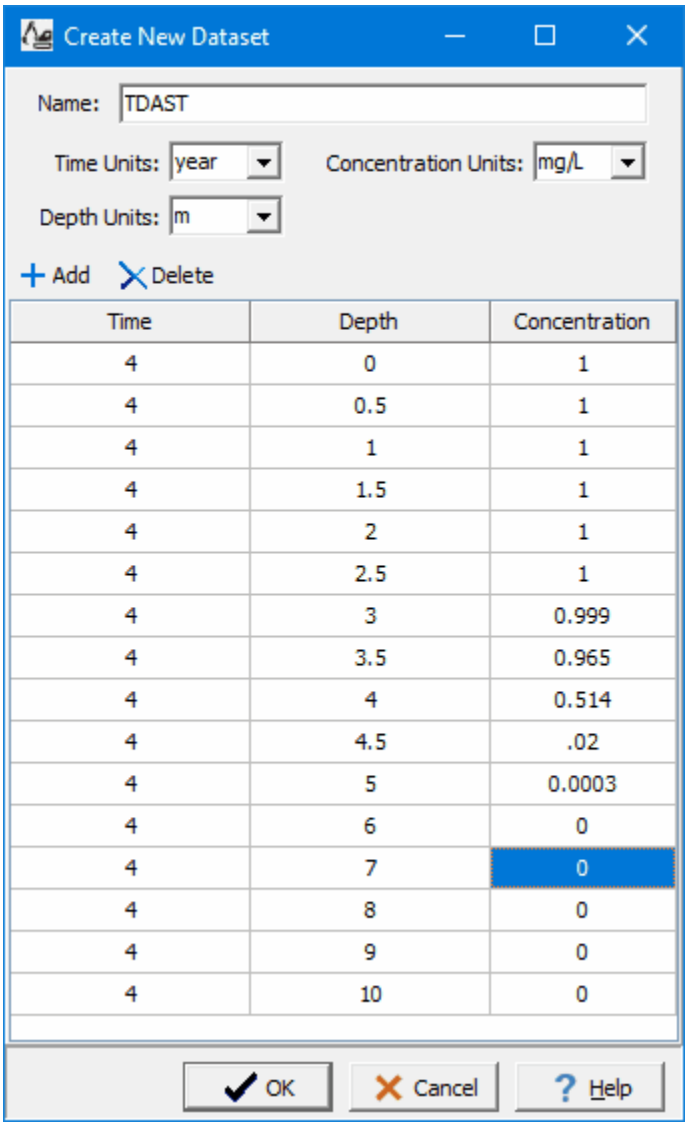
To run the model and calculate the concentrations press the Run button on the toolbar.

Model Output

After the model has been executed, the output for the model will be displayed.

Output Comparison

The results given by TDAST can be compared to the output by creating a new imported dataset using *File > New > Imported Dataset*.

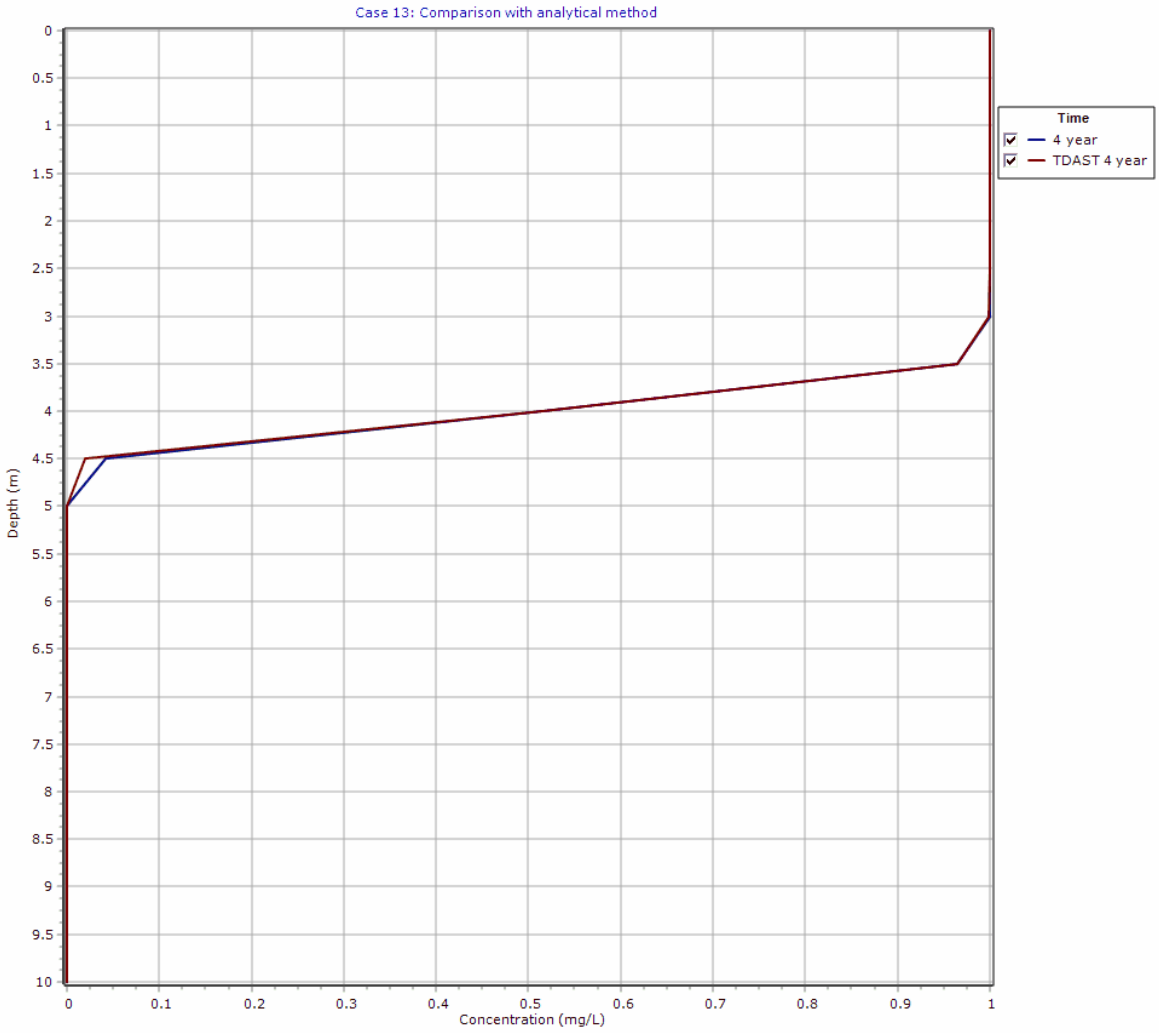


Time	Depth	Concentration
4	0	1
4	0.5	1
4	1	1
4	1.5	1
4	2	1
4	2.5	1
4	3	0.999
4	3.5	0.965
4	4	0.514
4	4.5	.02
4	5	0.0003
4	6	0
4	7	0
4	8	0
4	9	0
4	10	0

Concentrations obtained by both methods are in close agreement for a dispersion coefficient of 0.01 m^2/a. However, it should be noted that at higher values of dispersion coefficient, for example 5 or 10 m^2/a, the POLLUTE program will not give the same result as TDAST. This is because POLLUTE considers only 1-dimensional migration in the layer below the source, whereas TDAST considers 2-dimensional migration.

Depth vs Concentration

The Depth vs Concentration chart can be displayed by selecting the Depth vs Concentration item for the Chart Type.



Output Listing

To display the output as a text listing that will show the calculated concentrations as numbers, click on the List tab.

POLLUTEv8

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Case 13: Comparison with analytical method

THE DARCY VELOCITY (Flux) THROUGH THE LAYERS Va = 1 m/year

Layer Properties

Layer	Thickness	Number of Sublayers	Coefficient of Hydrodynamic Dispersion	Matrix Porosity	Distributon Coefficient	Dry Density
Soil	10 m	20	0.01 m²/a	1	0 m³/kg	0 g/cm³

Boundary Conditions

Constant Concentration

Source Concentration = 1 mg/L

Infinite Thickness Bottom Boundary

Laplace Transform Parameters

TAU = 7 N = 100 SIG = 0 RNU = 10

Calculated Concentrations at Selected Times and Depths

Time year	Depth m	Concentration mg/L
4	0.000E+00	1.000E+00
	5.000E-01	1.000E+00
	1.000E+00	1.000E+00
	1.500E+00	1.000E+00
	2.000E+00	1.000E+00
	2.500E+00	1.000E+00
	3.000E+00	9.998E-01
	3.500E+00	9.646E-01
	4.000E+00	5.141E-01
	4.500E+00	4.133E-02
	5.000E+00	2.277E-04
	6.000E+00	1.928E-09
	7.000E+00	1.927E-09
	8.000E+00	1.927E-09
	9.000E+00	1.927E-09
	1.000E+01	1.927E-09