ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR-
UND MEERESFORSCHUNG

Pymor - Units

Pavan

HELMHOLTZ

Units

- Units in cmorized files must reflect the units found in CMIP table
- If units in source files differ from units defined in CMIP table, Pymor does unit conversion
- Pymor unit conversion is powered by “Pint” library and “chemicals” library
- Pymor understands chemical elements found in units (example: `molC`)
- Pymor support alternative source of providing units
- Pymor provides a mechanism to handle dimensionless units (example: `0.001`)

pint

CalebBell/
chemicals

chemicals: Chemical database of Chemical Engineering Design Library (ChEDL)

Units handling

- Pymor has built-in support for handling chemical elements in units

  Consider following unit conversion

  ```
  mmolC —> kg  # Express milli moles of Carbon in kilograms
  ```

  Conversion factor calculated by hand.

  ```
  1) mmolC -> molC: / 1e3.  # milli moles to moles
  2) molC -> gC: * 12.0107  # molecular weight of Carbon in grams
  3) gC -> kgC: / 1e3
  —> 1/1e3 * 12.0107 / 1e3
  ```

- No need to do manual conversion anymore as `chemical` package takes care of it.

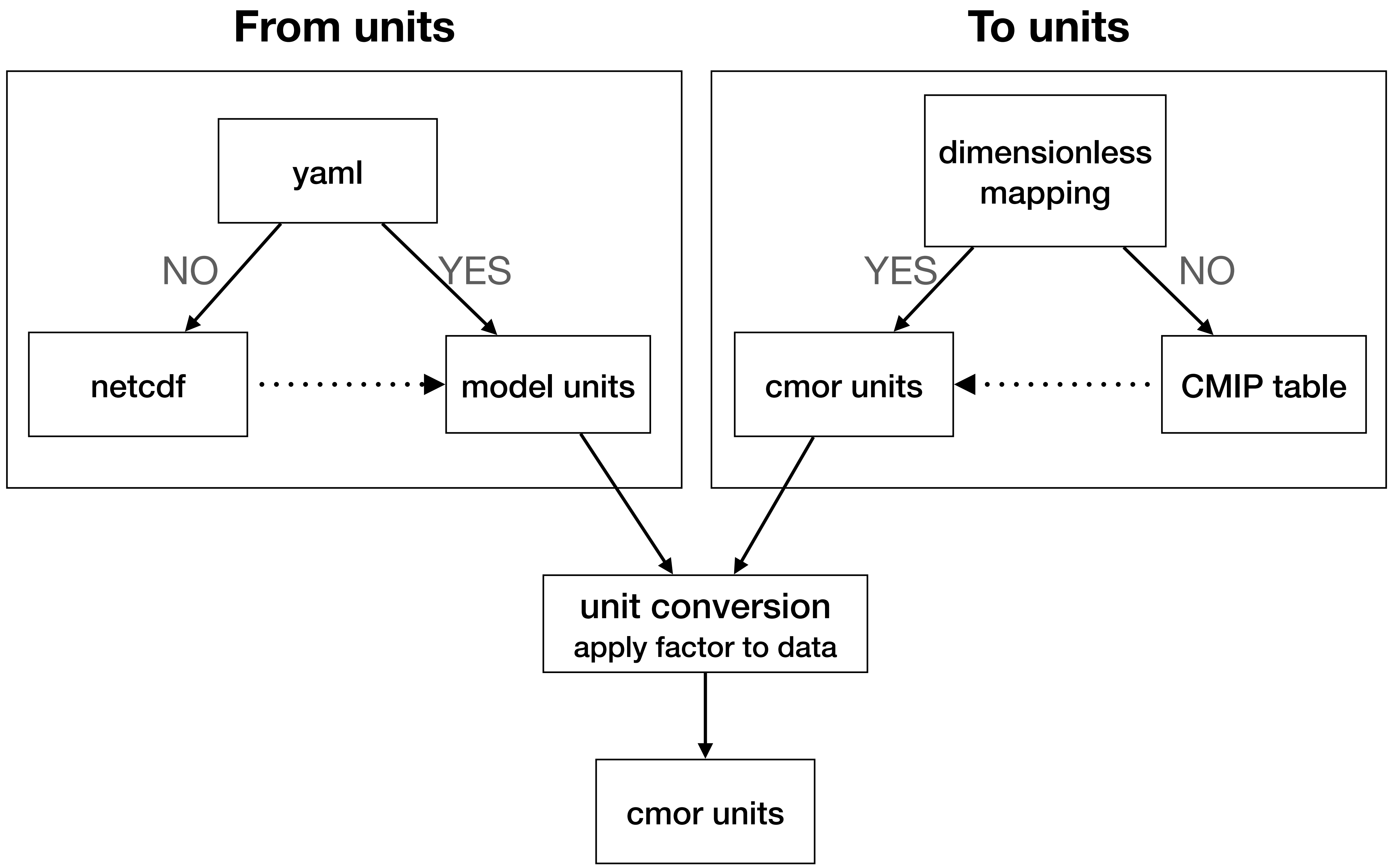
```
➜ grep -i "molC" $(ls -rtd logs/pymorize-process* | tail -n 1 )

| DEBUG    | pymor.std_lib.units:handle_chemicals:67 - Chemical element Carbon detected in units mmolC/m2/d.
| DEBUG    | pymor.std_lib.units:handle_chemicals:68 - Registering definition: molC = 12.0107 * g
```

Units - Alternate sources

- Wrong units in source netcdf files
  Provide the correct units in yaml file (`model_units`)

- Dimensionless units in `cmor_units`
  - Provide mapping for dimensionless units
  - Pymor uses the mapping for unit conversion only.
  - It always writes `cmor_units` in the output netcdf file
  - Example:

```
> cat dimensionless_mappings.yaml
# cmor_variable_name:
#   cmor_unit_string: pint_friendly_SI_units
so:
  "0.001": g/kg
sos:
  "0.001": g/kg
intpp:
  # primary (organic carbon) production by phytoplankton
  "mol m-2 s-1": "molC m-2 s-1”
```


From units
To units
yaml
NO
YES
netcdf
model units
dimensionless mapping
YES
NO
cmor units
CMIP table
unit conversion
apply factor to data
cmor units