

# GoldSim 14 Summary

Summary of New Features and Changes

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**GoldSim**  
TECHNOLOGY GROUP

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## INTRODUCTION

This document describes the primary changes and new features implemented in GoldSim 14. A full listing of all of the changes can be found in the Release Notes (accessible under Help in the main menu).

### **Documentation of New Features**

This document summarizes the major changes in GoldSim 14. All new features discussed in this document are described in detail in the accompanying Help system and user manuals for this release. Note that there is also a web-based version of the Help system available (which is identical to the Help system that is integrated into the software), and in the sections below, links are provided to those parts of the web-based Help system describing the the new features.

Of course, if you have questions about any of the new features in GoldSim, please contact us at [support@goldsim.zendesk.com](mailto:support@goldsim.zendesk.com). We also encourage you to visit our online user forum at <http://www.goldsim.com/Forum>.

### **Installation Instructions for this Version**

You do not need to uninstall other GoldSim versions (such as GoldSim 11.1, GoldSim 12.0 or GoldSim 12.1) in order to install GoldSim 14. The new version will be installed in parallel to any existing pre- GoldSim versions currently on your machine (it will not overwrite them).

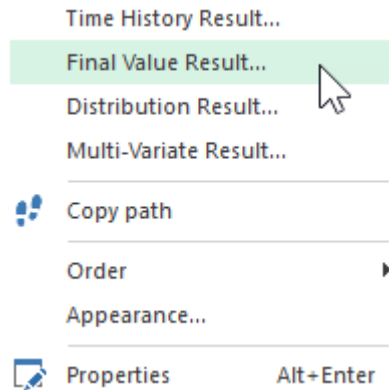
To install GoldSim 14, you must download the full installation file: “GoldSim\_14\_Setup.exe”. Download the file from the website, and run it. Note that you must have administrative privileges in order to install GoldSim successfully.

In order to use GoldSim 14, you will need to enter a new Activation Code. All users with active maintenance should have received a new Activation Code. If you have not, please contact us at [support@goldsim.zendesk.com](mailto:support@goldsim.zendesk.com).

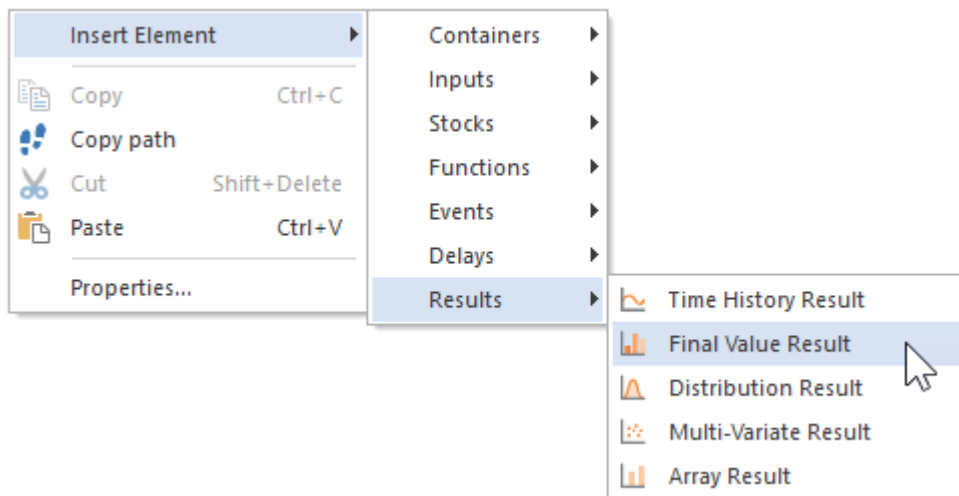
## IMPORTANT NEW FEATURES

### The Final Value Result Element

GoldSim 14 introduces a powerful new result display option referred to as a Final Value Result:



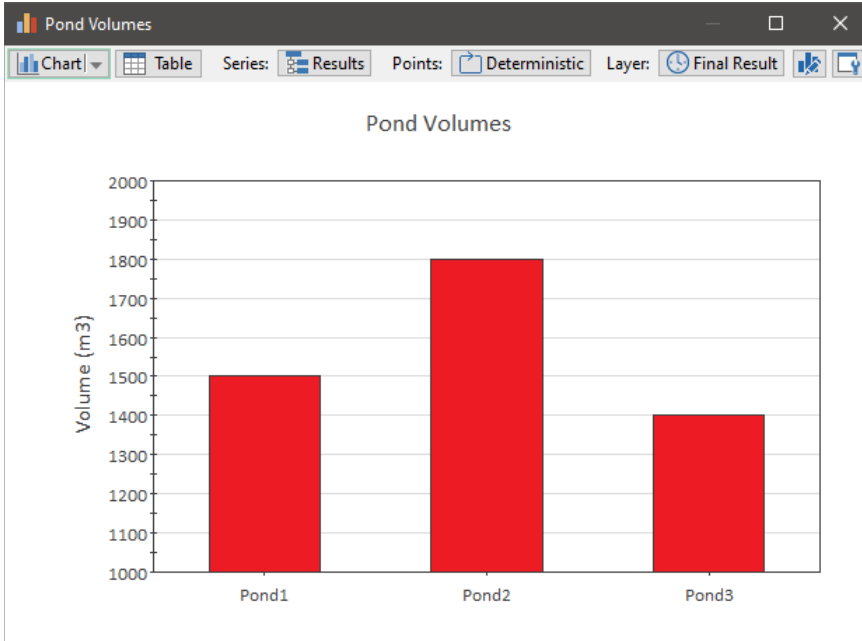
There is also a new Result element associated with this result display:



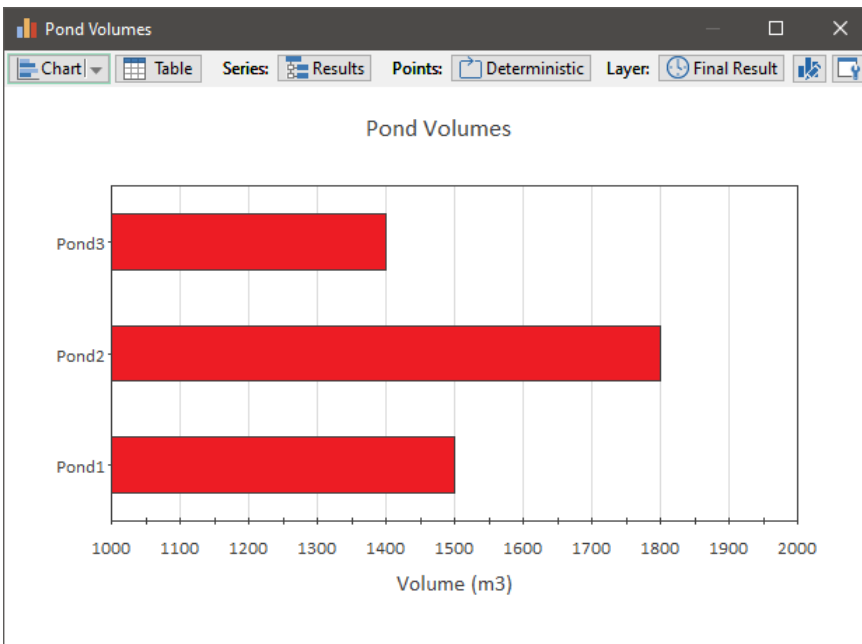
Final Value results are used to carry out side-by-side *comparisons* of the final values of outputs for different types of simulations. In order to use them, you need to carefully specify what you wish to compare and how you want to display that comparison. Depending on how your model has been run (e.g., multiple realizations, multiple scenarios, multiple Capture Times) and the outputs you have specified to compare (e.g., one output, multiple outputs, vector results, matrix results), there can be a large variety of ways to display the comparison.

One of the simplest Final Value results you might want to display is simply the comparison of multiple outputs for a deterministic run or a single realization. For such a result, there are three meaningful ways that you can choose to display this in a Final

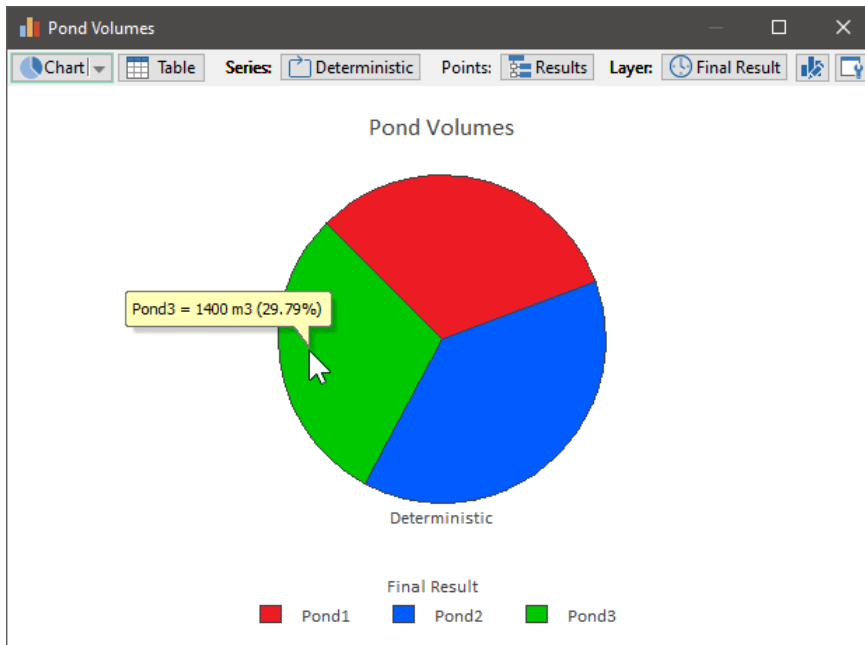
Value result. This is a *column chart*:



This a *bar chart*:



This is a *pie chart*:



There are two possible ways to view this same data in tabular form, either as rows or columns of values:

Unit: m3	Final Result Deterministic
Pond1	1500
Pond2	1800
Pond3	1400

Unit: m3	Final Result Pond1	Final Result Pond2	Final Result Pond3
Deterministic	1500	1800	1400

We can make this “one-dimensional” data set “two-dimensional” by running a Monte Carlo simulation. In this case, the final values we would want to look at would likely be statistics (e.g., the mean or some percentile), although we could also look at all the realizations together (something you would typically not do). In this case, the tabular form of the data would look like this (as in the previous case, the rows and columns can be reversed):

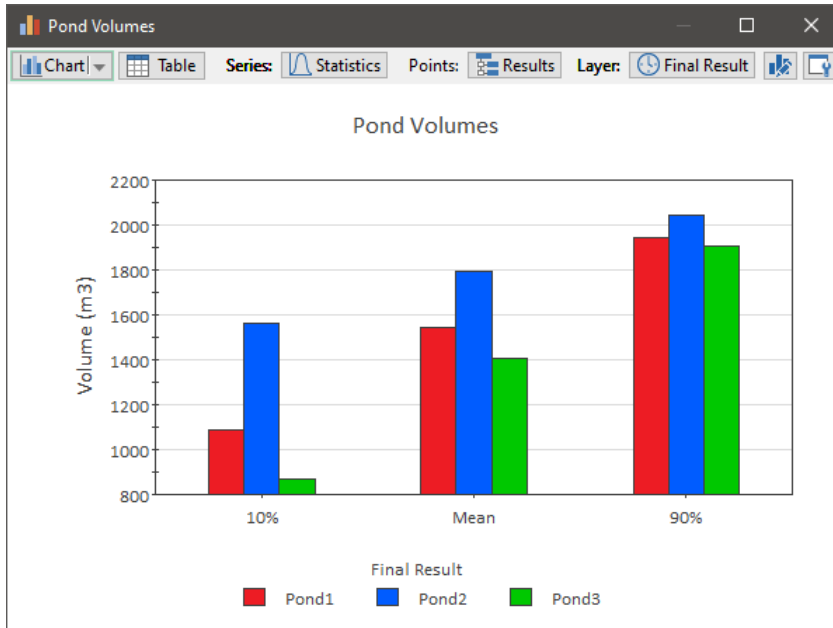
Unit: m3	Final Result 10%	Final Result Mean	Final Result 90%
Pond1	1087.2	1545.5	1946.3
Pond2	1565.5	1796.2	2045.1
Pond3	867.46	1404.7	1908.5

Unit: m3	Final Result Pond1	Final Result Pond2	Final Result Pond3
10%	1087.2	1565.5	867.46
Mean	1545.5	1796.2	1404.7
90%	1946.3	2045.1	1908.5

Now that we have “two-dimensional” data, our charts can become a bit more interesting and we can explore and compare the results in different ways. For example, we could produce a *clustered* column chart like this:

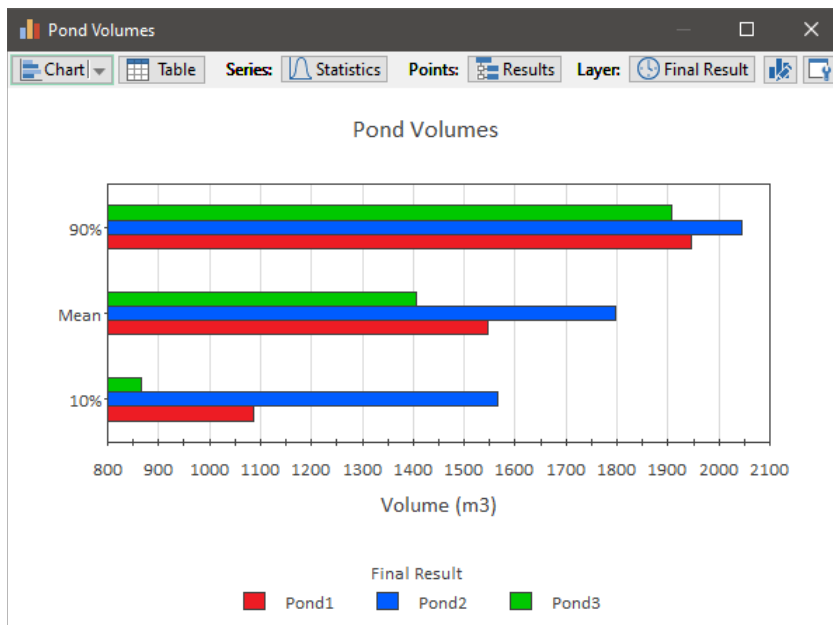


This chart displays three groups (clusters) of columns. Each group represents a different output, and each column represents a different statistic for that group. The Final Value result, however, can also “flip” how this information is displayed:



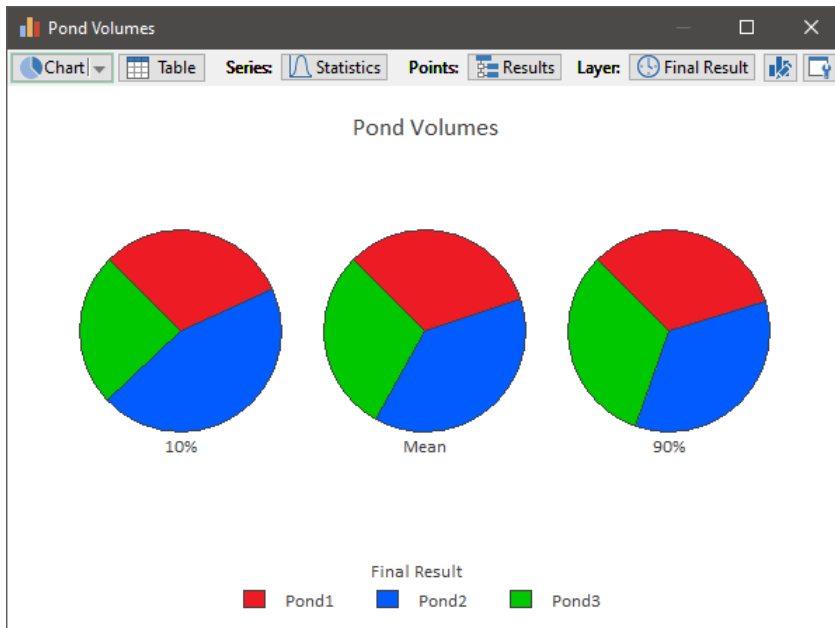
In this case, each group of columns represents a different statistic, and each column represents a different output.

These two displays are in the form of column charts, but we also display bar chart versions of these same results. For example, here is the clustered column chart above displayed as a clustered bar chart:



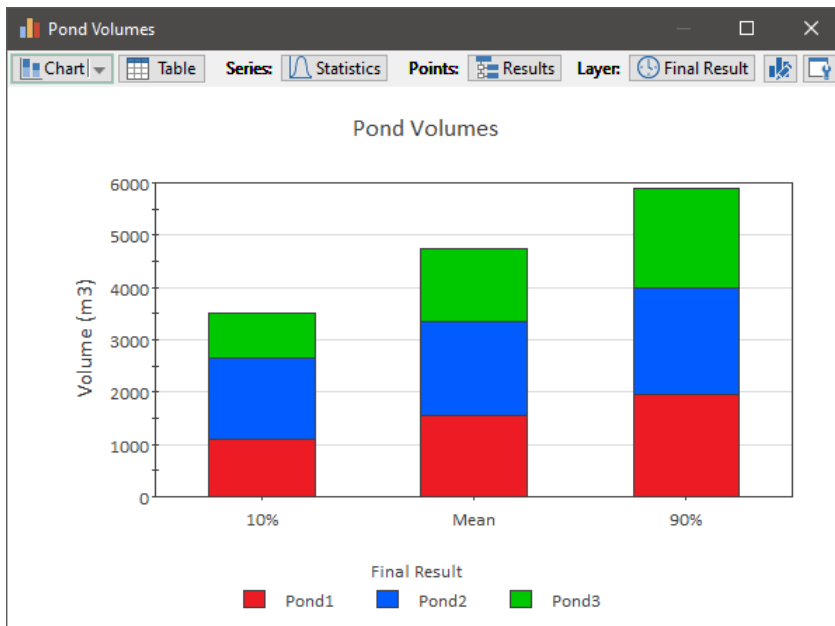
We can also display “two-dimensional” pie charts:

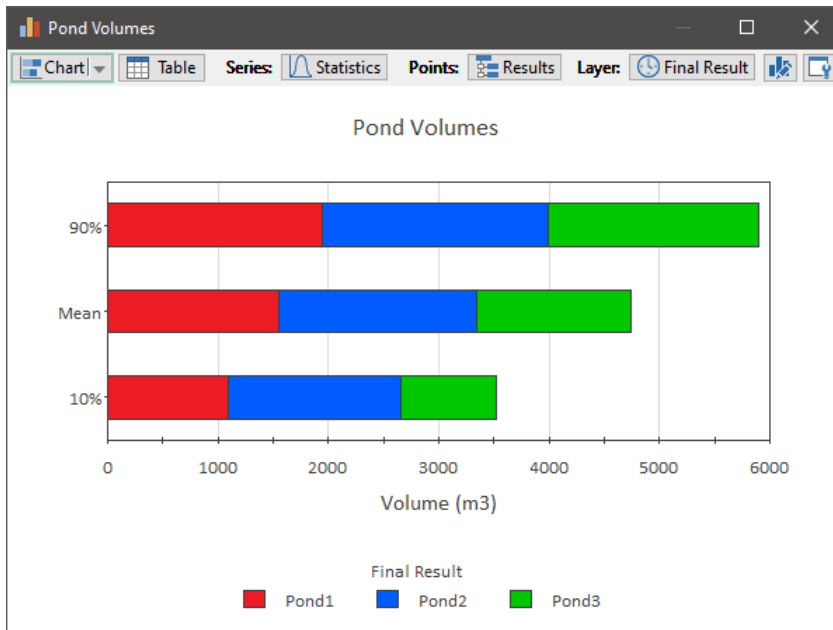




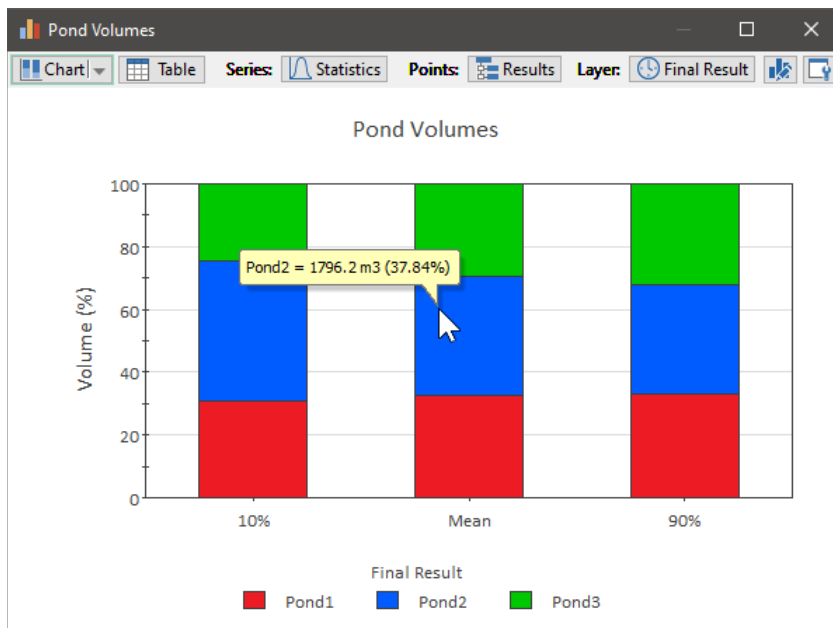
In this case, each pie represents a different statistic, with each pie slice representing a different output. Alternatively, however, we could specify that each pie represents a different output, and each pie slice represents a different statistic.

Finally, having a “two-dimensional” set of data allows us to make use of *stacked bar* and *stacked column* charts. That is, rather than presenting the data using groups of columns (or bars), we can present it using stacked columns (or bars):





Stacked bar and column charts can also be displayed as percentages (of all the items in the “stack”) rather than values. Here is what the stacked column chart above would look like if displayed as a **100% stacked column** chart:

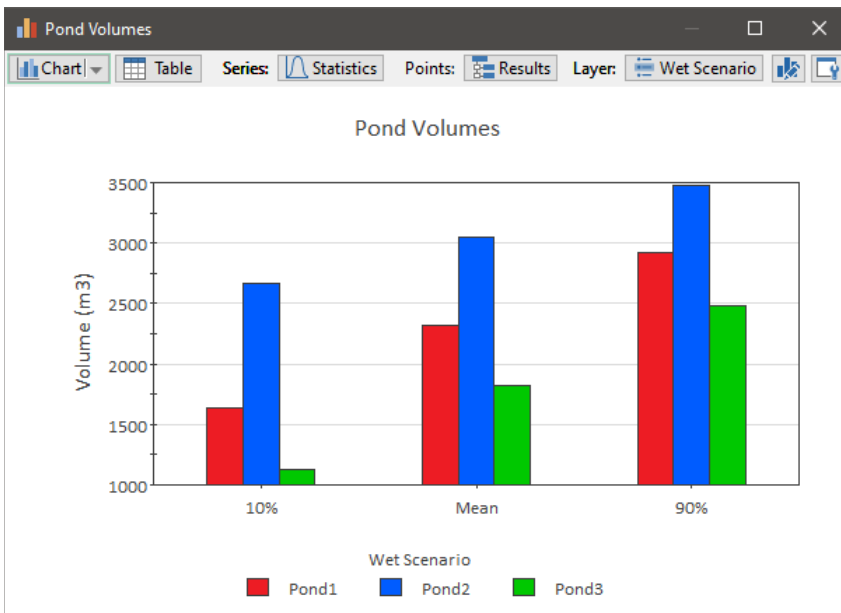
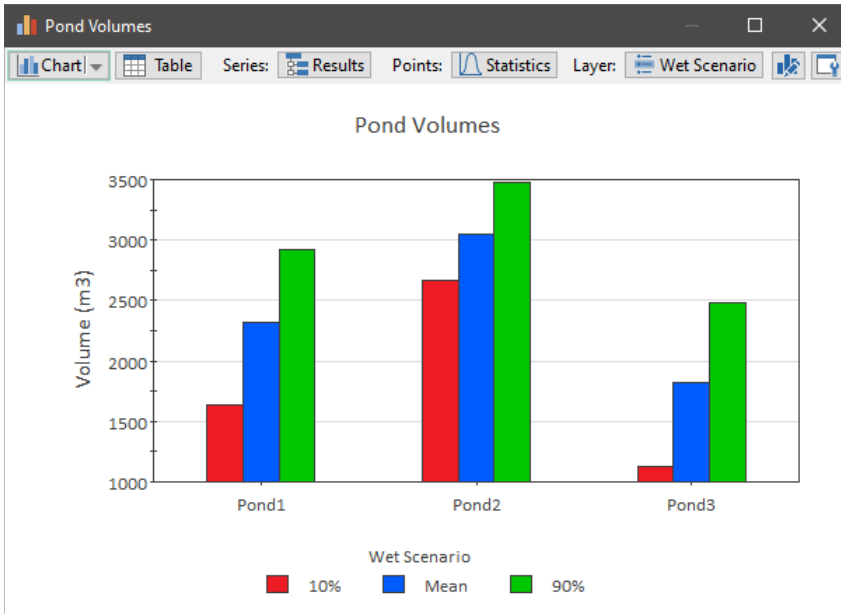


Such a chart is similar to a pie chart (in that all of the sections add to 100%).

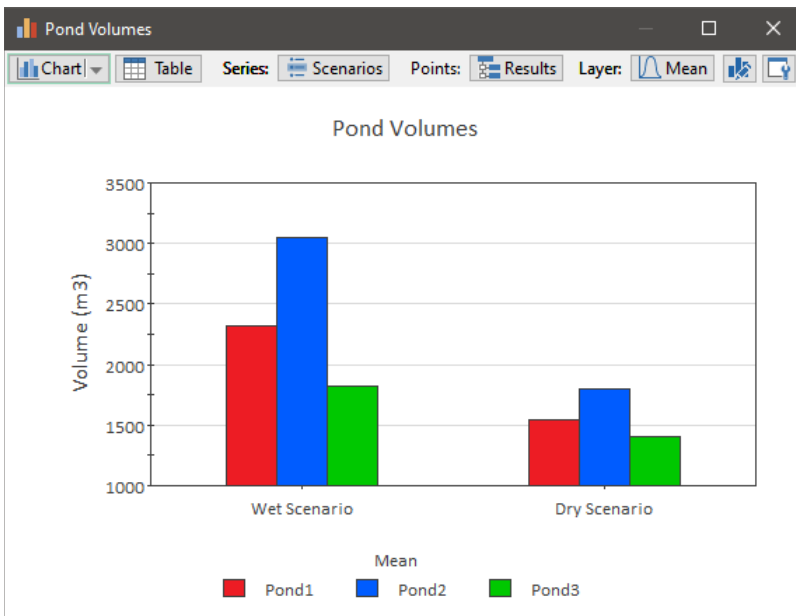
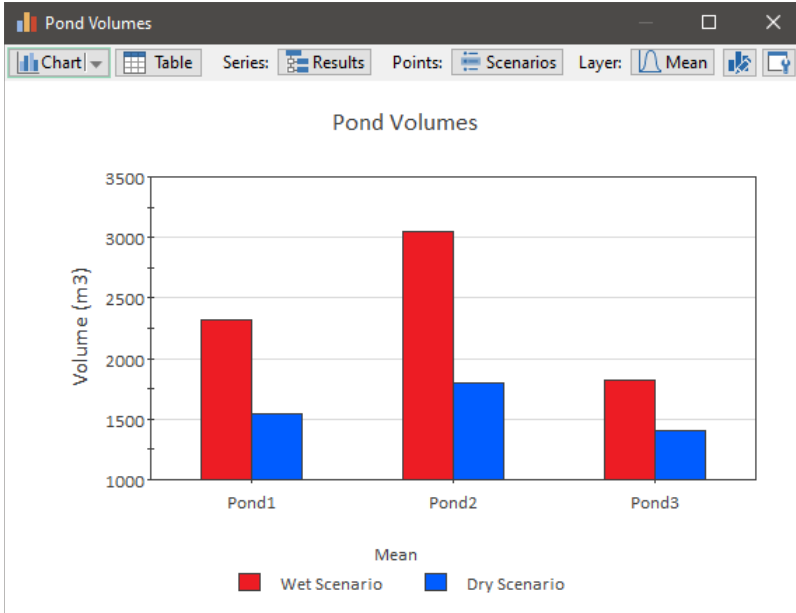
Running your model in different ways can add additional “dimensions” (beyond two) to the set of data that you wish to display. For example, we could have run this particular model for two different scenarios. We would then have three “dimensions” to our data set (outputs, statistics, scenarios). Charts themselves can not extend beyond “two-dimensions” (like those shown above), so when we have three “dimensions” in the set of

results, we need to select a single value for one of the dimensions (referred to as the Layer) when displaying the chart. But having three dimensions provides great flexibility in how we display the data.

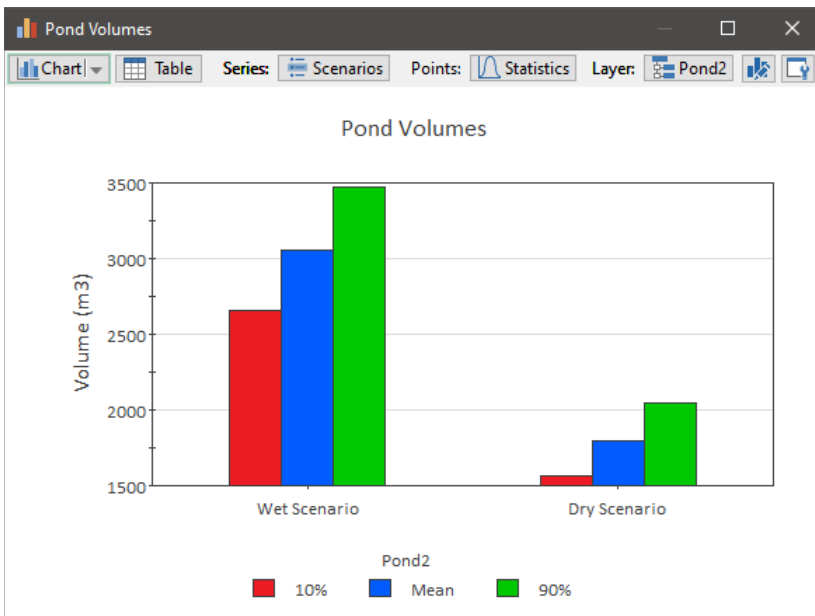
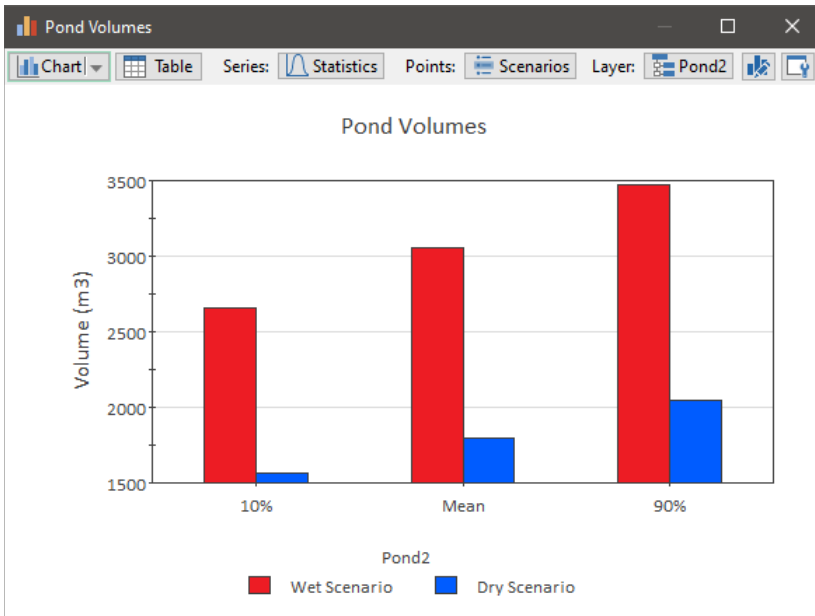
For example, we could choose to display a column chart showing all outputs and all statistics for a particular scenario (in two different ways):



Alternatively, we could choose to display a column chart showing all outputs and all scenarios for a particular statistic (in two different ways):



Finally, we could choose to display a column chart showing all scenarios and all statistics for a particular output (in two different ways):



In this case, we produced six different column charts displaying these results in different ways (which allows you to emphasize different aspects of the results). Note that we could have also produced equivalent stacked column charts, bar charts, stacked bar carts, and pie charts (six different charts for each type of display).

The tabular view of this data would look like this (and could also be displayed in multiple ways, by switching what is displayed in the rows and columns):

Unit: m3	Wet Scenario 10%	Wet Scenario Mean	Wet Scenario 90%	Dry Scenario 10%	Dry Scenario Mean	Dry Scenario 90%
Pond1	1630.8	2318.2	2919.4	1087.2	1545.5	1946.3
Pond2	2661.4	3053.6	3476.7	1565.5	1796.2	2045.1
Pond3	1127.7	1826.1	2481	867.46	1404.7	1908.5

In the case of tables, unlike charts, the “third dimension” can be fully displayed (GoldSim simply increases the number of columns).

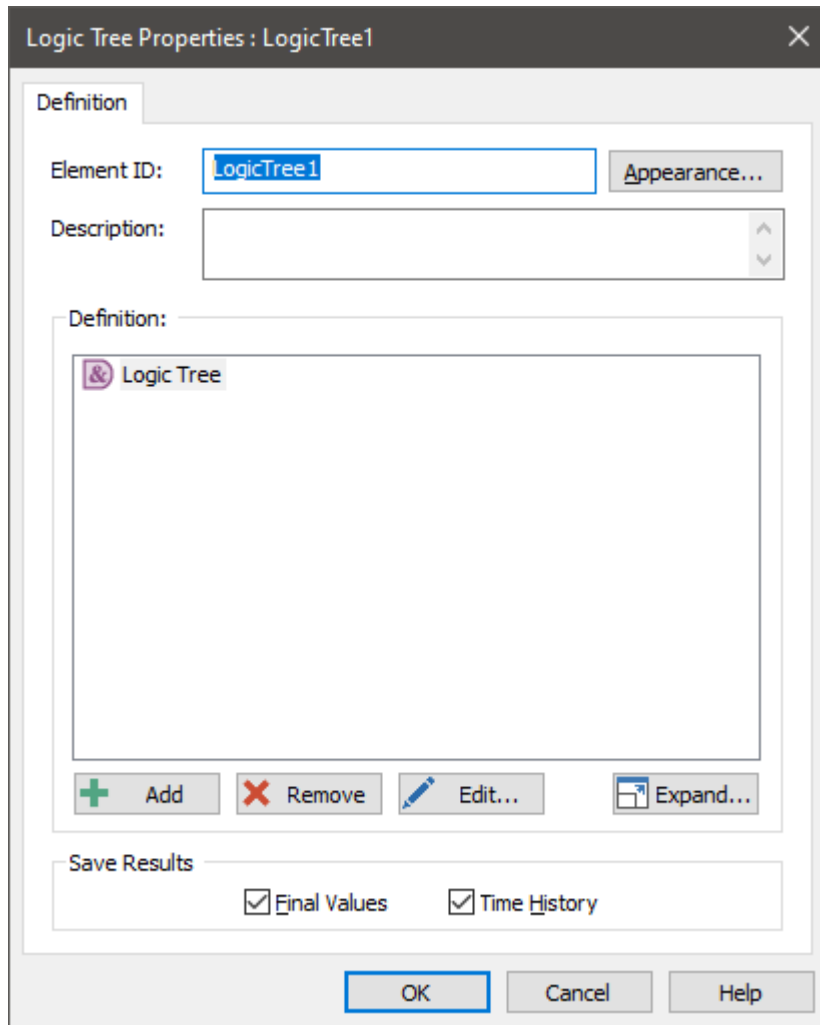
The examples provided here do not cover all of the combinations of results that you can display (e.g., Final Value results can also display arrays and results for different Capture Times), but what you should conclude from this overview is the following:

- The Final Value result is very powerful and flexible, and allows you to produce a variety of charts and tables to display results at the end of the simulation (Final Values) or at defined Capture Times.
- At their most complex level, charts can display up to two “dimensions” of results from higher dimensional data sets (e.g., multiple outputs and multiple statistics for a single scenario; multiple outputs and multiple scenarios for a single statistic, multiple statistics and multiple scenarios for single output).
- Tables can display the full data set selected (by increasing the number of columns).
- The various charts and tables can be displayed and rearranged in a wide variety of ways, giving you great flexibility in order to emphasize specific aspects of the results.

Final Value results are described in more detail [here](#).

## **The Logic Tree Element**

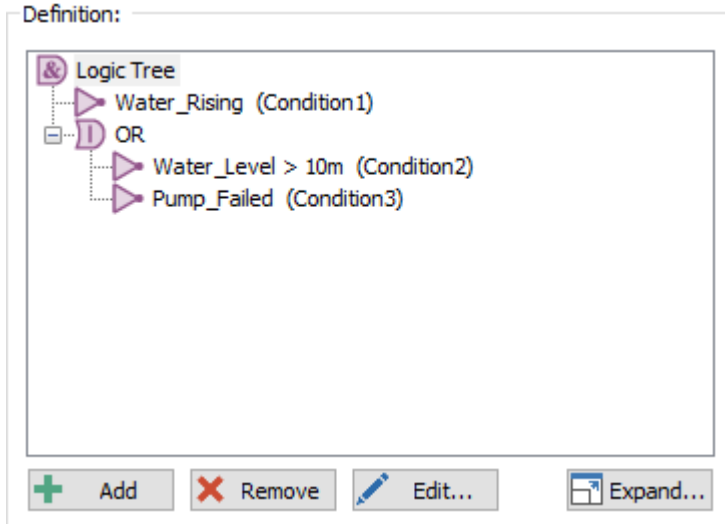
GoldSim 14 provides a new element called a Logic Tree. It provides powerful tool for creating complex logic:



Logic Tree elements have a single output, which is a scalar condition (True or False). The logical framework of Logic Trees is constructed using a number of *gate nodes* (e.g., AND-gates, OR-gates). The various gate nodes have *child nodes* (sub-nodes) and the gates are evaluated based on the value (True or False) of their child nodes and the type of gate (e.g., in order for an AND-gate to be True, all of the child nodes defining the gate must be True).

Gates can be nested with no limit (hence, creating a “tree”), which allows very complex logic to be represented. The various nodes in the tree are evaluated hierarchically to determine if the output of the element is True or False.

To illustrate this, consider the simple logic tree shown below:



In this example, there are two gate nodes: the top AND-gate (the top of a logic tree is always an AND-gate) and an OR-gate (that is one of the children of the AND-gate). “Water\_Rising” is a child of the AND-gate and “Pump\_Failed” and “Water\_Level > 10 m” are children of the OR-gate. “Water\_Rising” and “Pump\_Failed” are element outputs defined as conditions and “Water\_Level > 10 m” is a conditional expression.

Hence, the logic expressed here is:

If

(Water\_Rising) **AND** (Water\_Level>10m **OR** Pump\_Failed)

Then

The Logic Tree is True

Else

The Logic Tree is False

In addition to AND and OR gates, you can also create N-Vote gates (in which at least N conditions need to be true for the gate to be true).

Logic Tree elements are described in more detail [here](#).

## **Simulation Time Control for Dashboards**

GoldSim 14 provides a new Dashboard control: the Simulation Time control. This control allows you to change the Duration (for Elapsed Time simulations) or the Start Date and End Date (for Calendar Time simulations) directly from a Dashboard.

For an Elapsed Time simulation, in Active view within a Dashboard the Simulation Time control looks like this:





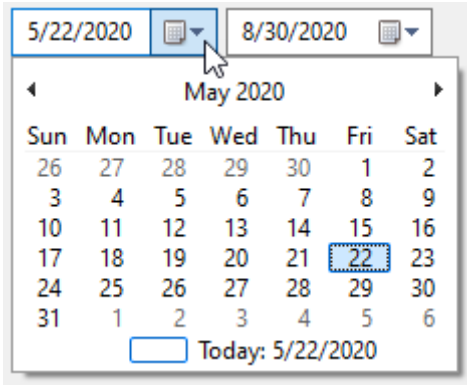
The control directly changes the Duration (in the Simulation Settings) for the model. It must be entered as a number (with a valid time unit).

For a Calendar Time simulation, in Active view within a Dashboard the Simulation Time control looks like this:



This control directly changes the Start Date and End Date (in the Simulation Settings) for the model.

You can click on the arrow in the box to view a calendar to assist you in selecting a start or end date:



This new control is described in more detail [here](#).

## **Date Functions**

To assist in using dates in your models, GoldSim 14 provides a number of new specialized functions that can be used to create dates and provide information on variables that represent dates:

<b>Function</b>	<b>Description</b>
GetYear(Date)	Returns the calendar year (dimensionless value)
GetMonth(Date)	Returns the calendar month (dimensionless value from 1 to 12)
GetDay(Date)	Returns the day of the month (dimensionless value from 1 to 31)
GetDayofYear(Date)	Returns the day of the year (dimensionless value from 1 to 366)
GetHour(Date)	Returns the hour of the day (dimensionless value from 1 to 24)

Function	Description
GetMinute(Date)	Returns the minute of the hour (dimensionless value from 1 to 60)
GetSecond(Date)	Returns the second of the minute (dimensionless value from 1 to 60)
MakeDate(Year, Month, Day)	Returns a date built from those integer inputs
MakeDateTime(Year, Month, Day, Hour, Minute, Second)	Returns a date/time built from those integer inputs
IsLeapYear(Date) or IsLeapYear(Year)	Returns a condition (True or False)

These new functions are described in more detail [here](#).

## **Modification to the Cell Algorithm to Handle Emptying Cells**

An notable change was made to the algorithm for how Cells calculations are carried out.

If the quantity of the medium involved in advecting mass (typically the volume of water) in a Cell is constant or changing slowly, the solution algorithm is quite accurate. However, rapidly changing Cell media amounts can result in errors (spikes) in computed concentrations (and mass transfer rates). (In these cases, GoldSim writes warning messages to the Run Log.) These errors are most common and significant when the amount of media in a Cell is low and rapidly changing (either emptying or filling), in which case the fractional volume change is by definition high.

The traditional way to address this issue is to dynamically adjust the timestep to prevent the volume from changing significantly over a single step. GoldSim 14 adds a second method for addressing this. The Cell algorithm was adjusted so that when using Low Precision, the spikes can be largely avoided. This approach is not recommended for systems that require higher precision settings (e.g., when simulating systems with rapidly decaying species, solubility constraints and/or isotopes), but can be very advantageous for simpler systems.

**Note:** The actual change that was made is associated with how GoldSim computes an “effective volume” for Cells whose volume is changing (the effective volume is a weighted average of the current and previous timestep’s values). This is necessary in order to support GoldSim’s use of fractional timesteps (in which GoldSim automatically divides every time step into a number of fractional timesteps, depending on the user’s selected precision level). Using fractional timesteps is a very computationally efficient way to enhance the accuracy of the solution under most circumstances. The use of effective volume, however, results in concentration spikes if the volume is changing very rapidly over a timestep. Because Low Precision runs do not use fractional timesteps, the effective volume calculation is not strictly necessary and was removed in GoldSim 14.

As part of this change, several of the warning messages that alert you to these problems were also modified and improved.

Both approaches for addressing the problem of rapidly changing volumes and emptying Cells (dynamic timestepping or using Low Precision) are discussed in detail [here](#).

## **Updated Color Palette, Default Colors for Charts and Graphical Objects and Default Chart Fonts**

There are numerous places in the GoldSim user interface where you can specify colors for different objects (e.g., backgrounds, text, chart lines, influence lines). GoldSim selects default colors for all items. In GoldSim 14, the color palette for all such colors was updated to reflect the use of more modern displays (e.g., the palette is less bright and more muted).

For influence lines, the new default colors are similar to the old default colors (e.g., a default color that was previous red is still red, but just a different shade of red). However, the default chart colors used when there are multiple lines or items on a chart are different. That is, the new default colors are not the same as the old (the newer ones were deemed to be better).

Default fonts used for charts objects (e.g., headers, legends) have also been updated.

Conversion of existing models is treated as follows:

- All charts will be converted to use the new colors regardless of previous customization. If users have previously customized the line color in their charts, this customization will be lost during the conversion.
- For influence lines, all default colors will be converted to the new default colors. However, if the user has customized the color of a particular influence, then it will remain the same.
- For fonts for chart objects, all default fonts are changed to new fonts. However, if the user has customized a particular font for an object in a Result element, then it will remain the same.

## **Creating, Saving, Exporting and Importing Custom Colors**

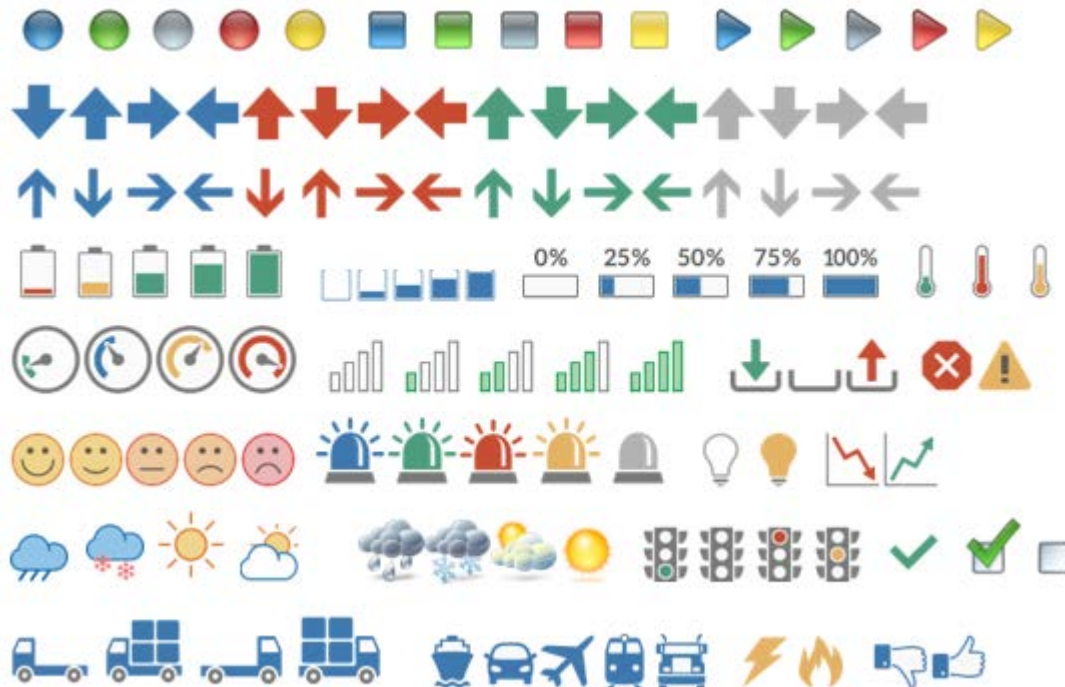
As pointed out above, there are numerous places in the GoldSim user interface where you can specify colors for different objects (e.g., backgrounds, text, chart lines). GoldSim selects default colors for all items, so it is not necessary for you to edit these. However, in many cases, you may want to do so.

GoldSim 14 provides a number of new tools for selecting and customizing the colors you use in your model. This includes saving custom colors to your registry so they can be used for all of your models, as well as exporting your custom colors so the same color scheme can be shared and used on other computers.

These new features are described in more detail [here](#).

## **New Icons For Result Status Control**

The Result Status Display control for a Dashboard allows you to display one of a series of icons based on the value of an output (e.g., if the value is less than 10, display a Green circle, if the value is between 10 and 30 display a yellow circle, and if the value is greater than 30 display a red circle). In GoldSim 14, most of the icons were updated. The updated set of icons are shown below:

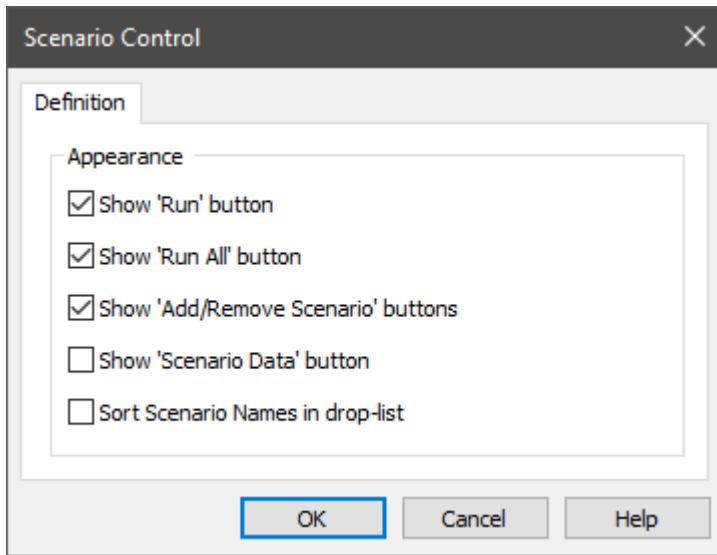


There are three types of changes (relative to the old set of icons):

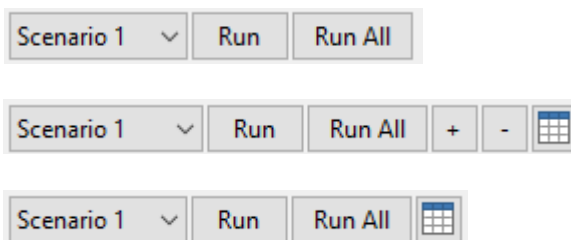
- Some new icons have been added (that were not available before).
- Many (but not all) icons were replaced with similar icons (with a slightly different style).
- One set of icons (flags) were eliminated. If these are being used in a model, they will be replaced with triangles (of similar colors).

## **New Dashboard Features for Scenario Control in Dashboards**

When adding a Scenario control to a Dashboard, you can now control which buttons are displayed in the control:



This provides a lot of flexibility for controlling how the Scenario control looks (and what it can be used to do) in a Dashboard:



Note that the latter two examples include a button that allows the Dashboard user to directly open the Scenario Data dialog. This allows the user to view and compare the Scenario Data values for different scenarios:

The screenshot shows the 'Scenario Data' dialog box. It displays a table titled 'Assigned Data Values for each Scenario:' with the following data:

Element ID	Scenario 1	Scenario 2	Scenario 3
Data1	1	7	11
Data2	2	4	2

At the bottom of the dialog are two buttons: 'Close' and 'Help'.

## **Writing Data Element Information to the Model Inventory (XML) Export File**

In GoldSim 12.1, a feature was added to allow you to create a simple XML file that can be viewed in a text editor, browser or XML editor that echoes out all of the elements in a GoldSim model. XML stands for eXtensible Markup Language. It was designed as a software and hardware independent tool to store and transport data such that it is both human- and machine-readable. Like HTML, XML uses tags. However, unlike HTML, XML does not have predefined tags. Rather, the author defines custom tags (as well as the document structure). The general concept behind XML is to create a tree structure which starts at a root object and branches to child object. Such a structure, of course, is ideal for displaying the hierarchical design of a GoldSim model.

This file contains the name, type, description and path for each element, and specifically illustrates the model hierarchy. It did not, however, include the definition (e.g., input values, units) for any elements.

In GoldSim 14, this format was extended to include the full definition (input values, units, array labels) for all Data elements in the model.

This feature is described in more detail [here](#).

## **Setting the Start Time, End Time and Duration from the Command Line**

In some cases, it may be useful to bypass GoldSim user interface and run GoldSim directly from the command line. GoldSim has supported this for some time. However, new command line flags have been added so that you can now set the Start Time, End Time and Duration of a simulation from the command line. (This was actually implemented in 12.1.4 but was previously undocumented).

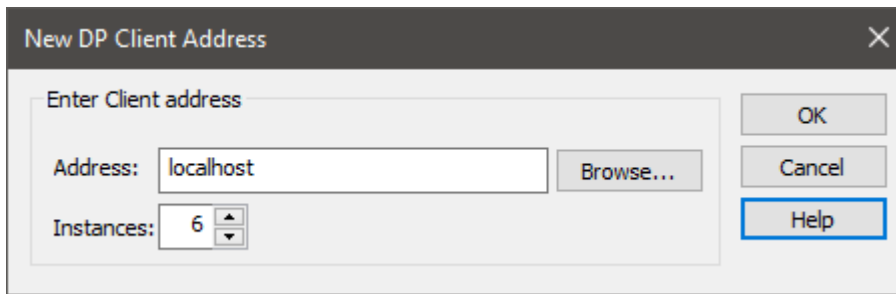
This feature is available both in GoldSim and the GoldSim Player.

This feature is described in more detail [here](#).

## **Improvements to Distributed Processing Module**

A number of changes were made to the Distributed Processing Module. Most noticeably, the Master/Slave terminology was replaced with Controller/Client. The dialogs for both the Controller (formerly referred to as Master) and Client (formerly referred to as Slave) were modified and improved. As part of this, the command line flag to launch a GoldSim or GoldSim Player instance as a Client was changed from “-s” to “-dpclient”. Note, however, that the “-s” flag will continue to function. Similarly, the file extension used for exporting and importing Client lists was changed from .slv to .dpl.

In addition, a new feature was added to allow you to quickly add multiple instances of the same computer/address when creating DP Clients:



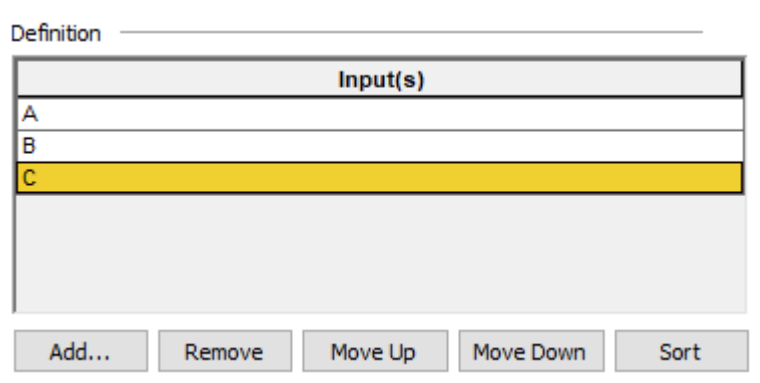
This makes it much easier to add multiple processors to your DP Client list.

Finally, a separate program that could be used with the Distributed Processing Module, the GoldSim Slave Manager, has been discontinued. This was a Windows Service that could be installed on a computer that permitted a Master (Controller) GoldSim process to remotely launch GoldSim in Slave (Client) mode on a different computer. Clients can now only be launched manually.

The various new dialogs for the Distributed Processing Module are described in detail [here](#).

## OTHER CHANGES

- The Sum element now has **Move Up**, **Move Down** and **Sort** buttons in order to change the order of items in the list (this obviously does not affect the output, but can be useful for organizing how the list is displayed):



Holding the **Ctrl** key while pressing the **Remove** button deletes every item in the list.

- Sometimes you may want to return the minimum or maximum value of the dependent variable defined in your Lookup Table. GoldSim 14 provides two special functions to support this: `tablemin` and `tablemax`. These special functions require as their argument the name of the Lookup Table element. They return the minimum or maximum value, respectively, of the dependent variable of the referenced table. This feature is described in more detail [here](#).

- A new option (**Reset Model**) has been added to the Button control in Dashboards. This allows the Dashboard author to add a button for resetting the model to “Ready” (from Result Mode) so that the Player user can edit input controls. It is equivalent to pressing the **Reset** button in the Run Control toolbar.
- In previous versions, you could change the GoldSim user interface in a purely cosmetic way by change the application theme (by selecting **View | Application Theme...** from the main menu). Three different themes were provided. In GoldSim 14, a total of six themes are now provided. This feature is described in more detail [here](#).
- In previous versions, you could export the final values for selected outputs (e.g., all Stochastics) for every realization to an external file (e.g., in order to subsequently read into a statistical analysis software package to facilitate post-processing). This was done by manually using a key combination when viewing a Raw Multi-Variate Data Table. However, in some cases, it could be cumbersome to open the Multi-Variate Result element and view the Raw Data table before exporting the data. Therefore, an additional option to export the final values for all of the outputs specified in the Multi-Variate Result element is now provided. In particular, when the model is in Result Mode, you can simply right-click on the icon for the element in the graphics pane and select **Export Results...** to export the final value results to a comma-delimited file. This is discussed further [here](#). (This was actually implemented in 12.1.2 but was previously undocumented).
- A new short-cut key was added (**Ctrl-D**) to toggle between Active and Design View when in a Dashboard.
- The error function (erf) has always been in GoldSim, but GoldSim 14 adds the complementary error function (erfc) to the list of built-in functions.

In addition to these changes, a large number of additional minor modifications and bug-fixes were implemented in GoldSim 14. A full listing of these is provided in the Release Notes Notes (accessible under Help in the main menu).

## CONVERSION ISSUES WHEN READING AND RUNNING EXISTING MODELS

All GoldSim models saved in 10.5 and later can be successfully read by GoldSim 14 (although some conversion issues may occur that will need to be addressed).

In particular, when converting from GoldSim 12 or 12.1, only the following minor (cosmetic) conversion issues may affect some users:

- As discussed above, the default chart colors used when there are multiple lines or items on a chart has been changed. The new default colors are not the same as the old (the newer ones were deemed to be better). Moreover, if users have previously customized the line color in their charts, this customization will be lost during the conversion.



- As discussed above, most of the icons for the Result Status Dashboard control were updated. In all but one case, existing icons have been replaced with similar (but modified) icons and this will happen automatically when you read in a model. However, one set of icons (flags) were eliminated. If these are being used in a model, they will be replaced with triangles (of similar colors).

Converting models from 10.5, 11, or 11.1 to GoldSim 14, however, is potentially more time-consuming (i.e., in some cases may result in some conversion issues that will need to be addressed after reading in the model). This is due to significant changes in the GoldSim framework and functionality between earlier versions and GoldSim 12. These conversion issues are discussed in [GoldSim 11 Summary Document](#), the [GoldSim 11.1 Summary Document](#), and the [GoldSim 12 Summary Document](#).

Note also that while GoldSim 14 can read in models made in earlier versions (GoldSim 10.5 and above), those earlier versions cannot read a file that was saved in GoldSim 14.

If you are having any difficulty converting a model to GoldSim 14, do not hesitate to contact us at the [GoldSim Help Center](#).