

The logo for triwaco, featuring a stylized white wave above the word "triwaco" in a bold, lowercase, sans-serif font.

groundwater modelling software



6 Setting up and Execution of Scenario Simulations

Chapter 6: Setting up and execution of scenario simulations

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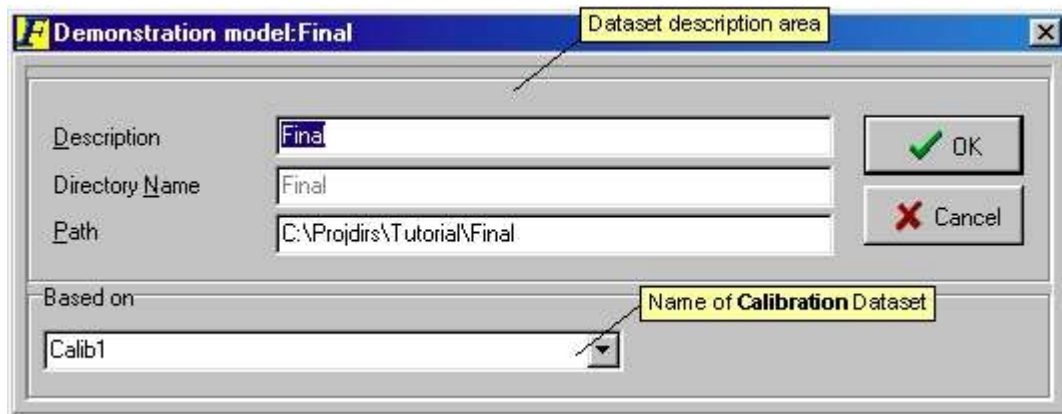
6.1 Creating a Final data set

6.1.1 Introduction

The Final data set contains the definitive model parameters based on the Calibration and Initial data set. The model parameters are stored with the parameter maps (.ung and .par), grid-dependent data (.ado) and calibration result (flairs.flo). In other words it is the definitive version of the calibrated model. Scenario simulations and corresponding data sets are based upon the Final data set. A scenario data set only contains parameters that are altered with respect to the Final data set it is based on. The advantage is that for each scenario it is immediately clear what parameters are altered for that particular scenario simulation. Secondly the calibrated model remains intact enhancing the reproducibility of the results.

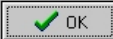
6.1.2 Opening a Final data set

The Final dataset is created similar as any other data set. Selecting 'data set' 'Add' from the pull down menu and 'Final set' from the 'create new data set' dialog window displays the 'Final data definition' window.



The user has to provide the following information:

- A. A descriptive name of the data set and the data set's directory name where the files of the calibrated model are stored.
- B. The name of the calibration dataset the Final dataset is based on.

Confirming the selection with the  -button causes the program to open the 'Final data set window', displaying all model parameters of the calibrated model.

6.1.3 Updating model parameters

When parameters in the Initial and/or Calibration data set are changed the Final set is no longer up to date. In that case the Final set may be updated by selecting 'Final' 'Update' from the pull down menu. The new input and output from the data sets Initial and Calibration on which the Final data set is based on are copied to the Final data set.



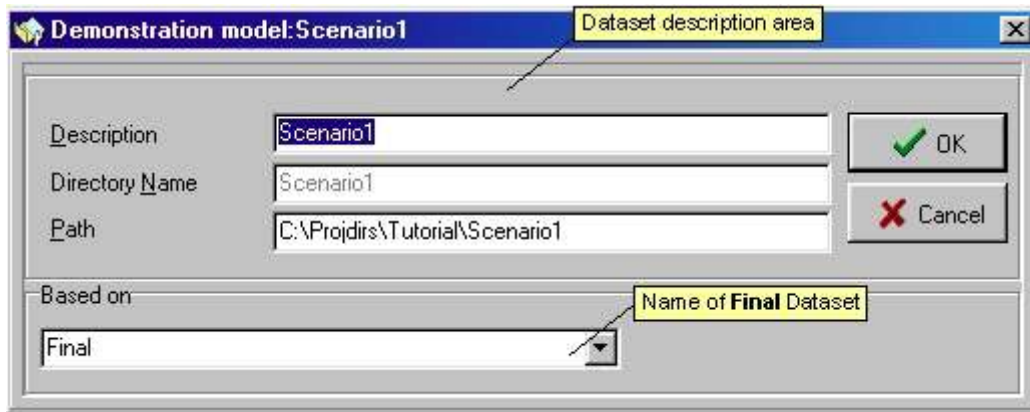
6.2 Creating a Scenario data set

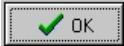
6.2.1 Introduction

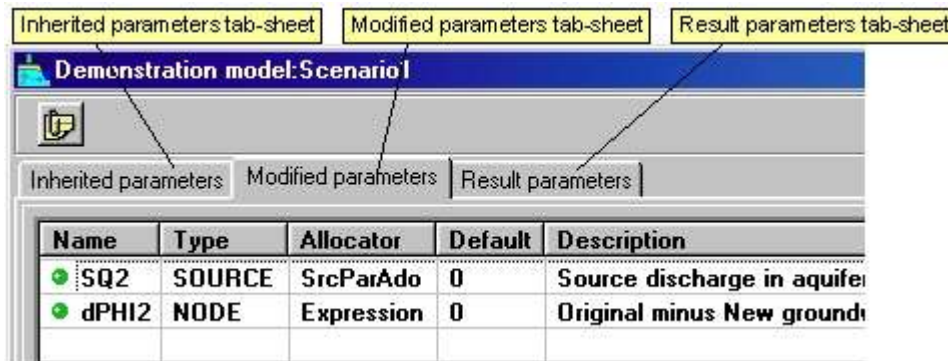
In most cases a groundwater model is used to predict the consequences of changes made to the water system. These changes usually concern only a few model parameters. Therefore **Triwaco** has introduced the so called scenario data set. For a particular scenario data set the model parameters are inherited from the Final data set (on which it is based) and only the parameters that need to be altered for that scenario have to be defined.


6.2.2 Opening a Scenario data set

The '**Scenario data set**' is created similarly to the other data sets by selecting 'Add' from the 'data set' pull down menu and 'Scenario' from the 'create new data set' dialog window. The user is prompted to provide a description, the sub-directory name and the (Final) data set the '**Scenario data set**' is based on.



Confirming the selection with the  -button causes the program to add the '**Scenario data set**' to the '**project window**'. Opening the '**Scenario data set window**' displays all model parameters defined and allocated in the (Final) data set referred to. The '**Scenario data set window**' contains three tab-sheets similar to those of the '**Calibration data set window**': the **Inherited** parameters, the **Modified** parameters and the **Result** parameters tab-sheets.



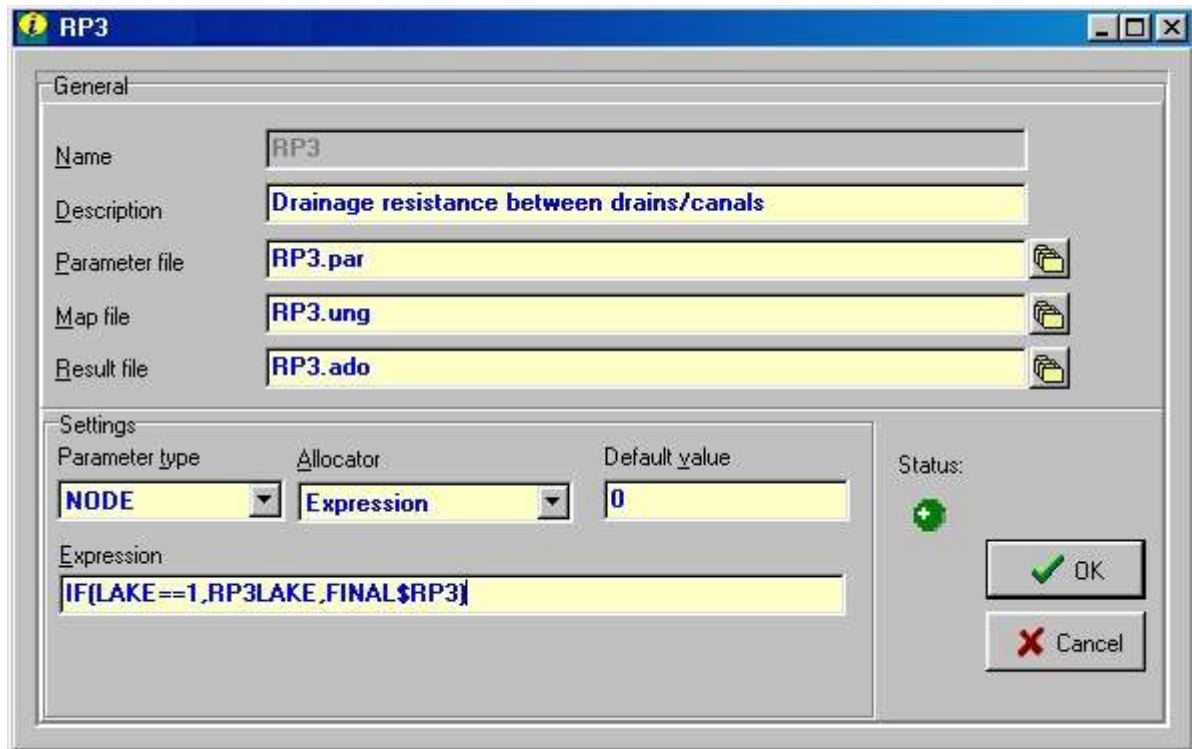
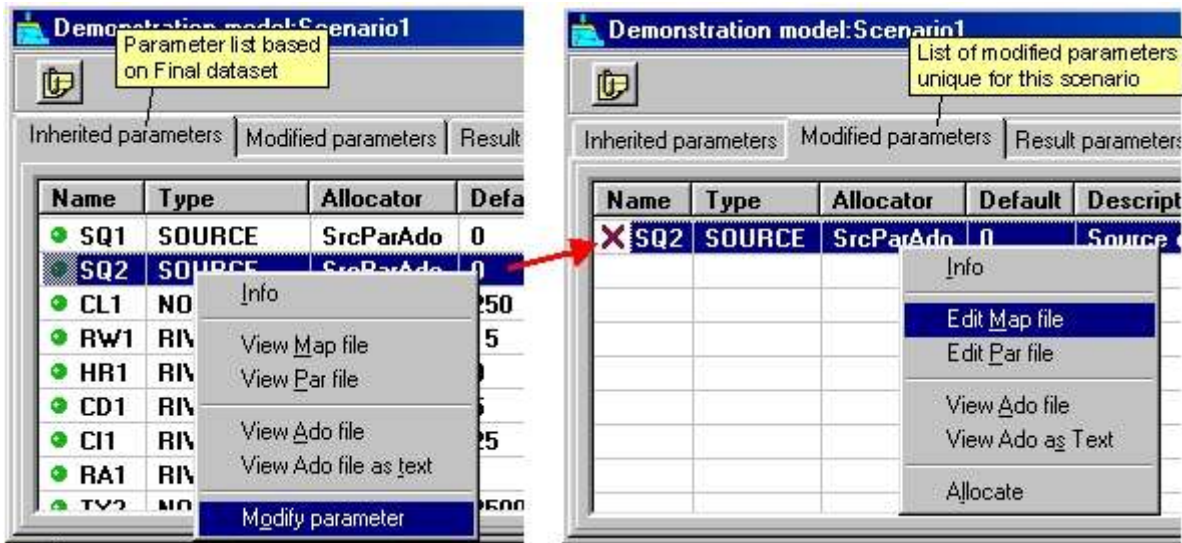
Inherited parameters	This sheet displays all model parameters defined in the (final) data set the scenario set is based on. All parameters in this data set will have a status  .
Modified parameters	This sheet displays all parameters created or modified in the (actual) scenario data set. At the start this sheet is empty.
Result parameters	This sheet displays all parameters that result from the model calculations. It is displayed only after model calculations have been carried out.

Pressing the right hand mouse button displays the well-known pop-up menu with a number of possible actions. The options of the pop-up menu allow retrieving 'Info', to 'View' and edit the **map** or **par file**, to 'View' the **Ado** file using the graphical presentation tool Triplot or as an ASCII text file and to 'Modify' the parameter selected. Opening this window in the **Modified** parameters tab-sheet allows the user to 'Allocate' the parameter in stead of Modifying it.

The same selection can be made from the 'Parameter' pull-down menu, while one of the sheets is displayed. The pull-down menu offers a slightly different selection of possibilities: 'Info', 'Delete', 'Add' ('User Defined' or 'Internal'), 'Allocate', 'Modify parameter', 'View' ('Par', 'Map', 'Adore' and 'Adore as text') and finally 'Copy' and 'Paste'. The commands that can not be selected are grayed out, like 'Delete' while the **Inherited** parameters sheet is displayed.

6.2.3 Creating a Scenario

For a particular scenario data set the model parameters are inherited from the Final data set (on which it is based) and only the parameters that need to be altered for that scenario have to be defined. Select 'Modify parameter' for the parameter that is changed with respect to the reference simulation. The selected parameter now moves from the **Inherited** parameters tab-sheet to the **Modified** parameters tab-sheet. The **map** and **par** files of the parameters are also copied to the **Modified** parameters tab-sheet. The parameter can now be altered for the scenario simulation which is carried out in the same way as parameters from the 'Calibration data set'.



To define changes in the hydrological system it is recommended to define these changes in separate parameter files and to define the modified model parameters by means of an [expression](#). To do so the user has to add the scenario parameters by selecting 'Add' 'User defined' from the 'Parameter' pull-down menu. This will open the '*parameter info window*' in which the user has to define the name and description of the parameter (the parameter files will obtain the same name). Next, one should provide the type of parameter, the allocator, the default value and an expression (if applicable).

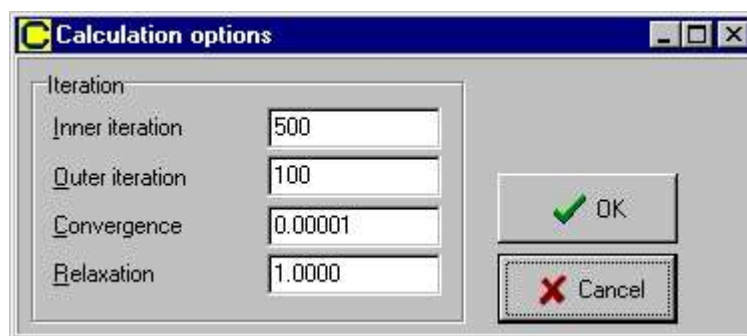
Selecting 'Delete' from the 'Parameter' pull-down menu after having selected a parameter from the **Modified** parameters tab-sheet removes the parameter and restores the link to this parameter in the **Inherited** parameters tab-sheet.

6.2.4 Allocating scenario parameters

Similar to the allocation in the '*Calibration data set*' selecting 'Allocate', from either the 'Parameter' pull-down menu or the pop-up menu, starts the selected *allocator* and an *Ado* file will be generated. After allocation the status of the parameter will change from **X** to **+**

6.2.5 Scenario simulation options

After having successfully allocated parameter values for the scenario parameters one may start groundwater flow calculations. Selecting 'Options' from the 'Scenario' pull-down menu displays the '*Calculation options*' dialog box.



Description	Function
Inner iteration	Sets the maximum number of inner iterations
Outer iteration	Sets the maximum number of outer iterations
Convergence	Sets the criterion for convergence ϵ
Relaxation	Sets the relaxation factor ($\zeta \leq 1$)

The values appearing in the dialog box for the number of **Inner** and **Outer iterations**, for the criterion of **Convergence** and for the **Relaxation** are adopted from the '*Calibration data set*' and may be changed if necessary.

6.2.6 Executing the scenario simulation

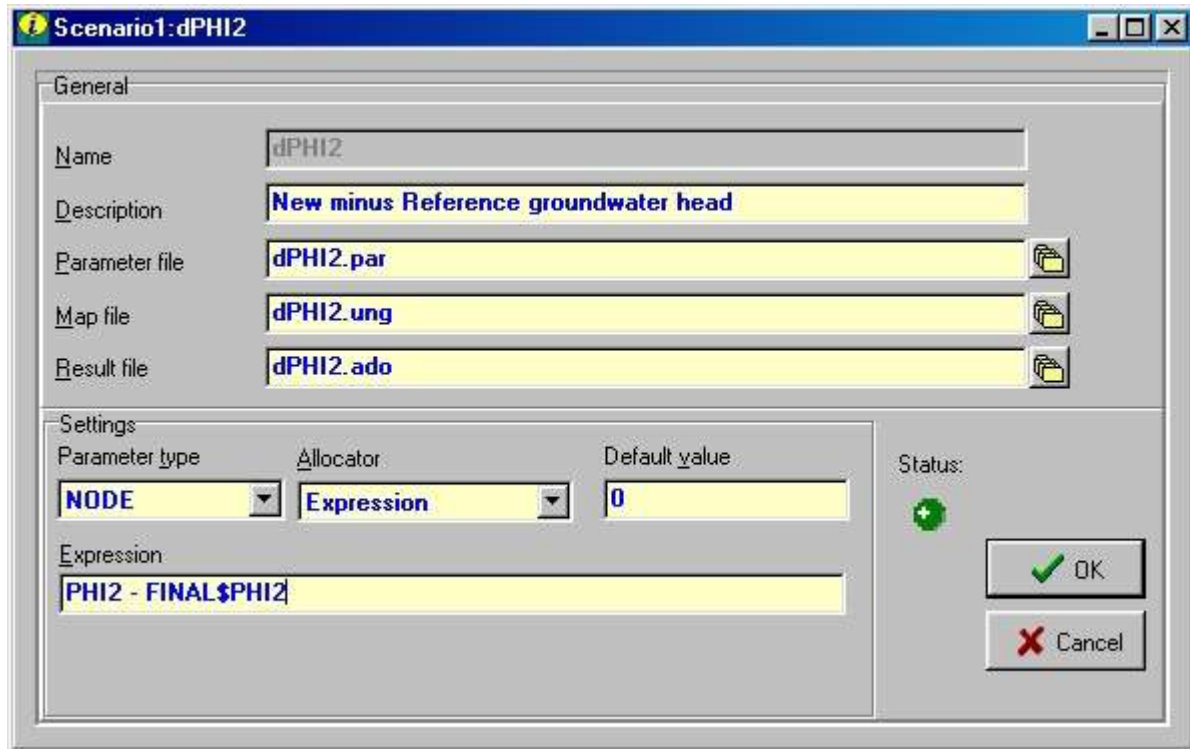
Scenario simulations may be carried out after having generated the INPUT FILE. Selecting 'Generate Input' from the 'Scenario' pull-down menu causes the program to generate this input file. The input file (*flairs.fli*) may be viewed or edited selecting 'View' 'Input'. Editing of the input file is only needed in case special calculation options are required. In the input file all parameters needed for the calculations are defined.

Selecting 'Run simulation' from the 'Scenario' pull-down menu starts the groundwater flow program. A window, showing the calculation process will be displayed and the process is added to the Tasks window. Once calculation has stopped the **Result** parameters tab-sheet will be updated. Running the simulation program for the first time will add this sheet to the '*Scenario data set*' window.

The print output file (*flairs.flp*), the execution log file (*flairs.flg*) and the calculation results (from the file *flairs.flo*) may be viewed in the same way as in the '*Calibration data set*'; by selecting 'View' followed by 'Print' 'Log' or 'Results' from the 'Scenario' pull-down menu.

6.2.7 Viewing scenario output results

Now, one may define the difference between the scenario calculations and the calibrated (reference) situation by adding (user-defined) parameters. As allocator one chooses 'Expression', and the [expression](#) entered should have the form of: "**PAR - data set\$PAR**", with 'PAR' the (result) parameter considered and 'data set' the name of the **Triwaco** data set with the results of the reference situation (usually the [Final data set](#)).



Selecting '**View** **Results**' from the '**Scenario**' pull-down menu starts the graphical presentation tool **Triplot**, loads the grid and parameter information and displays the layout of the model area. Now the user can contour or classify the result parameters and view the results in plane view or can select a cross-section of the model area.

Alternatively, the user can select one of the parameters from the **Result** parameters tab-sheet to view the parameter separately. The program **Triplot** is started after selecting '**View** **Adore**' from the '**Parameter**' pull-down menu or '**View Adore file**' from the pop-up menu (right hand mouse button). Adding other parameters (In **Triplot** select '**Load**'**Param**' from the pull-down menu) gives the user the opportunity to compare result parameters with model input parameters.