NorESM2 user workshop 2024

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Overview

- Namelist files
- How to read xml
- Default namelist variable values

Advanced model customization: namelist files

Most of the components support setting component-specific options through Fortran namelists:

User-defined namelist options appear in a your case appear as **user_nl_<component>** in your case directory after **./case.setup** has been run.

Namelists that will be used for the model run are built on the **./case.build** and **./case.submit** steps from default values for the namelist variables and the ones assigned in **user_nl_<component>**.

You can build **just** the namelists and check what values your are setting with **./preview_namelists**

Built namelists can be found in **CaseDocs** as **<component>_in**

What's a namelist?

Fortan has a nice feature, where you can assign variables within some file or in the commandline.
Namelists use normal Fortran syntax.
In you program you can specify which exact variables you want to read from a namelist.

Namelist files structure example, atm_in:

```
&cldfrc_nl  ! this is how a namelist (group of variables) is defined
 ! below is how variables are assinged
 cldfrc_dp1                = 0.10D0
 cldfrc_dp2                = 500.0D0
 cldfrc_freeze_dry         = .true.
 cldfrc_ice                = .true.
 cldfrc_icecrit            = 0.93D0
 cldfrc_iceopt             = 4
 cldfrc_premib             = 700.0D2
 cldfrc_premit             = 75000.0D0
 cldfrc_rhminh             = 0.800D0
 cldfrc_rhminl             = 0.950D0
 cldfrc_rhminl_adj_land    = 0.000D0
 cldfrc_sh1                = 0.04D0
 cldfrc_sh2                = 500.0D0
```

This is what you will find un **atm_in** but have put thins in your **user_nl_cam**

Where to find what do these variables live?

If you really do not like to look through the code, you can look up variables that are common between CESM and NORESM here:

https://docs.cesm.ucar.edu/models/cesm2/settings/current/clm5_0_nml.html

https://docs.cesm.ucar.edu/models/cesm2/settings/current/cam_nml.html

In the source code, the definitions for namelist variables usually live in (CAM, CLM etc.):
$SRCROOT/components/<component-name>/bld/namelist_files/namelist_definition*.xml
Or (BLOM, CICE):
$SRCROOT/components/<component-name>/cime_config/namelist_definition*.xml

Namelist definitions example (cam):

```
<entry id="cldfrc_dp1" type="real" category="cldfrc"
       group="cldfrc_nl" valid_values="" >
parameter for deep convection cloud fraction.
Default: set by build-namelist
</entry>

<entry id="cldfrc_dp2" type="real" category="cldfrc"
       group="cldfrc_nl" valid_values="" >
parameter for deep convection cloud fraction.
Default: set by build-namelist
</entry>
```

Namelist files structure example, atm_in:

```
&cldfrc_nl  ! this is how a group of variables is defined
 ! below is how variables are assigned
 cldfrc_dp1                                = 0.10D0
 cldfrc_dp2                                = 500.0D0
 cldfrc_freeze_dry                         = .true.
 cldfrc_ice                                = .true.
 cldfrc_icecrit                            = 0.93D0
 cldfrc_iceopt                             = 4
 cldfrc_premib                             = 700.0D2
 cldfrc_premit                             = 75000.0D0
 cldfrc_rhminh                             = 0.800D0
 cldfrc_rhminl                             = 0.950D0
 cldfrc_rhminl_adj_land                    = 0.000D0
 cldfrc_sh1                                = 0.04D0
 cldfrc_sh2                                = 500.0D0
```

You do not have to specify the group in your **user_nl_cam**

How the model gets default values?

- Compsets
- Use cases
- Namelist defaults

COMPSETS: where do compset aliases live:

- Your noresm clone location will be referenced as $SRCROOT:
- Depending on what you are running:
- Fully coupled model:
  - **$SRCROOT/cime_config/config_comsets.xml**
- Standalone components:
  - **$SRCROOT/components/<component_name>/cime_config/config_compsets.xml**

For CMIP6 compsets, you can look there: https://noresm-docs.readthedocs.io/en/noresm2/configurations/

If you are running a compset that is not scientifically tested, use **--run-unsupported** in **./create_newcase**

Compset long names:

```
<compset>
  <alias>N1850frc2</alias>
  <lname>1850_CAM60%NORESM%FRC2_CLM50%BGC-CROP_CICE%NORESM-
CMIP6_BLOM%ECO_MOSART_SGLC_SWAV_BGC%BDRDDMS</lname>
  <science_support grid="f09_tn14"/>
  <science_support grid="f19_tn14"/>
</compset>
```

Let's look what **CAM60%NORESM%FRC2** sets things:

$SRCROOT/components/cam/cime_config/config_component.xml

```
<entry id="CAM_CONFIG_OPTS">
  <values match="last" modifier='additive'>
   <value compset="_CAM60">-phys cam6</value>
    <value compset="_CAM60%NORESM" >-chem trop_mam_oslo</value>
 </entry id="CAM_CONFIG_OPTS">

  <entry id="CAM_NML_USE_CASE">
   <value compset="1850_CAM60%NORESM%FRC2">1850_cam6_noresm_frc2</value>
  <entry id="CAM_NML_USE_CASE">
```

CAM_CONFIG_OPTS setup namelist values in **$SRCROOT/components/cam/bld/build-namelist**

CAM_NML_USE_CASE gets some default namelist values. Use case files are located in:
$SRCROOT/components/cam/bld/namelist_files/use_cases/

Namelist use cases and defaults:

In **$SRCROOT/components/cam/bld/namelist_files/use_cases/**:

If you look into **1850_cam6_noresm_frc2.xml:**
(you might notice that the xml-schema is called namelist_defaults)

```
<solar_irrad_data_file >  'atm/cam/solar/SolarForcingCMIP6piControl_c160921.nc' </solar_irrad_data_file>
<solar_data_ymd        >  18500101                                              </solar_data_ymd>
<solar_data_type       >  FIXED                                                 </solar_data_type>
```

If you look in that file, you would not find the **cldfrc_dp1**,
Where else are the values setup?
$SRCROOT/component/cam/bld/namelist_files/namelist_defaults_cam.xml

```
<cldfrc_dp1                          > 0.14D0 </cldfrc_dp1>
<cldfrc_dp1  phys="cam5"             > 0.10D0 </cldfrc_dp1>
<cldfrc_dp1  phys="cam6"             > 0.10D0 </cldfrc_dp1>
<cldfrc_dp1  dyn="fv" phys="cam4"    > 0.10D0 </cldfrc_dp1>
<cldfrc_dp1  dyn="se" phys="cam4"    > 0.10D0 </cldfrc_dp1>
```

CLM example

Search for all namelist definition files in $SRCROOT:

```
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/noresm20]$ find $SRCROOT -print -name *namelist* | grep 'namelist.*definition.*xml'
./cime_config/usermods_dirs/cmip6_noresm_keyCLIM_ism/SourceMods/src.cism/namelist_definition_cism.xml
./components/cam/bld/namelist_files/namelist_definition.xml
./components/blom/cime_config/namelist_definition_blom.xml
./components/mosart/cime_config/namelist_definition_mosart.xml
./components/cice/cime_config/namelist_definition_cice.xml
./components/clm/bld/namelist_files/namelist_definition_clm4_5.xml
./components/clm/bld/namelist_files/namelist_definition_drv.xml
./components/clm/bld/namelist_files/namelist_definition_drv_flds.xml
./components/clm/bld/namelist_files/namelist_definition_clm4_0.xml
./cime/src/drivers/mct/cime_config/namelist_definition_modelio.xml
./cime/src/drivers/mct/cime_config/namelist_definition_drv.xml.orig
./cime/src/drivers/mct/cime_config/namelist_definition_drv.xml
./cime/src/drivers/mct/cime_config/namelist_definition_drv_flds.xml
./cime/src/components/data_comps/dice/cime_config/namelist_definition_dice.xml
./cime/src/components/data_comps/drof/cime_config/namelist_definition_drof.xml
./cime/src/components/data_comps/docn/cime_config/namelist_definition_docn.xml
./cime/src/components/data_comps/dlnd/cime_config/namelist_definition_dlnd.xml
./cime/src/components/data_comps/dwav/cime_config/namelist_definition_dwav.xml
./cime/src/components/data_comps/datm/cime_config/namelist_definition_datm.xml
./cime/src/components/data_comps/desp/cime_config/namelist_definition_desp.xml
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/noresm20]$
```

CLM example

Search for anything related to landuse in the clm4.5 namelist definitions:

```
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/noresm20]$ grep landuse $SRCROOT/components/clm/bld/namelist_files/namelist_definition_clm4_5.xml
<entry id="flanduse_timeseries" type="char*256" category="datasets"
Full pathname of time varying landuse data file. This causes the land-use types of
If TRUE, apply transient natural PFTs from flanduse_timeseries file.
(Only valid for transient runs, where there is a flanduse_timeseries file.)
If TRUE, apply transient crops from flanduse_timeseries file.
(Only valid for transient runs, where there is a flanduse_timeseries file.)
If TRUE, apply harvest from flanduse_timeseries file.
(Only valid for transient runs, where there is a flanduse_timeseries file.)
If TRUE (which is the default), check consistency between pct_nat_pft on the flanduse_timeseries file
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/noresm20]$
```

CLM example

Found a **flanduse_timeseries** variable that points to a landuse file that model uses.

```
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/noresm20]$ grep landuse $SRCROOT/components/clm/bld/namelist_files/namelist_definition_clm4_5.xml
<entry id="flanduse_timeseries" type="char*256" category="datasets"
Full pathname of time varying landuse data file. This causes the land-use types of
If TRUE, apply transient natural PFTs from flanduse_timeseries file.
(Only valid for transient runs, where there is a flanduse_timeseries file.)
If TRUE, apply transient crops from flanduse_timeseries file.
(Only valid for transient runs, where there is a flanduse_timeseries file.)
If TRUE, apply harvest from flanduse_timeseries file.
(Only valid for transient runs, where there is a flanduse_timeseries file.)
If TRUE (which is the default), check consistency between pct_nat_pft on the flanduse_timeseries file
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/noresm20]$
```

CLM example

To look what the default values for this variables are: find a namelist defaults file:

```
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/noresm20]$ find $SRCROOT/components/clm/ -print -name *namelist* | grep 'namelist.*defaults.*xml'
.//components/clm/bld/namelist_files/namelist_defaults_drydep.xml
.//components/clm/bld/namelist_files/namelist_defaults_clm4_0_tools.xml
.//components/clm/bld/namelist_files/namelist_defaults_usr_files.xml
.//components/clm/bld/namelist_files/namelist_defaults_clm4_5_tools.xml
.//components/clm/bld/namelist_files/namelist_defaults_clm4_5.xml
.//components/clm/bld/namelist_files/namelist_defaults_clm4_0.xml
.//components/clm/bld/namelist_files/namelist_defaults_fire_emis.xml
.//components/clm/bld/namelist_files/namelist_defaults_overall.xml
.//components/clm/bld/namelist_files/namelist_defaults_drv.xml
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/noresm20]$
```

CLM example

You can then look at the **namelist_defaults_clm_45.xml** to find out what the default values are.
Let's go to the existing case and check what is the model using for a landuse file by default for **NSSP585** compset case in already built namelist for **lnd**:

```
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/cases/NSSP585frc2_f19_tn14_fram_release-noresm2.0.9_20241107]$ grep flanduse_timeseries ./CaseDocs/ln
d_in
 flanduse_timeseries = '/cluster/shared/noresm/inputdata/lnd/clm2/surfdata_map/release-clm5.0.18/landuse.timeseries_1.9x2.5_SSP5-8.5_78pfts_CMIP6_simyr
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/cases/NSSP585frc2_f19_tn14_fram_release-noresm2.0.9_20241107]$
echo "flanduse_timeseries = '/absolute-path-to-an-awesome-landuse-file.nc'" >> user_nl_clm
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/cases/NSSP585frc2_f19_tn14_fram_release-noresm2.0.9_20241107]$ grep flanduse ./user_nl_clm
flanduse_timeseries = '/absolute-path-to-an-awesome-landuse-file.nc'
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/cases/NSSP585frc2_f19_tn14_fram_release-noresm2.0.9_20241107]$
```

defaults. Suppose you have a landuse file that you want to add:

```
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/cases/NSSP585frc2_f19_tn14_fram_release-noresm2.0.9_20241107]$
echo "flanduse_timeseries = '/absolute-path-to-an-awesome-landuse-file.nc'" >> user_nl_clm
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/cases/NSSP585frc2_f19_tn14_fram_release-noresm2.0.9_20241107]$ grep flanduse ./user_nl_clm
flanduse_timeseries = '/absolute-path-to-an-awesome-landuse-file.nc'
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/cases/NSSP585frc2_f19_tn14_fram_release-noresm2.0.9_20241107]$
```

Now you can run **./preview_namelists** to apply those changes to **lnd_in**.
Ater running **./preview_namelists**, check if the changes are applied:

```
[mdeb@login-3.FRAM /cluster/projects/nn9600k/mdeb/cases/NSSP585frc2_f19_tn14_fram_release-noresm2.0.9_20241107]$
grep flanduse_timeseries ./CaseDocs/lnd_in
```