

Installing MODFLOW-2005 on OS X 10.6

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About this installation guide

This guide is an **unofficial** guide for installing MODFLOW-2005 on OS X 10.6.2 Snow Leopard. The author cannot be held responsible for any damage that may occur, following the instructions. For your own safety, create a backup of all vital data before the installation. Comments and questions are welcomed by the author. This document is created with L^AT_EX

1 Installation overview

MODFLOW is the U.S. Geological Survey modular finite-difference flow model, which is a computer code that solves the groundwater flow equation. The program is used by hydrogeologists to simulate the flow of groundwater through aquifers. The code is free software, written primarily in Fortran, and can compile and run on DOS, Windows or Unix-like operating systems¹.

USGS provides a compiled version of MODFLOW-2005 (**exe-file**) for Microsoft Windows. Unfortunately, no compiled binaries exist for the OS X platform. On a computer running UNIX (this includes a macintosh running OS X), the source files from USGS need to be compiled on the end-user computer. The requirements are a Fortran compiler, a compatible C compiler, and the knowledge of using the compilers.

This guide is meant as an aid in the process of obtaining and installing the fortran and C-compilers, and compiling MODFLOW-2005.

¹<http://en.wikipedia.org/wiki/MODFLOW>

2 Installation of required components

2.1 Xcode

A C-compiler for OS X is included in Apple's Xcode environment. Xcode is a suite of tools for developing software on Mac OS X, developed by Apple. Xcode 3.2, the latest major version, is bundled free with Mac OS X v10.6, but is not installed by default².

You can check whether Xcode is already installed on your system by opening a terminal window (Applications → Utilities → Terminal) and typing the following in the Terminal window:

```
xcodebuild -version
```

If the output is something like this, Xcode is already installed:

```
Xcode 3.2.1
Component versions: DevToolsCore-1614.0; DevToolsSupport-1591.0
BuildVersion: 10M2003
```

If this is not the case, go to <http://developer.apple.com/technology/xcode.html> and choose 'Xcode for Mac-only Development'. Log-in or create a Apple Developer Connection user. Download the 'Xcode 3.2.1 Developer DVD (Disk Image)' that is about 751 Mb in size. Decompress the `dmg`-file, and run `Xcode.mpg` from the Xcode disk image. The default installation-options are fine. After the installation has finished, unmount the disk-image by dragging it to the paper bin in the dock.

2.2 GCC and Fortran compiler

GCC 4.5³ is compiled using source code from the GNU CVS servers. This contains current versions of `gfortran` (GNU F95, this is a version of the much awaited, free, open source, F95 compiler), `gcc` (GNU C) and `g++` (GNU C++) compilers⁴.

You can check whether the GCC environment is already installed on your system by opening a terminal window (Applications → Utilities → Terminal) and typing the following in the Terminal window:

```
gfortran -v
```

²<http://en.wikipedia.org/wiki/Xcode>

³Documentation: <http://gcc.gnu.org/onlinedocs/>

⁴<http://hpc.sourceforge.net/>

If the last line of the output is something like this, the GCC tools are already installed:

```
...  
gcc version 4.5.0 20100107 (experimental) (GCC)
```

If this is not the case, download GCC for OS X 10.6 (Snow Leopard) here: <http://prdownloads.sourceforge.net/hpc/gcc-snwleo-intel-bin.tar.gz?download>. Open a terminal window (Applications → Utilities → Terminal) and type the following in the Terminal window to decompress and install GCC. Type your system password when required:

```
cd ~/Downloads/  
export PATH=/usr/local/bin:$PATH  
gunzip gcc-snwleo-intel-bin.tar.gz  
sudo tar -xvf gcc-snwleo-intel-bin.tar -C /
```

The GCC files are now installed. Typing `gfortran -v` in the Terminal should give output showing, among other things, the GCC version number.

2.3 MODFLOW-2005

Go to <http://water.usgs.gov/nrp/gwsoftware/modflow2005/modflow2005.html> and download the `.tar.Z` file (`mf2005v1_8_00.tar.Z`), the size is approximately 6.6 Mb.

Open a terminal window (Applications → Utilities → Terminal). Type the following in the Terminal window to create the `Modflow` folder and decompress the MODFLOW-2005 source code:

```
mkdir ~/Modflow/  
cd ~/Downloads/  
mv mf2005v1_8_00.tar.Z* ~/Modflow/mf2005v1_8_00.tar.Z  
cd ~/Modflow/  
uncompress mf2005v1_8_00.tar.Z  
tar -xvf mf2005v1_8_00.tar
```

The source code has now been decompressed in a dedicated `Modflow`-folder in your home folder. The installation files need configuration before compilation. In the terminal, type:

```
cd ~/Modflow/src  
/Applications/TextEdit.app/Contents/MacOS/TextEdit makefile
```

This will open TextEdit in its own window. You need to edit three (3) entries. Do not include the bracket symbols ('):

1. The line saying: 'F90= f90' must be changed to 'F90= gfortran'
2. Beneath the 'F90= gfortran' line, add a line saying: 'F77= gfortran'
3. The line saying: 'CC= gcc' must be changed to 'CC= gfortran'

Save the file, and **quit** TextEdit (Cmd+Q). Closing the window is not enough.

It's now time for compiling MODFLOW-2005. In the terminal window, type:

```
cd ~/Modflow/src  
make
```

Some warnings may occur, but if the compilation the compilation succeeds, the **make**-command has among other things created the **mf2005-binary**.

You can create a symbolic link to this binary, so that typing 'mf2005' in the terminal, regardless of location, executes MODFLOW-2005:

```
cd /usr/bin  
sudo ln -s ~/Modflow/src/mf2005 mf2005
```