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Documentation of Conversion of the MODFLOW Flow and Head Boundary (FHB) Package To MODFLOW-2005

This documentation describes the changes to the Flow and Head Boundary (FHB) Package (Leake and Lilly, 1997) 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 GWFFHBMODULE was created to store the shared data for the FHB Package; GWFFHBMODULE incorporates the capability to support Local grid Refinement. The following table describes the data.

Variable Name	Size	Description
NBDTIM	Scalar	Number of times at which FHB data will be specified
NFLW	Scalar	Number of specified-flow cells
NHED	Scalar	Number of specified-head cells
IFHBCB	Scalar	Unit for writing cell-by-cell budget terms
NFHBX1	Scalar	Number of auxiliary flow variables
NFHBX2	Scalar	Number of auxiliary head variables
IFHBSS	Scalar	Steady-state option flag
IFLLOC	4,NFLW	Layer, row, and column location and IAUX value for specified flow cells
IHDLOC	4,NHED	Layer, row, and column location and IAUX value for specified-head cells
BDTIM	NBDTIM	Simulation time at which FHB data are specified
FLWRAT	NBDTIM*(1+NFHBX1),NFLW	Volumetric flow rate at specified-flow cells
SBHED	NBDTIM*(1+NFHBX2),NHED	Head at specified-head cells
BDFV	2+NFHBX1,NFLW	Computed flow and auxiliary-variable data for specified-flow cells
BDHV	NFHBX2,NHED	Auxiliary-variable data for specified-head cells
FHBXWT	10	Time-weighting factors for auxiliary variables
FHBXNM	10	Names of auxiliary variables

2. All subroutines were changed to designate 2 for the process version and 7 for the package version: GWF2FHB7.

3. Subroutines GWF2FHB7ALP and GWF2FHB7RPP were combined and renamed GWF2FHB7AR.

4. GWF2FHB7AR was modified to use ALLOCATE statements to reserve memory for the data in GWFFHBMODULE rather than reserving space in the RX and IR arrays used by MODFLOW-2000.

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

6. Subroutine GWF2FHB7DA was created to deallocate memory.

7. To support the Local Grid Refinement capability, subroutine SGWF2FHB7PNT was created to set pointers to a grid, and subroutine SGWF2FHB7PSV 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 SGWF2FHB7PSV and SGWF2FHB7PNT are called as appropriate.

Input Instructions for FHB7

    Input for version 7 of FHB is read from the file that has file type "FHB" in the MODFLOW name file. The input is the same as for version 1; however, clarification of the explanation of the IFHBSS variable is required because MODFLOW 2005 allows mixed steady-state and transient simulations. IFHBSS is the FHB steady-state option flag. If the simulation includes any transient-state stress periods, the flag is read but not used; in this case, specified-flow, specified-head, and auxiliary-variable values will be interpolated for steady-state stress periods in the same way that values are interpolated for transient stress periods. If the simulation includes only steady-state stress periods, the flag controls how flow, head, and auxiliary-variable values will be computed for each steady-state solution.

    If IFHBSS = 0, values of flow, head, and auxiliary variables will be those specified for the starting time of the simulation. This results in use of the first value in arrays FLWRAT, SBHED, and AuxVar for each respective boundary cell.

    If IFHBSS does not = 0, values of flow, head, and auxiliary variables will be interpolated in the same way that values are computed for transient simulations.

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.

Leake, S.A., and Lilly, M.R., 1997, Documentation of a computer program (FHB1) for assignment of transient specified-flow and specified-head boundaries in applications of the modular finite-difference ground-water flow model (MODFLOW): U.S. Geological Survey Open-File Report 97-571, 50 p.