

GoldSim Version 10.5 Summary

Summary of Major New Features and Changes

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GoldSim

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Introduction

This document describes the changes and new features implemented in GoldSim Version 10.5. This version includes a significant number of new features and user interface improvements. It also includes a number of bug fixes.

Documentation of New Features

This document simply summarizes the major changes in Version 10.5. All new features discussed in this document are described in detail in the accompanying Help file and user manuals for this release.

Of course, if you have questions about any of the new features in GoldSim, please contact us at support@goldsim.com. We also encourage you to visit our new online user forum at <http://www.goldsim.com/Forum/>, where you will find a sub-forum dedicated to Version 10.5.

Installation Instructions for this Version

If you are currently beta-testing 10.5, you should uninstall the beta version before installing this final release of 10.5. However, you do not need to uninstall other GoldSim versions (such as GoldSim 9.60 or 10.11) to install Version 10.5. In fact, until you have fully converted your existing models we recommend that you keep your previous GoldSim version installed on your machine. The new version will be installed in parallel to any existing pre-Version 10.5 GoldSim versions currently on your machine (it will not overwrite them).

To install GoldSim Version 10.5, you must download the full installation file: “GoldSim_10.5_Setup.exe”. Download the file from the website, and run it. You should have at least 200 MB of disk space available before downloading.

After installing this version, when you start the program it will automatically detect and use your existing license. Note that you must have administrative privileges in order to install GoldSim successfully.

Conversion Issues When Running Existing Models

There are no conversion issues when reading a model created in GoldSim 10.11 into GoldSim 10.5. Note, however, that once you save a model in GoldSim 10.5 it cannot be opened in GoldSim 10.11.

The Script Element

GoldSim 10.5 includes a major new feature: the Script element.

In some situations, you may wish to define a complex function which can not be readily implemented using the expression editing features supplied by GoldSim. For example, calculation of an output may require a very complex logic which would be cumbersome to represent using a Selector element, or it may require a numerical solution technique (e.g., iteration); or perhaps you need to construct an array using complex logic.

For some complex calculations, an External (DLL) element may be required, but for many applications a Script element can be used. The key advantages of a Script over an External (DLL) is that 1) it does not require use of a separate programming language and interface; and 2) it is much more transparent (all of the “code” can be seen directly in GoldSim).

Scripts are created by adding a Script element and inserting and editing statements or statement blocks, which may be variable definition statements, variable assignment statements, statements controlling the sequence of execution in the script (e.g., loops and if statements), or statements used for writing messages to the Run Log. The Script element sequentially evaluates the specified sequence of locally defined statements to determine its output(s).

The Script does not expect the user to learn or be familiar with a particular language. As a result, Scripts are *not* created using a text editor. Rather, statements are inserted and edited within a “controlled environment” within the Script element’s property dialog in which the user selects from a number of available statement types. The syntax is already defined for each type of statement – the user simply specifies the attributes and properties for each statement via a dialog box when the statement is inserted. Statements can subsequently be moved, deleted, and edited.

To provide a quick idea of what a Script looks like, a simple example in which a Script is used to define a vector is shown below:

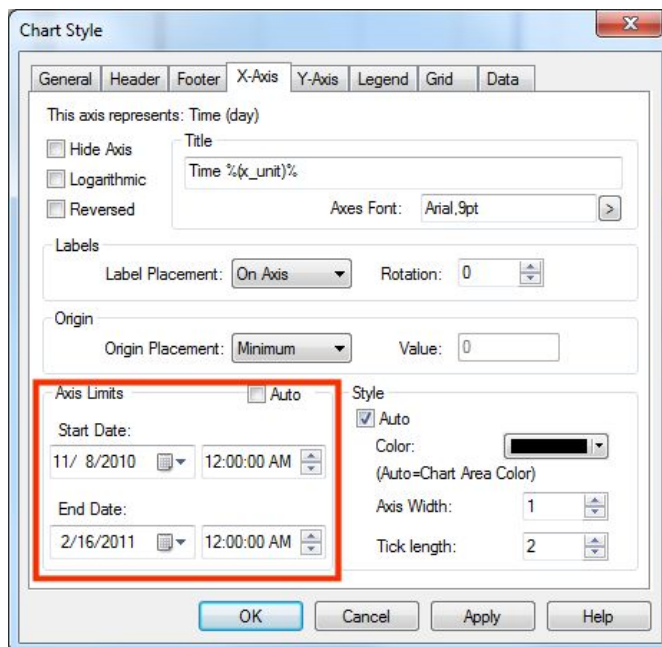
Script	
	Statement List
1	// Defines items in a vector as a function of the index
2	DO index = 1, 12, 1
3	IF (~Result[~index]<6) THEN
4	Result[~index] = ~index
5	ELSE IF (~Result[~index]<9)
6	Result[~index] = A
7	ELSE
8	Result[~index] = B
9	END IF
10	END DO

The Script element is powerful, and, as a result, somewhat complex. Therefore, it is strongly recommended that you read through the documentation carefully before attempting to build your own Scripts. Script elements are described in the GoldSim User’s Guide, starting on page 640. Alternatively, open the Help file, and on the Index tab enter *Script elements, introduction*.

Improvements to How GoldSim Manages Dates

Several important changes to how GoldSim manages dates have been implemented in GoldSim 10.5:

- Date/time simulations can now extend over a much broader range. In particular, the permitted date range for a date/time simulation is now 1 January 1700 to 31 December 9999. In previous versions of GoldSim, this range was restricted to 1900 to 2100).
- Time Series elements accept dates ranging from 1 January 100 to 31 December 9999.
- When plotting time history results for a date/time simulation, you can now set the date scale using dates (previously, this had to be done in Julian time, making it very difficult).



- When plotting time history results, the y-axis can now be plotted as a date. In previous versions, if the output being plotted in a time history result on the y-axis was a date-based output, it could only be plotted as a Julian time. This will be particularly noticeable for Milestone elements, as when they are used in date/time simulations their primary output is a date.

The Aquifer Pathway Element

GoldSim 10.5 includes a major new feature in the Contaminant Transport Module: a new pathway referred to as the Aquifer element.

An Aquifer pathway is intended to represent a feature that essentially behaves as a *fluid conduit*. It provides a way to simulate processes such as vertical transport through an unsaturated (vadose) zone, and horizontal transport in aquifers, rivers, channels and pipelines.

Note that a similar pathway, the Pipe, can be used for many of the same purposes. However, the Aquifer has some distinct advantages for many applications. This is because an Aquifer pathway actually performs its computations by creating a temporary set of linked Cell elements during the simulation, which are subsequently removed at the end of the simulation. In most cases, there is no need for you to be aware of how this is done, or to view the temporary Cell pathways that are created.

Because Aquifers internally use Cell to carry out their calculations, they can represent most of the same processes that can be represented by a Cell network. In particular, Aquifers can represent the following:

Partitioning. Within each internal Cell contaminants are partitioned between the the Reference Fluid and Infill Medium based on the partition coefficients and masses/volumes of the various media present.

Solubility constraints. You can assign solubility limits for the contaminants in the Reference Fluid (typically water) present in the pathway. The dissolved concentration of the contaminants in the pathway cannot exceed the solubility limit. If you are simulating isotopes of the same element, GoldSim ensures that the sum of the concentrations of all isotopes does not exceed the solubility limit.

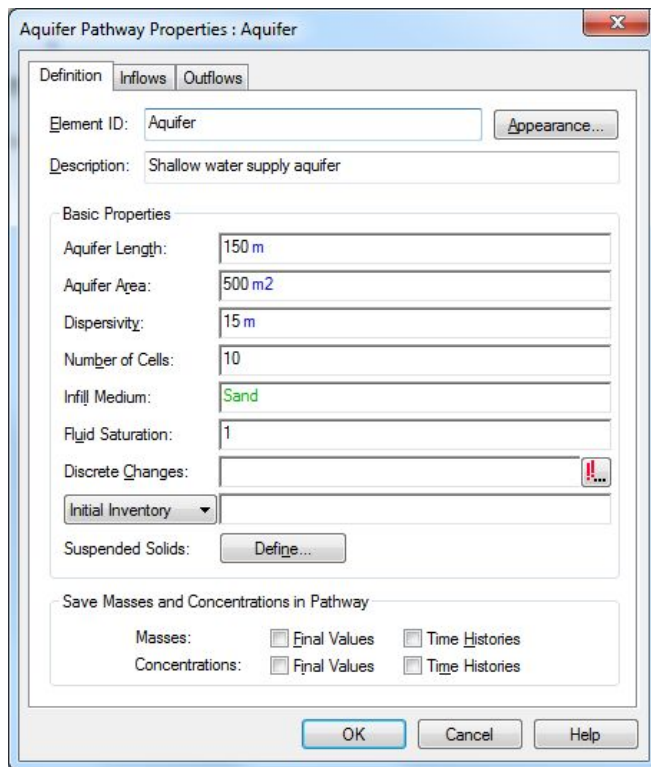
Mass transport. Advective, dispersive and diffusive transport mechanisms are explicitly represented within the pathway (using advective and diffusive mass flux links between the internal Cells).

Suspended Solids can be specified to be present in the Aquifer. These Solids are assumed to be advected and dispersed along the Aquifer. Species which partition onto the suspended Solids are transported with them as they move through the Aquifer.

Dynamic changes in flow rates, material properties or pathway length can be represented.

When multiple Cells are linked together via advective and diffusive mechanisms, the behavior of the Cell network is mathematically described using a coupled system of differential equations. In effect, the network of Cells created within an Aquifer pathway is mathematically equivalent to a finite difference network. GoldSim numerically solves the coupled system of equations to compute the contaminant mass present in the pathway (and the mass fluxes leaving the pathway) as a function of time.

Although Aquifers provide the power and flexibility of a Cell network, they are much easier to implement, as the details of constructing the network are all done automatically. The dialog for the Aquifer element is relatively simple and the required inputs are straightforward:

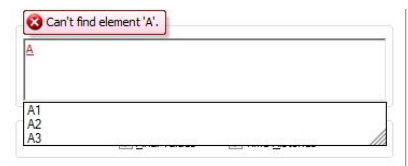


Aquifer elements are described in the GoldSim Contaminant Transport Module User's Guide, starting on page 152. Alternatively, open the Help file, and on the Index tab, enter *Aquifer pathways*.

Displaying Link Suggestions in Input Fields

Starting in GoldSim 10.5, when editing an input field, GoldSim automatically suggests the names of existing outputs at the bottom of the input field. That is, when you place your cursor into an input field and begin to type, GoldSim provides a list of suggestions for output names that are consistent with what you have entered so far.

For example, assume that the outputs A1, A2 and A3 all exist in your model (at a scope that is accessible from the current input field), and within an input field you type the letter A. The following will be displayed at the bottom of the input field:



If you simply want to select the first item in the list, you can press the **Tab** key. The suggestion box will close, the selection will be inserted, and in the input field, the cursor is placed to the immediate right of the selected output.

You can select one of the other suggestions either by selecting it with your mouse or by using the **Up** and **Down** arrow keys to select an option.

If you use the mouse to make the selection, the suggestion box will close, the selection will be inserted, and in the input field, the cursor is placed to the immediate right of the selected output.

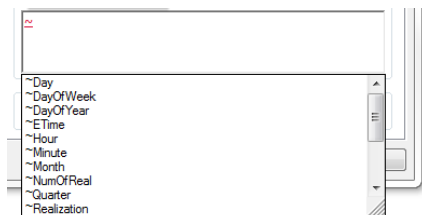
If you use the **Up** and **Down** arrows to make the selection, then the following rules apply:

- You can continue to move through the list using the **Home**, **End**, **PgUp** and **PgDn** keys.
- If you press the Tab key or right arrow, the suggestion box will close, the selection will be inserted, and in the input field, the cursor is placed to the immediate right of the selected output.
- If you press a non-character key (such as an operator like +), the suggestion box will close, the selection will be inserted, and in the input field, the operator is inserted and the cursor is placed to the immediate right of the inserted operator.

The suggestion list will also be closed if you left or right click elsewhere in the input field, or press **Esc**.

The following should be noted regarding how GoldSim constructs the suggestion list:

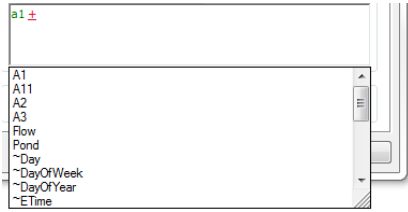
- The list only contains items that are within the scope of the input field.
- All locally available variables are included in the list (you can see these by typing ~):



- If you wish to link to a secondary output, you can do so by typing a period after the element name in the input field. The suggestion box will then list any secondary outputs that exist for that element:



- Pressing **Ctrl+Space** causes the suggestion box to be displayed. If the cursor is to the immediate right of a character, then the list that is consistent with the preceding character string is shown. If the cursor is not to the immediate right of a character (e.g., if there is a space or operator before the cursor), then a list of ALL available outputs is provided.



If you do not want the suggestion box to be displayed while you are editing inputs, you can turn it off in the Options dialog (accessed via **Model | Options...**):

Suggest element and output names when typing in input fields

Clearing this box will turn off this feature.

Other Notable Modifications

Support for Extended Worksheet Ranges in Excel

GoldSim 10.5 now supports the extended worksheet ranges (1,048,576 rows by 16,384 columns) introduced in Excel 2007. If you wish to exchange data between an extended worksheet range and GoldSim, you must use Excel 2007 or newer, and the file format must be .xlsx.

If Statements Can Handle Mixtures of Arrays and Scalars

Starting in GoldSim 10.5, If statements can use mixtures of arrays and scalars. The rules for how such statements are interpreted are as follows:

- 1) The first argument (the condition) can be an array or scalar. If it is an array, then the second and third argument must also be arrays with the same set of array labels. In this case, GoldSim does an item by item evaluation to construct the output array.
- 2) If the condition is scalar, and the second and third arguments are arrays, they must be of the same order, and the output has the same order as these arguments. Either one array or the other is output in its entirety as the result.
- 3) If the condition is a scalar, one of the latter two arguments can be a scalar, and one can be an array. The output of the If statement is then an array, and the scalar argument is treated as an array of identical values.

Shortened Array Constructors

GoldSim 10.5 includes a minor improvement to make it easier to use array constructors.

One of the quickest ways to create an array is to use array constructor functions. These are functions that can be entered into an input field that generates an array (a vector or a matrix) by specifying the array label set(s) and values as arguments. For example, the following expression generates a vector based on the Days array label set, in which all the items have a value of 1m:

Vector(days, 1m)

Starting in GoldSim 10.5, you do not have to specify the array label set(s) when using an array constructor. If you omit them, GoldSim will assume that the constructed array has the same order and set(s) as that of the input field where it is being defined. For example, if you created an Expression defined as a vector with array label set “days”, then to create a vector of zeros, you could enter either “*Vector(days, 0)*” or simply “*Vector(0)*”.

Improvements to the GoldSim Units Manager

The GoldSim Units Manager (accessed by selecting **Model|Units...** from the main menu) has been redesigned. In addition to streamlining and improving the user interface, two new features will be noticeable:

- All units are now “active”. In previous versions units could be deactivated (and would not show up in context menus until they were activated).
- A wizard has been added for adding new units, significantly simplifying this process.

The GoldSim Units Manager is described in the GoldSim User’s Guide, starting on page 377. Alternatively, open the Help file, and on the Index tab, enter *Units, Manager*.

Improvements to the Time Series Element

GoldSim 10.5 includes several minor improvements and modifications to the Time Series element.

New Options for What a Time Series Represents

In previous GoldSim versions, there were four options for defining what a set of time series data represented:

- Instantaneous values
- Constant values over the *next* interval
- Changes over the *next* interval
- Discrete changes

GoldSim 10.5 includes two additional options:

- Constant values over the *previous* interval
- Changes over the *previous* interval

These options make it easier to import measured time series data, as that is the manner in which it is often actually recorded (i.e., a change or an average value over the previous time interval).

New Options for Using the Time Series Element to Record and Play Back Histories

One of the advanced features of Time Series elements is that they can be used to read the output of another element in the model, “record” the results, and then “play them back” in a subsequent run of the model.

GoldSim 10.5 includes some additional options for controlling how these outputs are recorded.

Changes to the Format for Time Series Definitions in External Functions

Some advanced users read and output Time Series data within their custom DLLs. In GoldSim 10.5, the format for a Time Series Definition has been modified (to explicitly represent both elapsed time and date-based time series records).

New Import Option for Lookup Tables

Lookup Tables now support an option to be linked to a text file. The text file data is imported automatically whenever the data in the file is modified.

New Features for Exploring and Modifying the Causality Sequence

When you build a model, GoldSim automatically *sequences* the elements in the order that they must be computed. For example if A was a function of B, and B was a function of C, C would be sequenced first, followed by B, followed by A. This is referred to as the *causality sequence*. Although in this simple example, the sequence is obvious, for complex models with looping logic, the causality sequence may not be readily apparent.

In most cases, you need not to be concerned with how GoldSim sequences the elements. However, in some cases (e.g., when simulating systems that include discrete events and looping logic or systems that have competing Resource requirements), expert users may need to understand (and subsequently manipulate) the causality sequence.

GoldSim 10.5 provides powerful new tools for both exploring and manually changing the causality sequence.

This is described in the GoldSim User’s Guide, starting on page 739. Alternatively, open the Help file, and on the Index tab, enter *Causality sequence*.