Documentation of Conversion of the MODFLOW Geometric Multigrid (GMG) Package To MODFLOW-2005

This documentation describes the changes to the GMG Package (Wilson and Naff, 2004) to convert it to work with MODFLOW-2005. See Chapter 9 of Harbaugh (2005) for further information about the MODFLOW-2005 program.

1. Fortran module GMGMODULE was created to store the shared Fortran data for the GMG Package. The following table describes the data.

Variable Name	Size	Description
IITER	Scalar	Maximum number of inner iterations per outer iteration
IADAMPGMG	Scalar	Flag indicating if adaptive damping is used: 0 – Do not use adaptive damping not 0 – Use adaptive damping
ISM	Scalar	Flag indicating which smoother is used: 0 – ILU (Incomplete LU decomposition not 0 – Gauss-Seidel
ISC	Scalar	Flag indicating amount of semi-coarsening: 0 – Max coarsening for columns, rows, and layers 1 – Max coarsening for columns and rows 2 – Max coarsening for rows and layers 3 – Max coarsening for columns and layers 4 – No coarsening. PCG solver only
IOUTGMG	Scalar	Flag for outputting from the solver: 0 – No output 1 – For each linear solve, the number of PCG iterations, damping, residual, and maximum head change are output 2 – Residuals and convergence factor for each PCG iteration are output 3 – Same as IOUTGMG = 1 except output is sent to the screen 4 – Same as IOUTGMG = 2 except output is sent to the screen ly
ISIZ	Scalar	Number of megabytes allocated by GMG
IPREC	Scalar	Flag indicating precision: 0 – Single precision not 0 – Double precision
IIOUT	Scalar	Flag and unit number: •2 – IIOUT = IOUT •3 – IIOUT = 6 (unit number for writing to screen)
GMGID	Scalar	Identifier for current LGR grid number
HCLOSEGMG	Scalar	Head closure criterion for convergence
RCLOSEGMG	Scalar	Residual closure criterion for convergence
DAMPGMG	Scalar	Damping parameter
RELAXGMG	Scalar	Relaxation parameter

2. All subroutines were changed to designate 2 for the process version and 7 for the package version: GMG7.

3. Subroutine GMG1ALG was replaced by GMG7AR.

4. The C code was modified to incorporate Local Grid Refinement.

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

6. Subroutine GMG7DA was created to deallocate memory in GMGMODULE and call the routine that deallocates memory used by the C code.

7. To support the Local Grid Refinement capability, subroutine GMG7PNT was created to set pointers to a grid, and subroutine GMG7PSV 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 GMG7PSV and GMG7PNT are called as appropriate.

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.

Wilson, J.D. and Naff, R.L., 2004, The U.S. Geological Survey modular ground-water model -- GMG linear equation solver package documentation: U.S. Geological Survey Open-File Report 2004-1261, 47 p.