

How to Use WACCM-X in CESM?

Joe McInerney and Han-Li Liu

High Altitude Observatory (HAO)

National Center For Atmosphere Research (NCAR)

WACCM-X

CESM



WACCM



WACCM-X

WACCM-X capability included when downloading the CESM

Basic work flow for WACCM-X is the same as described for CESM.

CESM release has one scientifically validated WACCM-X case

WACCM-X CESM Case

WACCM-X case:

Compset – F_2000_WACCMX

Resolution – f19_f19 (lat x lon 1.9 x 2.5 atm/ln
1.9 x 2.5 ocn/ice)

Built from F_2000_WACCM - really just another WACCM case

Perpetual year 2000 atmosphere/land with prescribed ocean/
sea ice, solar maximum, quiet geomagnetic conditions

Where to specify you want this WACCM-X compset/resolution
in the CESM work flow?

Basic Work Flow

or how to set up and run an experiment

- **One-Time Setup Steps**
 - (A) Registration and Download
 - (B) Create an Input Data Root Directory
 - (C) Porting
- **Creating & Running a Case**
 - (1) Create a New Case
 - (2) Configure the Case
 - (3) Build the Executable
 - (4) Run the Model: Initial Run and Output Data Flow
 - (5) Run the Model: Continuation Run(s)

Creating the WACCM-X case (example for NCAR bluefire machine)

```
./create_newcase
```

```
-case ~/cases/mycase1
```

```
-res f19_f19
```

```
-compset F_2000_WACCMX
```

```
-mach bluefire
```

From here the process is the same as the basic work flow described for the CESM (configure, build, and run)

But what if you would like a different WACCM-X case?

- 1) Wait for later CESM releases with new WACCM-X cases
- 2) Try your hand at creating your own WACCM-X case from an existing WACCM case - pretty straightforward

Requirements for WACCM-X Case

WACCM case ➡ WACCM-X case need to:

- 1) create a WACCM case – use `create_newcase` in CESM download scripts directory
- 2) edit WACCM `env_conf.xml` file
- 3) create WACCM-X `usr_nl_cam` file
- 4) Get an appropriate WACCM-X initial conditions file

WACCM Cases

Data Ocean:

F_1850_WACCM (F1850W)

F_1955-2005_WACCM_CN (F55WCN)

F_2000_WACCM (FW)

F_2000_WACCM_SC (FWSC)

F_SD_WACCM (FSDW)

Coupled Ocean:

B_1850_WACCM_CN (B1850WCN)

B_1850-2005_WACCM_CN (B20TRWCN)

B_2000_WACCM_CN (BWCN)

B_1955-2005_WACCM_CN (B55TRWCN)

RCP future scenarios:

B_RCP2.6_WACCM_CN (BRCP26WCN)

B_RCP4.5_WACCM_CN (BRCP45WCN)

B_RCP8.5_WACCM_CN (BRCP85WCN)

WACCM cases either released or used in WACCM-X development simulations

More details in WACCM tutorial

Requirements for WACCM-X Case

WACCM case → WACCM-X case need to:

1) create a WACCM case – use `create_newcase` in CESM download scripts directory

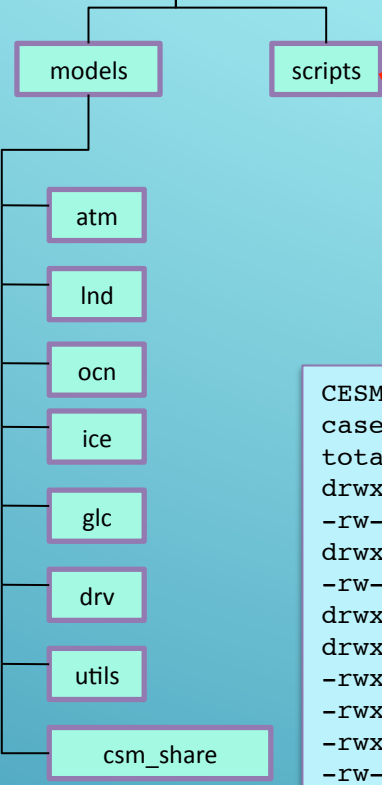
2) edit WACCM `env_conf.xml` file

3) create WACCM-X `usr_nl_cam` file

4) Get an appropriate WACCM-X initial conditions file

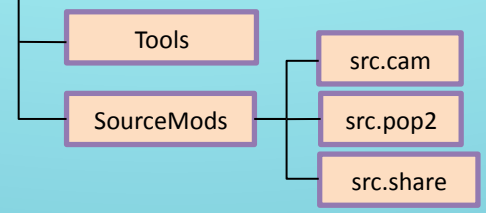
CESM Download

~/CESM1_0
\$CCSMROOT



CASE Directory

mycase1
\$CASEROOT
env_conf.xml



create_newcase

Find and edit WACCM env_conf.xml file and revise for WACCM-X

env.conf.xml file

```

CESM1_0/scripts> cd ~/cases/mycase1
cases/mycase1>ls -l
total 64
drwxr-xr-x  2 userx  ncar      8192 May 13  14:32 LockedFiles
-rw-r--r--  1 userx  ncar     10687 May 13  14:32 Macros.bluefire
drwxr-xr-x  2 userx  ncar      8192 May 13  14:32 README
-rw-r--r--  1 userx  ncar       66 May 13  14:32 README.case
drwxr-xr-x  9 userx  ncar      8192 May 13  14:32 SourceMods
drwxr-xr-x  4 userx  ncar      8192 May 13  14:32 Tools
-rwxr-xr-x  1 userx  ncar     9330 May 12  11:33 check_input_data
-rwxr-xr-x  1 userx  ncar    10092 May 12  11:33 configure
-rwxr-xr-x  1 userx  ncar     3085 May 12  11:33 create_production_test
-rw-r--r--  1 userx  ncar     4433 May 13  14:32 env_build.xml
-rw-r--r--  1 userx  ncar     5635 May 13  14:32 env_case.xml
-rw-r--r--  1 userx  ncar     7029 May 13  14:32 env_conf.xml
-rw-r--r--  1 userx  ncar     5915 May 13  14:32 env_mach_pes.xml
-rwxr-xr-x  1 userx  ncar     2199 May 13  14:32 env_mach_specific
-rw-r--r--  1 userx  ncar    10466 May 13  14:32 env_run.xml
-rwxr-xr-x  1 userx  ncar    10388 May 12  11:33 xmlchange
-rw-r--r--  1 userx  ncar         0 May 13  14:40 usr_nl_cam
  
```

Modify WACCM to WACCM-X env_conf.xml File

WACCM env_conf.xml

```
<!--"number of atm coupling intervals per NCPL_BASE_PERIOD (integer) (char) " -->
```

```
<entry id="ATM_NCPL" value="48" />
```

```
.  
. .  
. . .
```

```
<!--"CAM configure options, see CAM configure utility for details (char) " -->
```

```
<entry id="CAM_CONFIG_OPTS" value="-phys cam4 -chem waccm_mozart" />
```

WACCM-X env_conf.xml

```
<!--"number of atm coupling intervals per NCPL_BASE_PERIOD (integer) (char) " -->
```

```
<entry id="ATM_NCPL" value="288" />
```

```
.  
. .  
. . .
```

```
<!--"CAM configure options, see CAM configure utility for details (char) " -->
```

```
<entry id="CAM_CONFIG_OPTS" value="-phys cam4 -chem waccm_mozart -waccmx" />
```

Number of times atmosphere coupled to land, ocn, etc...

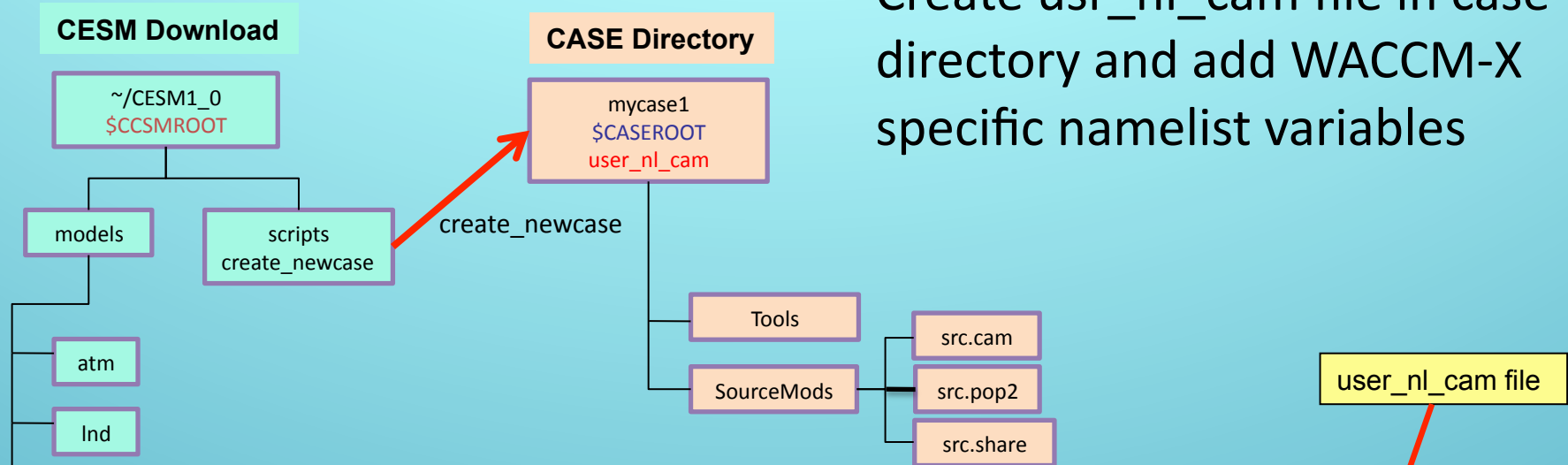
waccmx configure option

Requirements for WACCM-X Case

WACCM case → WACCM-X case need to:

- 1) create a WACCM case – use `create_newcase` in CESM download scripts directory
- 2) edit WACCM case `env_conf.xml` file
- 3) create WACCM-X `usr_nl_cam` file
- 4) Get an appropriate WACCM-X initial conditions file

Create `usr_nl_cam` file in case directory and add WACCM-X specific namelist variables



```

CESM1_0/scripts> cd ~/cases/mycase1
cases/mycase1>ls -l
total 64
drwxr-xr-x    2 userx  ncar          8192 May 13 14:32 LockedFiles
-rw-r--r--    1 userx  ncar       10687 May 13 14:32 Macros.bluefire
drwxr-xr-x    2 userx  ncar          8192 May 13 14:32 README
-rw-r--r--    1 userx  ncar         66 May 13 14:32 README.case
drwxr-xr-x    9 userx  ncar          8192 May 13 14:32 SourceMods
drwxr-xr-x    4 userx  ncar          8192 May 13 14:32 Tools
-rwxr-xr-x    1 userx  ncar       9330 May 12 11:33 check_input_data
-rwxr-xr-x    1 userx  ncar      10092 May 12 11:33 configure
-rwxr-xr-x    1 userx  ncar       3085 May 12 11:33 create_production_test
-rw-r--r--    1 userx  ncar       4433 May 13 14:32 env_build.xml
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-rw-r--r--    1 userx  ncar       5915 May 13 14:32 env_mach_pes.xml
-rwxr-xr-x    1 userx  ncar       2199 May 13 14:32 env_mach_specific
-rw-r--r--    1 userx  ncar      10466 May 13 14:32 env_run.xml
-rwxr-xr-x    1 userx  ncar      10388 May 12 11:33 xmlchange
-rw-r--r--    1 userx  ncar         0 May 13 14:40 usr_nl_cam

```

user_nl_cam file

Filling WACCM-X usr_nl_cam

usr_nl_cam is just a user specified namelist
- details in WACCM tutorial

Edit new file usr_nl_cam and modify/add namelist variables listed below which are required for WACCM-X:

```
&cam_inparm
```

```
nsplit = 6
```

```
dtime = 300
```

```
ncdata = f_2000_waccmx_cesm1_1_beta08_2001-01-16_b40.wcm.007.i.1955_01_01.nc
```

```
wacmx_opt = 'neutral'
```

```
/
```

Where do you get this WACCM-X
initial conditions file?



New WACCM-X run time
switch namelist variable



Optional namelist variables:

```
mfilt= 1,8,1, nhtfrq = 0,-3,-24
```

```
avgflag_pertape" = 'A', 'I', 'I', 'A', 'A'
```

```
solar_parms_file = 'wa_smax_quiet.nc'
```

```
fincl[1,2,3...] = 'AOA1', 'AOA2', 'BR', 'BRCL', ...
```

See WACCM tutorial



Requirements for WACCM-X Case

WACCM case → WACCM-X case need to:

- 1) create a WACCM case – use `create_newcase` in CESM download scripts directory
- 2) edit WACCM case `env_conf.xml` file
- 3) create WACCM-X `usr_nl_cam` file
- 4) Get an appropriate WACCM-X initial conditions file

WACCM-X Initial Conditions Files

CESM release includes one initial conditions file for
F_2000_WACCMX

Initial conditions files are available for the following WACCM-X
cases:

F_1955-2005_WACCMX_CN (transient data ocn/ice)

F_1996_WACCMX (perpetual solar minimum)

These files are not in the CESM release input data or download
directory

We can create a WACCM-X initial conditions file for any
WACCM case you modify

Requirements for WACCM-X Case

WACCM case → WACCM-X case need to:

1) create a WACCM case – use create_newcase in CESM download scripts directory

2) edit WACCM case env_conf.xml file

3) create WACCM-X usr_nl_cam file

4) Get an appropriate WACCM-X initial conditions file

From here the process is the same as the basic work flow described for the CESM (configure, build, and run)

WACCM-X Overview

- WACCM-X now in CESM download
- Basic work flow same for WACCM-X as for CESM
- One WACCM-X case currently available in CESM
- WACCM-X case can be created by user from any WACCM case
 - 1) Create desired WACCM case to modify for WACCM-X
 - 2) Modifications of WACCM env_conf.xml for WACCM-X
 - 3) Creation of usr_nl_cam user namelist file for WACCM-X
 - 4) Unique initial conditions file required for each WACCM case
- For 4) some WACCM-X initial conditions files currently available
- For any created WACCM-X case, a WACCM-X initial conditions file can be supplied – email joemci@ucar.edu
- For problems or questions go to the CESM Bulletin Board
 - <http://bb.cgd.ucar.edu/>