



Introduction to NCEPLIBS

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NCEPLIBS

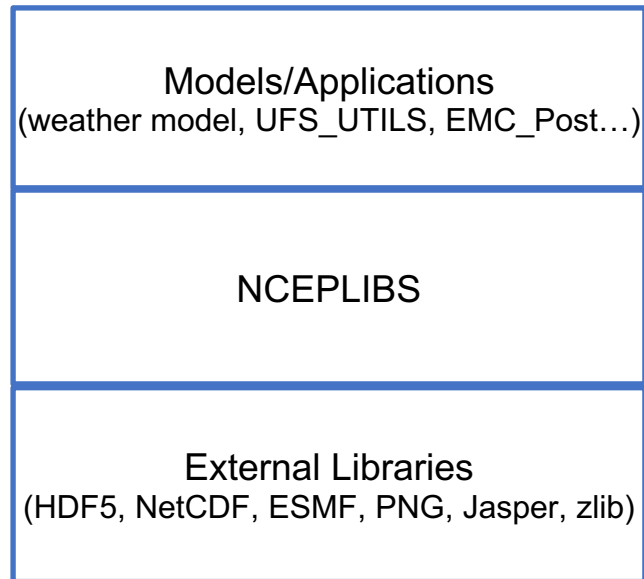
- NCEPLIBS is a collection of ~15 internally developed libraries and utilities that are used by the weather model and other applications
- Provide model I/O, grid transformations, interpolation, grib utilities...
- Mostly Fortran, some C
- CMake build system
- Distributed using Git
- Made publicly available on Github earlier this year as part of the UFS weather model public release

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- Made publicly available on Github earlier this year as part of the UFS weather model public release
- **Most users can treat NCEPLIBS as a black box**

Library Hierarchy

- NCEPLIBS sits in the middle between the external dependencies and the model



NCEPLIBS-external

- First step in building and running the weather model
- NCEPLIBS-external is a compilation of third-party libraries required to build NCEPLIBS, and by extension the UFS weather model
 - zlib, HDF5, NetCDF, libpng, libjpeg, Jasper, WGRIB2, ESMF
 - <https://github.com/NOAA-EMC/NCEPLIBS-external>
- Features
 - Can be configured to build only certain libraries
 - Provides Lua and tcl modules

The Libraries

- bacio - Binary I/O
- bufr - BUFR utilities
- g2 - grib2 encoder/decoder
- g2tmpl - grib2 template utilities
- gfsio - gfs gaussian to grib
- ip - grid interpolation (grib1 templates)
- ip2 - grid interpolation (grib2 templates)
- landsfcutil - Land surface utilities
- nemsio - I/O for NEMS
- nemsiogfs - I/O for NEMS gfs
- sfcio - surface I/O
- sigio - sigma I/O
- sp - spectral transformations
- w3emc - grib1 encoding/decoding
- w3nco - grib1 encoding/decoding
- wrf_io - wrf I/O
- wgrib2 - wgrib2 utility

I/O Libraries

- Models need to create and ready many types of files
- BACIO - Binary I/O
- GFSIO - GFS Gaussian to grib
- SIGIO - Sigma restart I/O for global spectral model
- WRF_IO - I/O for UPP
- SFCIO - Surface file I/O
- NEMSIO - NEMS I/O
- NEMSIORGFS NEMS-GFS I/O

Grib Libraries

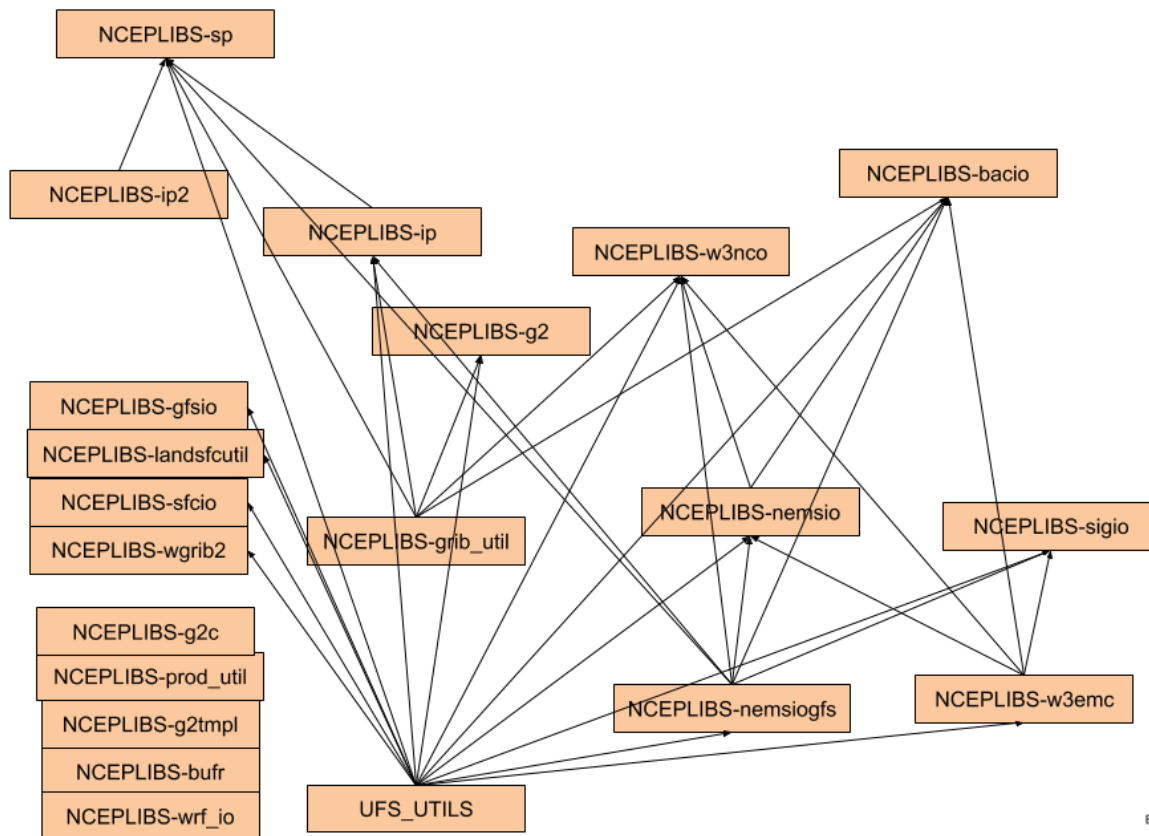
- GRIB is a common file format used in meteorology to store weather data
- Two editions (GRIB 1 and GRIB 2)
- G2 - GRIB2 encoder/decoder
- G2TMPL - Utility for GRIB2 templates
- WGRIB2 - Executable for reading/writing/interacting with grib2 files
- W3EMC - GRIB1 encoder/decoder
- W3NCO - GRIB1 encoder/decoder

Other Libraries

- SP - (Sp)ectral transformations
- Landsfcutil - Land surface utilities
- IP - Interpolates between different grids (grib1 descriptors)
- IP2 - Interpolates between different grids (grib2 descriptors)

NCEPLIBS Inter-dependencies

NCEPLIBS Inter-dependencies Oct 1, 2020



CMake Build System

- All NCEPLIBS use a CMake build system introduced as part of the public release earlier this year
- CMake is an open-source, cross-platform family of tools designed to build, test and package software similar to Autotools
- Benefits
 - Uses an out-of-source build
 - Easy to integrate tests into the build system
 - Provides a way of finding packages using package config files
 - Supports multiple generators (default is make, but also Ninja and more)
 - Cleaner than manually writing make files
- Updated for release/public-v2 with many fixes and improvements

NCEPLIBS Umbrella Build

- Building all those libraries individually would be tedious
- Luckily there's an “umbrella” build that builds all the libraries for you
 - <https://github.com/NOAA-EMC/NCEPLIBS>
- Requirements
 - Fortran and C compiler
 - Libraries listed under NCEPLIBS-external
- Features
 - Provides Lua and tcl module files for convenience
 - Flat or hierarchical install structure

Building NCEPLIBS

- NCEPLIBS is available on Github
 - <https://github.com/NOAA-EMC/NCEPLIBS>

```
> git clone https://github.com/NOAA-EMC/NCEPLIBS.git
> cd NCEPLIBS
> mkdir build && cd build
> cmake .. -DCMAKE_INSTALL_PREFIX=<install path> <-DOPTION=value>
> make

> module use <install path>/modules
> module load NCEPLIBS
```

Future

- NCEPLIBS is currently undergoing a major re-factoring
- Combine and deprecate libraries (ip, ip2; w3emc, w3nco)
- Improved documentation (Doxygen)
- Improved testing and CI

Resources

- Detailed instructions can be found on Github
 - <https://github.com/NOAA-EMC/NCEPLIBS-external>
 - <https://github.com/NOAA-EMC/NCEPLIBS>
- Github Wiki
 - <https://github.com/NOAA-EMC/NCEPLIBS/wiki>
- We are active on Github if any issues are encountered

Questions?

