

This is an instruction on how to setup C++ environment for the ED v3.0 model.

To run ED v3.0, several libraries need to be installed in your computer environment. They include zlib, hdf5, netcdf, TBB, Berkeley DB and libconfig. You can download their source code from where you obtained the ED v3.0 code.

Below are steps/commands on how to install each library in an Ubuntu linux system. Lines in italic are linux commands to be executed in the terminal window. These commands will install all libraries under the ED directory. **You may have already installed some of them or prefer to install them in other locations. In either case, please remember to update library locations in the Makefile under ED directory accordingly so that C++ compiler can locate these libraries.**

1. Download EDv3_code.zip and EDv3_dependencies.zip and then unzip them. Several folders (i.e., external_apps, source_code, installed_apps) need to be created under the EDv3_code folder. All libraries from EDv3_dependencies.zip also need to be moved to the source_code folder. The final EDv3_code directory should have the following structure:

```
/path/to/EDv3_code/  
  allometry.cc  
  belowground.cc  
  ...  
  external_apps/  
    source_code/  
      netcdf-4.1.3.tar.gz  
      oneTBB-2017_U3.tar.gz  
      db-4.6.21.tar.gz  
      zlib-1.2.8.tar.gz  
      hdf5-1.8.13.tar.gz  
      libconfig-1.7.3.tar.gz  
    installed_apps/
```

*** /path/to/ is the path to where you actually stored the EDv3_code folder.**

2. Open a terminal window, then change directory to /EDv3_code/external_apps/source_code/
3. Update package index information from all configured sources
 - *sudo apt-get update*
4. Install essential packages

- *sudo apt install make*
- *sudo apt install gcc*
- *sudo apt install g++*

5. Install the zlib package which is prerequisite of netcdf library

- *tar -zxvf zlib-1.2.8.tar.gz*
- *cd zlib-1.2.8*
- *./configure --prefix=/path/to/EDv3_code/external_apps/installed_apps/netcdf/4.1.3*
- *make*
- *make check*
- *sudo make install*
- *cd ../*

6. Install hdf5 package which is prerequisite of netcdf library

- *tar -zxvf hdf5-1.8.13.tar.gz*
- *cd hdf5-1.8.13*
- *./configure --prefix=/path/to/EDv3_code/external_apps/installed_apps/netcdf/4.1.3 --with-zlib=/path/to/EDv3_code/external_apps/installed_apps/netcdf/4.1.3*
- *make*
- *make check*
- *sudo make install*
- *cd ../*

7. Install netcdf library

- *tar -zxvf netcdf-4.1.3.tar.gz*
- *cd netcdf-4.1.3*
- *CPPFLAGS=-I/path/to/EDv3_code/external_apps/installed_apps/netcdf/4.1.3/include LDFLAGS=-L/path/to/EDv3_code/external_apps/installed_apps/netcdf/4.1.3/lib ./configure --prefix=/path/to/EDv3_code/external_apps/installed_apps/netcdf/4.1.3 --disable-dap*
- *make*
- *make check*
- *sudo make install*
- *cd ../*

8. Install Oracle Berkeley DB library

- *tar -zxvf db-4.6.21.tar.gz*
- *cd db-4.6.21*
- *cd build_unix*

- *../dist/configure* —
- *prefix=/path/to/EDv3_code/external_apps/installed_apps/BerkeleyDB/4.6.21* --
- *enable-cxx*
- *make*
- *sudo make install*
- *cd ../..*

9. Install Intel® oneAPI Threading Building Blocks (oneTBB) library

- *tar -zxvf oneTBB-2017_U3.tar.gz*
- *cd oneTBB-2017_U3*
- *make compiler=gcc stdver=c++17 tbb_build_prefix=my_tbb_build*
- *sudo mkdir /path/to/EDv3_code/external_apps/installed_apps/IntelTBB/*
- *sudo mkdir /path/to/EDv3_code/external_apps/installed_apps/IntelTBB/2017U3*
- *sudo mkdir /path/to/EDv3_code/external_apps/installed_apps/IntelTBB/2017U3/lib*
- *sudo cp -r include*
/path/to/EDv3_code/external_apps/installed_apps/IntelTBB/2017U3/include
- *sudo cp build/my_tbb_build_release/*so**
/path/to/EDv3_code/external_apps/installed_apps/IntelTBB/2017U3/lib
- *cd ../*

10. Install libconfig library

- *tar -zxvf libconfig-1.7.3.tar.gz*
- *cd libconfig-1.7.3*
- *./configure --prefix=/path/to/EDv3_code/external_apps/installed_apps/libconfig/1.7.3*
- *make*
- *make check*
- *sudo make install*

11. Compile ED. Open Makefile file and change 'ED = /path/to/' to the location where you stored the EDv3_code folder, then save and close.

- *cd /path/to/EDv3_code/*
- *make*
- *LD_LIBRARY_PATH=\$LD_LIBRARY_PATH:/path/to/EDv3_code/external_apps/installed_apps/netcdf/4.1.3/lib:/path/to/EDv3_code/external_apps/installed_apps/IntelTBB/2017U3:/path/to/EDv3_code/external_apps/installed_apps/libconfig/1.7.3/lib:/path/to/EDv3_code/external_apps/installed_apps/BerkeleyDB/4.6.21/lib*

This instruction was created with help from Tianqi Feng (Wuhan University). More questions, please reach out to Dr. Lei Ma (lma6@umd.edu; leima578542312@gmail.com).