Installation

Institute of Meteorology and Climatology, Leibniz Universität Hannover

Software Requirements

In order to successfully install PALM, please meet the following software requirements:

- The bash shell (available at **`/bin/bash`**).
- A recent Fortran and C++ Compiler (GNU, Intel, Cray, PGI, NEC).
- The build automation tools cmake and make (for library detection and build coordination).
- The Message Passing Interface (MPI) library with MPI-3 support (compiled with the same Compiler as PALM).
- A NetCDF library not earlier than 3.6.3 (compiled with the same Compiler as PALM).
- The FFT library FFTW (PALM also comes with a build-in FFT but with less performance).
- Python 3 (Needed by the GUI and other helper routines).
- PyQt5 (Needed by the GUI).
- The graphic-package NCL from NCAR (Needed by the data visualization tool palmplot).
- The FLEX library BISON parser generator (Needed by the chemistry tool kpp4palm)

The README.md file that ships with the PALM Model System release Package provides a one-liner that triggers the installation of all requirements on most Debian-based Linux Distributions like Ubuntu etc.

The PALM Model System installation

- The PALM Model System can be downloaded at:

  https://gitlab.palm-model.org/releases/palm_model_system/-/releases

- For the current seminar please choose release **23.04**
- A zip or tar archive is available for download. Please unpack the content (by using the "`unzip`" command in the terminal) to the directory `~/palm/current_version/palm_model_system` and open a terminal inside that directory.
- Please follow the installation instructions described in the README.md file that ships with the PALM Model System release Package. The installation instructions mention, that an "`<install-prefix>`" needs to be chosen. Please choose "`~/palm/current_version`" for the current seminar.
- Make sure no errors have occurred by carefully checking the output of the installation script.

Post-installation state and first simulation

After the installation is finished you should have the following files/folders inside the installation directory **~/palm/current_version**:

- The PALM Model System code repository **palm_model_system/**.
- A configuration file **.palm.config.default**.
- A folder named **bin/** that contains all the executables.
- A folder named **rrtmg/** that contains the RRTMG library.
- A folder named **MAKE_DEPOSITORY_default/** that contains the pre-compiled PALM code.

For a possible fast track to execute your first simulation, execute these commands:

```
export PATH=~/palm/current_version/bin:${PATH}
cd ~/palm/current_version
mkdir -p JOBS/example_cbl/INPUT
cp palm_model_system/packages/palm/model/tests/cases/example_cbl/INPUT/example_cbl_p3d \
JOBS/example_cbl/INPUT/
palmrun -r example_cbl -c default -a "d3#" -X 4 -v -z
```

Common Problems

Required libraries are missing

- **Symptom:** You experience a configuration error like:
  - **Could NOT find MPI_Fortran (missing: MPI_Fortran_LIBRARIES)**
  - **Could NOT find NetCDF (missing: NetCDF_LIBRARIES)**
- **Explanation:** The installer automatically looks for the required MPI and NetCDF libraries. Sometimes (especially with manual library installations) the libraries can not be automatically detected.
- **Solution:** Make sure you successfully installed all required libraries including their Fortran versions. Add the library locations to the environment variable **LD_LIBRARY_PATH**. You can also force the installer to use the MPI compiler wrapper mpif90 and specify the NetCDF library location instead of the automatic detection.

Common Problems

Your MPI or NetCDF libraries have been built with another compiler

- **Symptom:** During compilation compiler errors like the following are displayed:
  - **Fortran compiler "ifort" does not match NetCDF Fortran compiler "gfortran"**
  - **File 'mpi.mod' opened at (1) is not a GNU Fortran module file**
- **Explanation:** PALM requires MPI and NetCDF libraries to be build both with the same compiler as PALM is compiled with.
- **Solution:** Use the same compiler for compiling your MPI- and NetCDF-libraries, as well as for compiling the PALM code.

Common Problems

You have libraries from multiple MPI implementations installed (e.g OpenMPI and MPICH)

- **Symptom:** Between compilation and linking the libraries get mixed.
  - Any error that talks about multiple missing MPI functions at link time.
- **Explanation:** It could happen that the compiler includes the header/module file of one implementation but the linker later tries to use the library from the other implementation.
- **Solution:** Avoid having multiple MPI implementations installed. In case you really need them both, make sure they do not sit in the same location and only have the one activated in your environment, that you like to use for PALM (e.g. do not add both to your **`LD_LIBRARY_PATH`**).

Common Problems

Your compiler is too old (especially GNU 4.8.X is too old)

- **Symptom:** During compilation following errors are displayed:
  - `'x' argument of 'c_sizeof' intrinsic at (1) must be an interoperable data entity`
  - `argument 'array' to 'c_loc' at (1) must be an associated scalar POINTER`
- **Explanation:** A specific function or feature is not known to the compiler in use (as we test PALM regularly, it is unlikely that this is a bug in PALM).
- **Solution:** Install a recent compiler version!

Common Problems

Features are missing in your MPI library

- **Symptom:** During compilation, errors like the following are displayed:
  - **Error: There is no specific subroutine for the generic 'mpi_alloc_mem'**
- **Explanation:** PALM uses a wide range of MPI-3 functions. In some older MPI library versions, some of these functions are not implemented yet. We got problem reports especially with older OpenMPI versions.
- **Solution:** Install a recent MPI implementation (we recommend OpenMPI, mpich, mvapich, or Intel-MPI).