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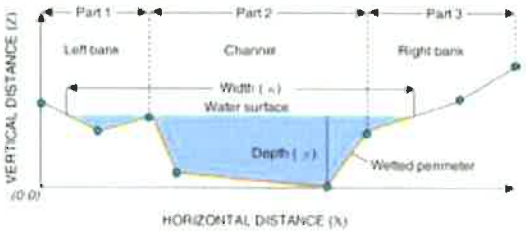
A NEW STREAMFLOW-ROUTING (SFR1) PACKAGE TO SIMULATE STREAM-AQUIFER INTERACTION WITH MODFLOW-2000

U.S. GEOLOGICAL SURVEY
OPEN-FILE REPORT 2004-1042



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A NEW STREAMFLOW-ROUTING (SFR1) PACKAGE TO SIMULATE STREAM-AQUIFER INTERACTION WITH MODFLOW-2000

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using only ITMP and repetitions of Item 6. In each stress period, the sum of ITMP plus the sum of all NLST values in Item 3 associated with the NP parameters listed in Item 7 must equal or be less than (if some stream segments are inactive) the total number of stream segments in the stream network (NSS of Item 1). Stream segments defined by Items 3, 4 and 7 cannot be repeated using ITMP and Item 6.

FOR EACH SIMULATION:

0. Data: [#Text]

Text — A character variable (up to 199 characters) that is printed when the file is read. The "#" character must be in column 1, and, accordingly, the variable starts in column 2. Any characters can be included in Text.

Note 1: Item 0 can be repeated multiple times.

1. Data: NSTRM NSS NSFRPAR NPARSEG CONST DLEAK ISTCB1 ISTCB2

NSTRM — An integer value equal to the number of stream reaches (finite-difference cells) that are active during the simulation. The value of NSTRM also represents the number of lines of data to be included in Item 2, described below.

NSS — An integer value equal to the number of stream segments (consisting of one or more reaches) that are used to define the complete stream network. The value of NSS represents the number of segments that must be defined through a combination of parameters and repetitions of Item 6 every stress period.

NSFRPAR — An integer value equal to the number of stream parameters (associated with one or more segments) to be defined.

NPARSEG — An integer value equal to (or exceeding) the number of stream-segment definitions associated with all parameters. This number can be more than the total number of segments (NSS) in the stream network because the same segment can be defined in multiple parameters, and because parameters can be time-varying. NPARSEG must equal or exceed the sum of NLST × N for all parameters, where N is the greater of 1 and NUMINST; that is, NPARSEG must equal or exceed the total number of repetitions of item 4b.

CONST — A real value (or conversion factor) used in calculating stream depth for stream reach. If stream depth is not calculated using Manning's equation for any stream segment (that is, ICALC does not equal 1 or 2), then a value of zero can be entered. If Manning's equation is used, a constant of 1.486 is used for flow units of cubic feet per second, and a constant of 1.0 is used for units of cubic meters per second. The constant must be multiplied by 86,400 when using time units of days in the simulation. An explanation of time units used in MODFLOW is given by Harbaugh and others (2000, p. 10.)

DLEAK — A real value equal to the tolerance level of stream depth used in computing leakage between each stream reach and active model cell. Value is in units

of length. Usually a value of 0.0001 is sufficient when units of feet or meters are used in model.

ISTCB1 An integer value used as a flag for writing stream-aquifer leakage values. If ISTCB1 > 0, it is the unit number to which unformatted leakage between each stream reach and corresponding model cell will be saved to a file whenever the cell-by-cell budget has been specified in Output Control (see Harbaugh and others, 2000, pages 52-55). If ISTCB1 = 0, leakage values will not be printed or saved. If ISTCB1 < 0, all information on inflows and outflows from each reach; on stream depth, width, and streambed conductance; and on head difference and gradient across the streambed will be printed in the main listing file whenever a cell-by-cell budget has been specified in Output Control.

ISTCB2 An integer value used as a flag for writing to a separate formatted file all information on inflows and outflows from each reach; on stream depth, width, and streambed conductance; and on head difference and gradient across the streambed. If ISTCB2 > 0, then ISTCB2 also represents the unit number to which all information for each stream reach will be saved to a separate file when a cell-by-cell budget has been specified in Output Control. If ISTCB2 ≤ 0, information will not be saved to a separate file.

Note 2: The first two variables (NSTRM and NSS) are used for dimensioning arrays, and must be equal to the actual number of stream reaches defined in Item 2 and the number of segments that define the complete stream network, respectively.

Note 3: The SFR1 Package differs from the previous Stream (STR1) Package because the new package solves for stream depth at the midpoint of each reach instead of at the beginning of the reach. To solve for depth at the midpoint of each reach, the SFR1 Package uses Newton's iterative method and consequently, a tolerance (DLEAK) is used for stopping the iterative process within the SFR1 Package.

One record for each stream reach:

2. Data: KRCH IRCH JRCH ISEG IREACH RCHLEN

KRCH An integer value equal to the layer number of the cell containing the stream reach.

IRCH An integer value equal to the row number of the cell containing the stream reach.

JRCH An integer value equal to the column number of the cell containing the stream reach.

ISEG An integer value equal to the number of stream segment in which this reach is located. Stream segments contain one or more reaches and are assumed to have uniform or linearly varying characteristics.

IREACH An integer value equal to the sequential number in a stream segment of this reach (where a reach corresponds to a single cell in the model). Numbering of reaches in a segment begins with 1 for the farthest upstream reach and continues in downstream order to the last reach of the segment.