Series Slots with Periodic Input Version 1 for RiverWare 6.3

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This document describes a new type of series slot in RiverWare which supports optional specification of input values for the series through a periodic-slot-like definition.

0.1 Document Status

08-23-2012: Ready for review. 08-24-2012: Minor edits

0.2 Other Documents

Series Slots with Periodic Input / Design for RiverWare 6.3 Initial analysis and design for the developed feature described in *this* document. 7-31-2012, 9 pp., R:\doc\simlib\SerSlotPeriodicInputs\SeriesSlotsWithPeriodicInput.fm

0.3 Contents

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1.0 Functional Description

1.1 Overview

Whether a particular *input* time series in a RiverWare model is specified as a series or as a periodically varying value is not fundamental to the physical or "policy" entity being modeled. With respect to certain entities implemented in RiverWare as series slots, users may want to have the option of specifying the slot's values in the form of a periodic slot.

The new **Series Slots with Periodic Input** in RiverWare 6.3 provide this optional capability for a prescribed set of physical series slots which -- *by design* -- are intended to provide *inputs* to the model. Series Slots with Periodic Input can also be created by the user on data objects.

These new slots support two Input Modes:

- When in ordinary **Series Input Mode**, the individual time-series values of Series Slots with Periodic Input are directly editable by the user in the Open Slot Dialog and in an SCT. In this mode, these slots are functionally equivalent to ordinary series slots.
- When in **Periodic Input Mode**, only the periodic input definition is editable. As with actual periodic slots, the user has the choice of several standard periods (e.g. annual, monthly, daily), either "irregular" or "regular" intervals within the period, and whether or not value retrieval between interval points is interpolated.

Series Slots with Periodic Input behave as ordinary series slots in virtually all ways except for the optional support for specifying their values in the form of a periodic slot in the slot's Open Slot dialog.

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Although Series Slots with Periodic Input are intended strictly for "Inputs", beyond the normal behavior of Input flagged series values (when the slot's values have that flag) there is no implemented functionality which explicitly prevents these slots from being written to. A minor exception to this is that DMI import operation to these slots is blocked when they are in Periodic Input Mode.

In general, when switching a Series Slot with Periodic Input from Series to Periodic Input Mode, the existing series values are lost; they are overwritten with values computed from the periodic input definition. When switching from Periodic to Series Input Mode, the periodic input values are hidden and become inactive.

1.2 Slot Creation

Series Slots with Periodic Input are created automatically on engineering objects which support them for the representation of certain physical and "modeling" entities. They are generally dependent on a particular method selection of the object, and will appear as slot items in the Open Object Dialog with the illustrated "*P and series trace*" slot icon.

Series Slots with Periodic Input can also be created on data objects by the user. From the Open Object Dialog for a data object, under the "Slot" menu, select the "Add Series Slot with Periodic Input" item.

Operations which support the special features of Series Slots with Periodic Input are implemented in the Open Slot dialog.

1.3 Series Input Mode

Series Slots with Periodic Input start off in Series Input Mode where they appear and behave as ordinary series slots. One exception to this is their slot type icon (*shown above*) indicating that these slots have the *possibility* of being switched to Periodic Input Mode.

1.4 Switching between Series and Periodic Input Mode

The Series Slots with Periodic Input's Open Slot Dialog shows two "Input Mode" radio buttons to indicate the current input mode and to switch to the other mode.

These radio buttons are disabled (inoperable) in RiverWare Viewer Mode and in a Scenario Baseline Model.

In general, when switching from Series Input Mode to Periodic Input Mode, the series values are overwritten by values computed from the periodic input defi-

Chan	ge to Periodic Input Mode?			×				
	WARNING: Switching from Series Input Mode to Periodic Input Mode will overwrite 30 series values in this slot.							
		Overwrite Series Values	Cancel					

nition. When series values are vulnerable to being changed, the user must confirm this Input Mode change with this popup dialog. This is not necessary if the series data is empty (all NaN) or if the series data matches the series that would be computed from the current periodic input definition. No confirmation dialog is shown when switching from Periodic Input Mode to Series Input Mode, as there is no loss of data in that change. The periodic input definition is made inactive, but is left intact for possible future use (i.e. if the user switches back to Periodic Input



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Mode). As a result of these provisions, unless the user makes a change to the series data while Series Input Mode is active, the user can freely toggle back and forth between the two input modes.

1.5 Periodic Input Mode

In Periodic Input mode, a Series Slot with Periodic Input is shown it its Open Slot dialog with a "read-only" (noneditable) series data panel and an editable periodic input data panel (*see the right-side image, below*). The SCT (*not illustrated here*) shows Series Slots with Periodic Input only as series slots (regardless of the slot's current input mode), non-editable when the slot is in Periodic Input mode.

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06-01-2004 Tue 0.83 I	06-01-2004 Tue 0,83 I 24:00 Jan 31 0.08
06-02-2004 Wed 0.81 I	06-02-2004 Wed 0.81 I 24:00 Feb 29 0.36
06-03-2004 Thu 0.79 I	06-03-2004 Thu 0.79 1 24:00 Mar 31 0.38
06-04-2004 Fri 0.76 I	06-04-2004 Fri 0.76 I 24:00 Apr 30 0.56
06-05-2004 Sat 0.74 I	06-05-2004 Sat 0.74 I 24:00 May 31 0.85
06-06-2004 Sun 0.72 I	06-06-2004 Sun 0,72 I 24:00 Jun 30 0.23
06-07-2004 Mon 0.70 I	06-07-2004 Mon 0.70 I 24:00 Jul 31 0.28
06-08-2004 Tue 0.68 I	06-08-2004 Tue 0.68 I 24:00 Aug 31 0.45
06-09-2004 Wed 0.66 I	06-09-2004 Wed 0.66 I 24:00 Sep 30 0.27
06-10-2004 Thu 0.64 I	06-10-2004 Thu 0.64 I 24:00 Oct 31 0.17
06-11-2004 Fri 0.62 I	06-11-2004 Fri 0,62 I 24:00 Nov 30 0.07
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Edits and operations on the periodic values immediately cause a recomputation of the series values -- assigned as *Inputs* except where periodic values are undefined, in which case NaNs (flagged as *Outputs*) are assigned to the series. Series values are computed for the series slot's currently configured time range. Of course, the series value computation from the periodic data always overwrites Input flagged timesteps in the series.

1.6 Open Slot Dialog operations on Slot data

The following operations which normally apply to the selected values in the *series data* display instead apply to values in the *periodic data* display when those values in the periodic display are selected.

- Entering a value in the "Value" entry field at the top of the dialog (to assign the same value to multiple selected cells)
- All copy and paste operations
- Fill Values Below
- Replace NaNs Below
- Interpolate
- Adjust Values

In order to support this functionality, selecting cells in either the series data display or periodic data display causes the selection in the *other* display to be cleared.

The **import** and **export** (slot data) operations under the File menu operate according to the current input mode: they operate on the *series data* when in Series Input Mode, and on the *periodic data* when in Periodic Input Mode. In order to avoid confusion, when in Periodic Input Mode (where both displays are visible), the import and export operations are enabled only when the selection is within the periodic data display.

The Row menu has operations relevant to Periodic Input Mode when *irregular intervals* are defined:

- Set Row Date
- Add Row
- Duplicate Row
- Delete Rows

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1.7 Period / Interval / Interpolation Configuration

A Series Slot with Periodic Slot's periodic data configuration is accessible from the Open Slot Dialog's "View" menu, below the series slot's standard slot configuration and time series range configuration operations. Refer to Periodic Slot configuration dialog online help for an explanation of the available period, interval, and data interpolation settings.

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1.8 Persistence, I/O, Plotting and Model Report Generation

When saved in a RiverWare model file or exported via a "export object file", all available series data and periodic data is retained (regardless of the currently active input mode). Of course, all new data used to support Series Slots with Periodic Input also persists (e.g. an indication of the active input mode).

Model Report Generation ... <u>Not yet implemented (as of August 2012)</u>: The Model Report Generation feature in RiverWare recognizes Series Slots with Periodic Input in Periodic Input Mode as essentially Periodic Slots (except for the slot icon), and shows the periodic data for the slot.

DMI Operation ... In this initial implementation of Series Slots with Periodic Input, *only series data* (not periodic data) DMI operations are supported. Furthermore, an error is generated if an Input DMI attempts to assign series data to a Series Slot with Periodic Input which is in Periodic Input mode.

Plotting ... Series Slots with Periodic Input will be plotted as *series slots* (with a time range limited to the series slot's configured time range).

1.9 Migration support for Periodic Slots to Series Slots with Periodic Input

When loading a physical Periodic Slot from an old model file to a slot which has since been changed to a Series Slot with Periodic Input, the periodic slot's configuration and data is loaded into the Series Slot's periodic input specification. The following actions also occur:

- The slot is put into Periodic Input mode.
- The series slot's time range is set to the run period.
- The series slot's values are computed from the periodic data.
- A diagnostic warning message is generated -- something like:

Migrating Periodic Slot "PreRes Irrigated Area Loss Rate" to a Series Slot with Periodic Input.

Note: In practice, this automatic migration will occur only for physical slots which had been periodic slots and have been re-implemented as Series Slots with Periodic Input (in a subsequent RiverWare version). However, internally, this automatic migration would be applied also for plain Series Slots (i.e. not internally implemented as "with Periodic Input"). In such a case, the Series Slot is automatically promoted to a Series Slot with Periodic Input.

2.0 Implementation Overview

Note: See detailed implementation notes filed with the 8-15-2012 Bormchom GIT commit. Also, the "Automated migration of old Periodic Slots to new Series Slots w/Periodic Input" commit on 8-17-2012.

2.1 Data Model

Series Slot with Periodic Input is not a new C++ class. It is a SeriesSlot with additional properties, including:

- An internal flag distinguishing the SeriesSlot as being "with Periodic Input".
- A dynamically allocated child instance of a Periodic Slot. The "parent/child" relationship implementation is modelled on the AggSeriesSlot's maintenance of child SeriesSlots for its slot columns. A significant difference, however, is that the child Periodic Slot is completely "private" within the SeriesSlot, and is not exposed within the user interface as a slot.

The child Periodic Slot has a (private) name of "Periodic Input", and is serialized with a "dot" ('.') prefix, similar to AggSeriesSlot columns. It uses the display attribute settings (e.g. display units, and also unit type) of the parent SeriesSlot.

2.2 Special Function Development

- Computation of a Series Slot's values (for its current timestep range) from a Periodic Slot.
- Comparison of a Series Slot's values to values computed from a Periodic Slot.

2.3 DMI Issues

A small amount of special handling is required for DMI Import operations. (See section 1.7.2, above). In particular, checks for attempting to import series data into a Series Slot with Periodic Input which is in Periodic Import mode is needed.

2.4 Open Slot Dialog

The following features are supported by the SlotQtDlg class, and related classes:

- Implementation of "Input Mode" radio buttons, and support for mode switching with user confirmation.
- Management of the Periodic Input Definition Panel, consisting primarily of a (Qt4) "SlotDataTableView" and "SlotDataTableModel" to display editable periodic data.
- Redirection of dialog operations to the appropriate data: *series* or *periodic*, dependent on the mode and current cell selection.
- Incorporation of Periodic Slot support features which had not been provided by for Series Slots, e.g. period configuration and row operations for irregular intervals.
- Geometry management features -- automatic panel width adjustments

2.5 Model Report Generation Support

Note: Not yet implemented (as of August 2012)

The Model Report Generation feature in RiverWare recognizes Series Slots with Periodic Input in Periodic Input Mode as essentially Periodic Slots (except for the slot icon), and shows the periodic data for the slot.

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