

Overview of MODFLOW

MODFLOW needs many ASCII text files describing grid, properties, boundary conditions, initial conditions, time steps, stresses, solution and output options.

A graphical user interface (GUI) provides a nice image of model features where you can manipulate model inputs graphically. When you are ready, the GUI creates the text files and executes MODFLOW. You never need to see the text files or know the commands that are necessary to run MODFLOW ... until something goes wrong!

If you do not have the ability to look in, and understand the content of these files or control these commands, you will not be a valuable modeler. Inevitably something does not work correctly in the GUI. Or, you want to do something unique with your project that the GUI developer hadn't planned on. If you do not understand the file structure and commands, you cannot move forward. You are paralyzed, and your project is in jeopardy. I have seen this happen to many people.

In short, you may dislike the tedium of working with text files, but please be patient and persevere because the effort will be worth it in the future. You will be a hero on modeling projects due to this knowledge and skill.

AND we will use one GUI to view the model and results later in the course

Reading for MODFLOW modelers

Go To:

MODFLOW_CourseFiles/doc
Read the numbered documents in order
MODFLOW 88 96 2000 2005

Read for the essence of how the codes perform
Do not try to read detailed descriptions of input or source code
go back for those details at the specific time you need them in the future

Note the conceptual model features of MODFLOW discussed in the 1988 are
NOT repeated in later documents

Further Reading for MODFLOW modelers

There are many additional simulation packages
And
Many data processing tools
to learn about

KEEP UP-TO-DATE on

New Developments

And

MODFLOW Software updates

USGS Software Web Site

<http://water.usgs.gov/nrp/gwsoftware/>

BOOKMARK THAT PAGE!

Let's open a new browser session there now,
<http://water.usgs.gov/nrp/gwsoftware/>

ONLINE MODFLOW MANUAL

USGS Online Guide to MODFLOW-2000/2005

<http://water.usgs.gov/nrp/gwsoftware/modflow2000/MFDOC/guide.html>

BOOKMARK THAT PAGE!

Let's open a new browser session there now,
or if you are off the Internet then go to your DVD:
[MODFLOW_CourseFiles\MODFLOW_Guide\ModflowGuide.chm](#)

MODFLOW 2000/2005 PROCESS:

MODFLOW-2000/2005 include:

GLO Global Process that controls overall program flow

GWF Ground-water Flow Process

OBS Observation Process

MODFLOW-2000 also includes:

SEN Sensitivity Process (slated for MF2005)

PES Parameter Estimation Process (being discontinued)

Plans are to expand the available tools

SUMMARY OF MODFLOW CAPABILITIES:

Single Phase, Saturated Flow

Constant Density

Porous Media (Darcy's Law applies)

1, 2, Or 3 Dimensional (2D areal or cross-section OR Quasi-3D)

Steady State or Transient Flow

Heterogeneous, Anisotropic (aligned with grid), Layered Units

Block Centered Finite Difference with variable grid spacing

Units can be Confined or Convertible

Boundary conditions include: Dirichlet, Neuman, Cauchy, and Phreatic Surface

Stresses such as Wells, Recharge, Evapotranspiration, Rivers, Drains etc

Springs, Thin Barriers to Horizontal Flow, Re-wetting

Many Solver options

Monitoring of simulated values comparable to field observations

Sensitivity of simulated values to changes in some parameter values is available in MF2000 and will be added to MF2005

Estimation of some types of parameters is available in MF2000

Parameter estimation has been discontinued in MF2005 and will instead be accomplished by UCODE

BASIC INPUT ITEMS INCLUDE

Grid
Time stepping
Hydraulic parameters
Boundary Conditions
Stresses
Solution parameters

BASIC OUTPUT ITEMS:

Hydraulic Heads
Drawdown
Flow rates
Mass Balance
Optional info at specified times
Iteration information

Underscore files describing various model inputs/outputs
Binary files containing output in compressed form

Modular Flow Modeling

MODFLOW needs an ASCII text file that lists the modules that are to be used to simulate a ground water flow system.

This is the NAME file

MODFLOW needs an ASCII text file for each module. Our focus in this class will be on the commonly use modules. Once you are prepared to use these packages, picking up a new package and using it is easy.

Examples of Common modules we will use for the Ground Water Flow Process of MODFLOW

dis - discretization - describes the grid and time stepping
bas6 - basic - describes the active cells and initial conditions
lpf - layer property flow - describes the properties of the porous media
rch - recharge - describes the rate of water infiltration to the ground water
wel - well- describes flow rates at point locations
ghb - general head boundary - describes head dependent flux boundaries
drn - drain - describes drain/spring location, elevation and bed properties
riv - river - describes river location, stage and bed properties
str - stream - describes stream location, stage/flow and bed properties
pcg/sip - solvers for the matrix equations
oc - output control - describes what to print
mult - multiplication arrays - describes how properties are distributed in space
zone - zone arrays - describes how properties are distributed in space