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Documentation of Conversion of the MODFLOW Drains With Return Flow (DRT) Package For MODFLOW-2005

This documentation describes the changes to the Drains With Return Flow (DRT) Package (Banta, 2000) to convert it to work with MODFLOW-2005. See Chapter 9 of Harbaugh (2005) for further information about the MODFLOW-2005 program. The modified code is designated version 7, and this code has the same functionality as version 1 of this package, which is the version used in MODFLOW-2000.

1. Fortran module GWFDRTMODULE was created to store the shared data for the DRT Package; GWFDRTMODULE incorporates the capability to support Local Grid Refinement. The following table describes the data.

Variable Name	Size	Description
NDRTCL	Scalar	Number of drain-return cells used in a stress period.
MXDRT	Scalar	The total number of cells in DRTF array, which is the maximum cells used in any stress period plus the number of parameter cells.
NDRTVL	Scalar	The number of values for each cell in DRTF array.
NDRTNP	Scalar	The number of non-parameter drain-return cells in a stress period.
IDRTCB	Scalar	File unit for saving drain-return cell-by-cell budget data.
NPDRT	Scalar	The number of drain-return parameters.
IDRTPB	Scalar	The location in DRTFL of the first parameter cell.
IDRTFL	Scalar	Return-flow flag: 4 if RETURNFLOW option is specified – 0 otherwise.
NRFLOW	Scalar	Number of drain-return cells with a positive return-flow proportion.
NOPRDT	Scalar	No-print flag – 1 indicates no printing of drain-return cell data.
DRTF	NDRTVL,MXDRT	Drain-return cell data.
DRTAUX	C*16,20	Auxiliary variable names.

2. All subroutines were changed to designate 2 for the process version and 7 for the package version: GWF2DRT7.

3. Subroutines GWF2DRT7ALP and GWF2DRT7RPPD were combined and renamed GWF2DRT7AR.

4. GWF2DRT7AR was modified to use ALLOCATE statements to reserve memory for the data in GWFDRTMODULE rather than reserving space in the RX and IR arrays used by MODFLOW-2000.

5. GWF2DRT7RPSS was renamed GWF2DRT7RP.

6. Subroutine arguments that are contained in Fortran modules were replaced with USE statements in all subroutines.

7. Subroutine GWF2DRT7DA was created to deallocate memory.

8. To support the Local Grid Refinement capability, subroutine SGWF2DRT7PNT was created to set pointers to a grid, and subroutine SGWF2DRT7PSV was created to save the pointers for a grid. The grid number, IGRID, was added as a subroutine argument to all of the primary subroutines, and subroutines SGWF2DRT7PSV and SGWF2DRT7PNT are called as appropriate.

9. The CBCALLOCATE option was removed. The cell-by-cell budget data are always stored in DRTF rather than making this an option.

10. The NDRTVL values for each drain-return cell are:

Layer;
Row;
Column;
Elevation;
Cond;
LayR, RowR, ColR, and Rfprop if RETURNFLOW option is active;
up to 20 values of auxiliary data;
computed return flow; and
computed flow from drain (always negative indicating outflow from aquifer).

11. The observation capability was removed.

Input Instructions for DRT7

Input for version 7 of DRT is read from the file that has file type "DRT" in the MODFLOW name file. The input is the same as for the modified version 1 included in MODFLOW-2000, except that the CBCALLOCATE option is removed. The CBCALLOCATE option will not be required when using the Ground-Water Transport Process in MODFLOW-2005. Parameter instances are supported as implemented in MODFLOW-2000. Up to 20 auxiliary variables are allowed.

REFERENCES

Harbaugh, A.W., 2005, MODFLOW-2005, the U.S. Geological Survey modular ground-water model—the Ground-Water Flow Process: U.S. Geological Survey Techniques and Methods 6-A16, variously p.

Banta, E.R., 2000, MODFLOW-2000, the U.S. Geological Survey modular ground-water model – documentation of packages for simulating evapotranspiration with a segmented function (ETS1) and drains with return flow (DRT1): U.S. Geological Survey Open-File Report 00-466, 127 p.