# Installing Hdef

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#### Requirements

- Unix-style operating system: Mac OS, Linux, or WSL
- GCC and Gfortran compilers (I cannot guarantee the software will work with other compilers)
- LAPACK is required for some (not all) programs; for LAPACK installation instructions, see the *Installing LAPACK* tutorial
- CMake

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#### https://github.com/mherman09/Hdef

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#### https://github.com/mherman09/Hdef









If you cloned the Github repository, start from here



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• •	📄 build — -	zsh — 76×18	
	~/Downloads/Hdef-	master/build — -zsh	+
[10:52:09 Downloads \$ cd	Hdef-master		1
[10:52:15 Hdef-master \$ l	S		]
AUTHORS LICENSE	ext	src	
CMakeLists.txt README	man	test	
INSTALL doc	scripts		
10:52:17 Hdef-master \$ m	kdir build		]
[10:52:22 Hdef-master \$ c	d build		]
10:52:27 build \$	•	Change into the H Make a new direct build	Idef directory tory called
	•	Change into the b	uild directory

### LAPACK in Hdef

- At this point, you need to decide whether you want to install Hdef with the linear algebra library LAPACK or not
- The LAPACK functions are used in fitting curves and inversions

If you want to use LAPACK functionality, stop this tutorial now and go install LAPACK.

If you need help with this, check out the Installing LAPACK instructions

• • •	📄 build — -zsh	— 76×18	
~/	Downloads/Hdef-mas	ter/build — -zsh	-
10:56:35 Downloads \$ cd H	def-master		
10:56:41 Hdef-master \$ ls			
AUTHORS LICENSE	ext	src	
CMakeLists.txt README	man	test	
INSTALL doc	scripts		
10:56:44 Hdef-master \$ mk	dir build		
10:56:47 Hdef-master \$ cd	build		
10:56:48 build \$ cmake \			
-DCMAKE_INSTALL_PREFIX=	1		
-DCMAKE_C_COMPILER=gcc-10	1		
-DCMAKE_Fortran_COMPILER=	gfortran-10 \		
-DLAPACK LIB DIR=/Users/m	herman2-local/Re	esearch/lapack-3.9.0	

From the build directory, run CMake with the flags shown here

Note: you can put all these flags on one line. I have put the flags on separate lines (with "\" at the end of each line) so you can read them more easily



-DCMAKE\_INSTALL\_PREFIX: the location to install Hdef after it is built (I usually put everything in the main Hdef directory, hence ".." but you can choose a different installation directory if you organize your system differently)



-DCMAKE\_C\_COMPILER: your C compiler -DCMAKE\_Fortran\_COMPILER: your Fortran compiler

	📄 build — -zsh	— 76×18	
~/	Downloads/Hdef-mas	ter/build — -zsh	+
10:56:35 Downloads \$ cd Ho	def-master		
10:56:41 Hdef-master \$ ls			
AUTHORS LICENSE	ext	src	
CMakeLists.txt README	man	test	
INSTALL doc	scripts		
10:56:44 Hdef-master \$ mkg	dir build		
10:56:47 Hdef-master \$ cd	build		
10:56:48 build \$ cmake \			
-DCMAKE_INSTALL_PREFIX=	1		
-DCMAKE_C_COMPILER=gcc-10	١		
-DCMAKE_Fortran_COMPILER=	gfortran-10 \		
-DLAPACK_LIB_DIR=/Users/ml	nerman2-local/Re	esearch/lapack-3.9.0 \	

-DLAPACK\_LIB\_DIR: the location where you installed LAPACK (if you are not using LAPACK, you can omit this flag)



Do not forget the "..." at the end of the argument list!

This tells CMake where to find the instructions for configuring and building Hdef

• • •	📄 build — -zsl	h — 76×18	
	~/Downloads/Hdef-ma	aster/build — -zsh	+
L0:56:35 Downloads \$ cd	Hdef-master		
10:56:41 Hdef-master \$	ls		
AUTHORS LICENSE	ext	src	
CMakeLists.txt README	man	test	
INSTALL doc	scripts		
10:56:44 Hdef-master \$ i	nkdir build		
10:56:47 Hdef-master \$	cd build		
10:56:48 build \$ cmake	١		
-DCMAKE_INSTALL_PREFIX=	\		
-DCMAKE_C_COMPILER=gcc-	L0 \		
DCMAKE_Fortran_COMPILE	R=gfortran-10 \		
-DLAPACK LTB DTR=/Users	/mherman2-local/F	Research/lapack-3.9.0 \	

Press return and wait a few seconds for configuration...

• •	•	🚞 build — -zsh — 76×18	
		~/Downloads/Hdef-master/build — -zsh	+
Us	ing C compiler fl	lags:	
Тур	pe 'make' to comp	bile Hdef (in this directory)	
Тур	pe 'make test' to	o run unit tests	
Typ	pe 'make test-exe	ec' to run executable tests	
Typ	pe 'make install'	' to install Hdef in directory '/Users/mherman2-local,	/[
ownloa	ads/Hdef-master'		
	Executables -	-> /Users/mherman2-local/Downloads/Hdef-master/bin	
	Libraries -	-> /Users/mherman2-local/Downloads/Hdef-master/lib	
	Tests -	<pre>-&gt; /Users/mherman2-local/Downloads/Hdef-master/test</pre>	
***	* * * * * * * * * * * * * * * * * * * *	* * * * * * * * * * * * * * * * * * * *	* 7
*****	* * *		
Cor	nfiguring done		
Ger	nerating done		
Bu	ild files have be	een written to: /Users/mherman2-local/Downloads/Hdef-r	na
ster/k	build		
11:23	:20 build \$		

At the end of configuration, information is provided for how to build Hdef and where files will be placed. If anything is wrong, run CMake again with the correct options.

🛑 😑 🛑 build — -zsh — 76×18
~/Downloads/Hdef-master/build — -zsh
Using C compiler flags:
Type 'make' to compile Hdef (in this directory)
Type 'make test' to run unit tests
Type 'make test-exec' to run executable tests
Type 'make install' to install Hdef in directory '/Users/mherman2-local/
ownloads/Hdef-master'
Executables -> /Users/mherman2-local/Downloads/Hdef-master/bin
Libraries -> /Users/mherman2-local/Downloads/Hdef-master/lib
Tests -> /Users/mherman2-local/Downloads/Hdef-master/test
************************************
*****
Configuring done
Generating done
Build files have been written to: /Users/mherman2-local/Downloads/Hdef-m
ster/build
11:23:20 build \$ make 🛛 🗲 🛶 🛶 🛶 🛶 🛶 🛶 🛶 🛶 🛶 🛶 🛶 🛶 🛶

#### Type make to build Hdef...this takes a few seconds

	Duliu2511 - 150X44	
	~/Downloads/Hdef-master/build — -zsh	
1:53:56 build \$ ./o	y92util	
Usage: o92utilo	ptions	
Input fault options		
-ffm FFMFILE	Fault file in USGS .param format	
-fsp FSPFILE	Fault file in SRCMOD FSP format	
-mag MAGFILE	Fault file in "psmeca -Sa" format (mag)	
-flt FLTFILE	Fault file with slip and dimensions (slip wid len)	
-tns TNSFILE	Tensile source file (IN DEVELOPMENT)	
-fn -pt	Treat faults as finite rectangular (default) or point	
-empirical OPT	Empirical scaling relation	
-thr THR	Set low slip to zero	
Input target/receiv	er options	
-sta STAFILE	Station/receiver locations	
-auto h DEPTH N	Generate horizontal location grid	
-auto v AZ N	Generate vertical location grid (through centroid)	
-auto:thr DISP	Displacement threshold for auto grids	
-trg TRGFILE	Target/receiver geometry	
Input balf-space on	tions	
-haf HAFSPCFILE	Elastic half-space properties	
Output options		
-disp DSPFILE	Displacement (E N Z)	
-strain STNFILE	Strain matrix (EE NN ZZ EN EZ NZ)	
-stress STSFILE	Stress matrix (EE NN ZZ EN EZ NZ)	
-estress ESTSFILE	Effective (maximum) shear stress	
-normal NORFILE	Normal traction on target faults (requires -trg)	
-shear SHRFILE	Shear traction on target faults (requires -trg)	
-coul COULFILE	Coulomb stress on target faults (requires -trg)	
Miscellaneous optio	ns	
-parallel [NTHREADS	5] Calculate deformation in parallel	
-geo -xy	Use geographic (default) or cartesian coordinates	
-az	Displacement vector outputs (AZ HMAG Z)	
-prog	Turn on progress indicator	
-v LVL	Turn on verbose mode	
-debug [ROUTINE]	Turn on debugging	
See o92util man pag	e for details	
.1:53:59 build \$		

If there are no errors, Hdef has been built. You can check this by typing ./o92util – if the usage statement prints, then the program has been compiled in the build directory

- Hdef has been built, so you could stop here!
- To **test** the programs, type make test. If Hdef is built correctly, all tests should pass. This goes quickly, so I highly recommend testing!
- To **install** the programs in the directory you indicated when running CMake, then type make install

- Last but not least, you need to tell your computer where to find the installed programs by adding the Hdef directory (e.g., /path/to/Hdef/bin) to your PATH environment variable
- The syntax depends on your shell (type "echo \$SHELL" to see which shell you are using):
  - Bash: add the following line to .bashrc:
    - export PATH=\$PATH:/path/to/Hdef/bin
  - Zsh: add the following line to .zshrc:
    - export PATH=\$PATH:/path/to/Hdef/bin
  - Csh: add the following line to .cshrc:
    - setenv PATH \$PATH:/path/to/Hdef/bin

	doc — less → man o92util — 100×47
	~/Research/MWHPROGRAMS/doc — less • man o92util
092UTIL(1)	User Manuals 092UTIL(1
NAME 092	util - compute fault-generated deformation in an elastic half-space
SYNOPSIS 092 hal [	util -ffm -fsp -mag -flt fault_file -sta station_file [-trg target_file] [-has fspace_file] -disp -strain -stress -estress -shear[max] -normal -coul defm_file .]
DESCRIPTIO 092 ded dis def pos	N util computes deformation generated by point or rectangular fault sources embed in an elastic half-space using the equations of Okada (1992). It can produce placements, strains, stresses, and resolved stresses. Note that depths are ined positive down, while displacements, strains, and stresses have z defined itive up.
OPTIONS	
INP	UTS
-ff	m <u>fault_file</u> Finite fault model in USGS param format (Hayes, 2017; https://earth- quake.usgs.gov)
-fs	<pre>p fault_file Finite fault model in SRCMOD FSP format (http://equake-rc.info)</pre>
-ma	<pre>g fault_file Fault_file: evlo evla evdp(km) strike dip rake magnitude. If using finite sources, the magnitude is converted using the specified empirical relation</pre>
-f1	<pre>t fault file Fault file: evlo evla evdp(km) strike dip rake slip(m) width(km) length(km) where width is the down-dip dimension and length is the along-strike dimen- sion</pre>
-st	a <u>station_file</u> Locations to compute deformation: <u>stlo</u> <u>stla</u> <u>stdp(km)</u>
-tr	<pre>g target_file Target fault parameters: strike dip rake friction. If target_file has on line, all locations have the same target parameters. If target_file has the same number of entries as station_file, then target fault parameters corre- spond to matching station coordinate. Alternatively, replace target_file with strike/dip/rake/friction to define the target parameters as a command line argument.</pre>

There are man pages for several of the tools. These may be particularly useful for the larger programs with lots of options. These are in the directory:

#### Hdef-master/man

Add these to the MANPATH variable in your .bashrc, .zshrc, .cshrc, etc.