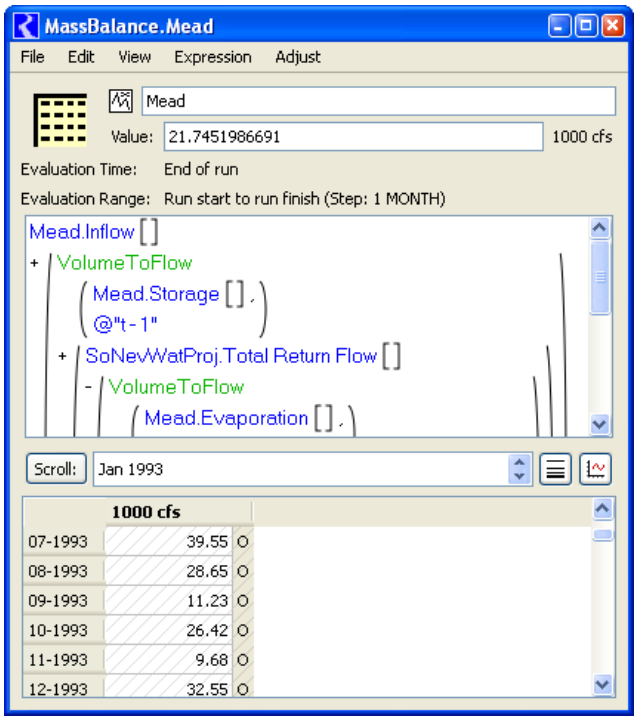
3.5 Expression Slots - Series

Expression slots are computational expressions. The user can either create a **Series Slot with Expression** or a **Scalar Slot with Expression**. They are used to calculate quantities such as “combined Storage of all Reservoirs,” “weekly average Outflow of Hoover Dam,” “the ratio of Hydrologic Inflow to Reach Inflow at selected structures”, or any conceivable equation. Expression slots (both series and scalar) are available only on Data Objects. To add a Series slot with expression select **Slot ➥ Add Series Slot with Expression.**

Expression slots utilize the RiverWare Policy Language (RPL). RPL is computationally expressive language and has an associated structured editor. Because Expression slots utilize RPL (the same language in which RiverWare rules are written) they may contain simple expressions or complex logic and functions. Anything that may be expressed in a rule may also be evaluated in an Expression slot. The use of RPL also provides dimensional analysis to ensure that units are reconciled throughout the expression. It is important to make sure that the unit type of the slot is the same as the units to which the expression evaluate.



3.5.1 Configuration

Following is description of the configuration options available for expression slots.

3.5.1.1 File Menu

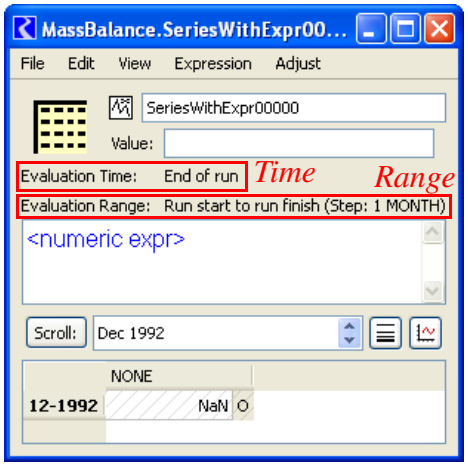
On the File menu, the Import options are not available as you cannot import or type data into the slot. The export options are available and can be used to export the calculated data out of the slot. A Print Expression menu option is available to print the expression. This uses the same printing mechanism as other RPL sets, described **HERE (RPLUserInterface.pdf, Section 4.1)**.

3.5.1.2 Edit Menu

On expression slots, the **Edit** menu has options to **Copy** (to the RiverWare clipboard) and **Export Copy** (to the system clipboard). Importing, pasting, and other data editing features are disabled as the expression slot is “output only”.

3.5.1.3 View Menu

The View Menu on expression slots show the following menu options:



Configuration: The configuration uses the standard series slot configuration dialog described HERE (Section 3.1.1).

Evaluation Range: By default, Expression slots are evaluated for each timestep in the model run (i.e., the range is synchronized with the run control). If you are only interested in the result of an expression for a reduced range of dates or for a different timestep, you may select **View ➥ Evaluation Range**, deselect **Always Synch with Run Control** and enter the date range in which you are interested.

> **Note:** An expression slot does not need to have the same timestep as the run control. If the user chooses to Always Synch with Run Control but uses a different timestep than the run, the slot will evaluate for only those timesteps that fall within the run dates.

Open RPL Set: The RPL set containing functions used by any expression slot can be opened by **View ➥ Open RPL Set.** All of the functionality associated with a RPL set can be utilized from this RPL set editor such as importing/exporting, analysis, search and replace, and creating utility groups of functions. Note, that only functions will be shown in the RPL set editor, the expressions on the slots themselves are the equivalent to the rules in a ruleset. Click HERE (RPLUserInterface.pdf, Section 1) for more information on RPL sets. From the RPL set, the user can control the layout using the **Set ➥ Layout...** menu. Click HERE (RPLUserInterface.pdf, Section 4.2) for more information on layouts.

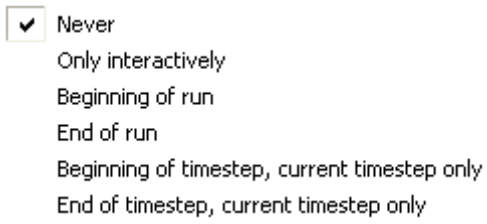
3.5.1.4 Expression Menu

Show Expression: This toggle is used to show or hide the expression. By default, the expression is shown.

Evaluate: The user can manually evaluate the expression from the **Expression ➥ Evaluate** menu.

Validate: The user can manually verify the expressions validity using the **Expression ➥ Validate** menu.

Evaluation Time: Expression slots can be evaluated at the beginning or end of each simulation run, at the beginning or end of each timestep, never, or interactively on demand. These options are particularly useful for performance when running large models and when evaluating a large number of expression slots. To select when an Expression slot is evaluated select **Expression ➥ Evaluation Time** from the Expression slot menu, and choose from the options shown to the right. A check mark will be shown next to the selected option.



The Expression menu is used to build expressions. There are options to **Cut**, **Copy**, **Paste, Delete**, and **Enable** and expression. **Undo** and **Redo** are available to go back or go forward when editing expressions. These are only available when a relevant expression is selected. Finally, there is a menu option to bring up the **Palette** open the **RPL Debugger** and open the **RPL set**.

3.5.2 Building Expressions

Expression slots utilize the RPL palette to build expressions. The RPL palette provides a syntax-guided editor designed to assist in the construction of complex syntactically correct expressions within the RiverWare Policy Language environment. The editor works by maintaining a partially constructed expression and allowing the user to manipulate unfinished portions using the palette. Initially, the buttons in the palette are grayed out. When building an expression, the **palette** enables any buttons that could possibly go in a highlighted portion of the expression.

See the documentation **HERE (RPLUserInterface.pdf, Section 1)** on RPL and the palette for further information on any of the RPL topics described.

Note: For Expression Series Slots, the symbolic datetime specifications @"Start Timestep" and @"Finish Timestep" refer to the expression slot's evaluation range, not the controller's start or end dates. The predefined functions, RunStartDate( ) and RunEndDate( ), **HERE (RPLPredefinedFunctions.pdf, Section 124)**, provide a reference to the controller's start and end dates, respectively

3.5.3 Diagnostics for Expression Slots

Diagnostics for expression slot evaluation can be configured in the **Diagnostics Manager** **HERE (Diagnostics.pdf, Section 1.2)**.

If expression slots are evaluated outside of a run, using the **Expression ➥ Evaluate** menu on the slot or the **Control ➥ Evaluate Expression Slots** menu from the workspace, then diagnostics must be set up using the Workspace diagnostics **HERE (Diagnostics.pdf, Section 4.1)**.

If expression slots are evaluate during a run, either beginning or end of timestep or beginning or end of run, then diagnostics must be set up using Simulation diagnostics **HERE (Diagnostic.pdf, Section 2.1)** or Rulebased Simulation diagnostics **HERE (Diagnostics.pdf, Section 3.1)**, depending on the selected controller.

Within each of those diagnostics configurations, the **Expr. Slot Execution** and **Expr. Slot Function Execution** categories deal with expression slots.