# How to compile the MOLOCH model and setup a domain on the ECMWF ATOS supercomputer

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1. Download the latest version of the Moloch (and ISAC's) model from the gitlab repository. It normally has the name `globo-bolam-moloch-main.tar.gz`

2. The suggested folders scheme is as in Figure 1

3. Load modules:

   (a) `module purge`

   (b) `module load prgenv/intel`

   (c) `module load intel`

   (d) `module load ecmwf-toolbox`

   (e) `module load netcdf4`

   (f) `module list`

4. Download from the github repository the radiation libray from ECMWF (latest version) and compile it in the suggested fols -lrtlder DA QUI

5. you need the following files:

   - `moloch_v22.tar.gz`, the model source files
   - `rad_ecmwf.tar.gz`, the radiation package from ECMWF
   - the `compile-*` files, which contain few commands to link libraries and compile sources with the appropriate compiler

6. the `v22` folder contains the source code, namely `common_routines.F90`, `moloch.F90`, `ppostmol.F90`, `premoloch.F90`, `prepar_grib2_coding_data.F90`, `read_grib2_data.F90`, `shf2grib2.F90`, `write_grib2_data.F90`

7. go in the `rad_ecmwf` directory and compile radiation module (as edit by ISAC/CNR staff). Targeted instructions to compile rad_ecmwf library are available in the tar archive. Remember that this is the OLD version of ECMWF radiation scheme. More updated software is available since September 2023 from A. Buzzi (or someone else from ISAC/CNR);
options for a standard Linux machine `options.linux` with gfortran are:
`FC=gfortran`
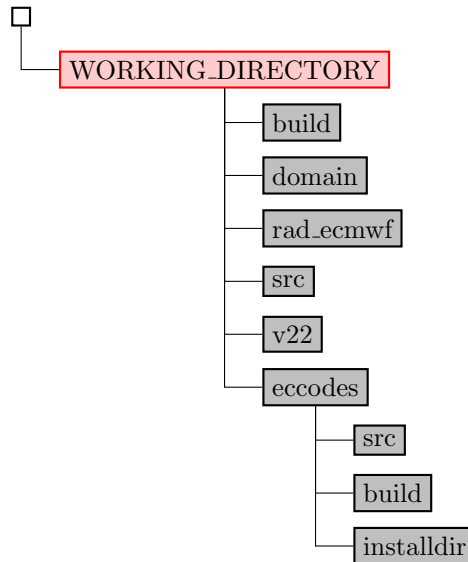`FFLAGS = -c -w -fallow-invalid-boz -I ../module -fopt-info-vec-optimized`

Figure 1: Suggested directory tree

8. go in the `domain` directory. You need the following files:

- `dimensions.inc`: defines the dimensions of the grid based on the number of cores available

○ `geo.F90` and `geo.inc`: define the geographical position of the grid and the static fields

⋆ `premoloch.inp`, `moloch.inp`, `ppostmol.inp` and `grib_sample.inp`: are namelists (see below)

Proceed as follows:

- `dimensions.inc`: it looks like

  ```
  integer, parameter :: gnlon=450, gnlat=546, nlev=50, nlevg=7
  integer, parameter :: nprocsx=8, nprocsy=16
  ```

  Suppose you have $P$ cores and you want to setup a domain with $N_x$ and $N_y$ grid points in the longitude and latitude direction, respectively. Then you have to:

  (a) factorize $P$ as in $P = P_x \times P_y$ (8 and 16 in the example above)

  (b) divide $N_x$ by $P_x$ and consider the closest even number

  (c) add 2 to the result of the previous step and you get the value for `gnlon`

○ `geo.inc`: it looks like

  ```
  ! Grid parameters for geo.F90 and plot_geo_domain_18.F90
  ! (values must be consistent with those in prebolam.inp
  ! or premoloch.inp).
  parameter (nlon=450, nlat=546)
  parameter (dlon=0.024, dlat=0.025,     &
             x0d=0., y0d=0.,              &
             alon0=6.0, alat0=36.0)
  ```

where `nlon` and `nlat` are defined in `dimensions.inc`, `dlat` is the desired resolution (in degrees), for instance is approximately 0.025 for a grid spacing of 2500 m and `dlon` is obtained by applying the formula `dlat/cos(lat0)`, where `lat0` is a mean latitude of the model grid (latitude of the center fo the grid?). `alon0` and `alat0` must define the true coordinates of the bottom-left corner of the domain.

Once `geo.inc` is defined, compile `geo.F90` with ifort, link the static global data, namely `soil12.bin`, `orography120.bin` and `landuse120.bin`, and run `geo.exe`, which should produce `geo.bin`

**ATTENZIONE NON SI RIESCE A COMPILARE geo.F90 CON gfortran PER-TANTO NON SI VA AVANTI. . .**

9. go in the `build` directory where you need to have the `compila-moloch` file. In this file nothing has to be changed unless you want to use a more aggressive compilation flag $(03)$. In this directory you further need the links the following files:

- `moloch.F90`: available in the `v22` directory

- `dimensions.inc`: available in the `domain` directory

- `version`: which should point to the `v22` directory

Run compila-moloch which should produce `moloch.exe`.

Similar steps for `compila-premoloch` [1], `compila-ppostmol` and `compila-shf2grib2`

A titolo d'esempio:

```
cp $SOURCE_DIR/compila-* .
cp $SOURCE_DIR/geo.F90 .
cp $SOURCE_DIR/dimensions.inc .
cp $SOURCE_DIR/geo.inc .
ln -svf $GEOG_DIR/GEOG_DATA/mol/* .
#vim dimensions.inc
#vim geo.inc
ifort geo.F90
./a.out
ln -svf $SOURCE_DIR/v22 version
cp version/moloch.F90 .
sh compila-moloch
module load ecmwf-toolbox
sh compila-premoloch
sh compila-ppostmol
sh compila-shf2grib2
```

dove `vim dimensions.inc` e `vim geo.inc` devono essere editati seguendo le regole per la griglia di MOLOCH.

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[1]if the eccodes is not loaded, load it first before compiling premoloch, then add the full pat of the library in the compila-premoloch