

Overview

Control

Run a control case: CAM6, data ocean, climatological forcings from around year 2000. Run for 5 days only, with 3-hourly instantaneous output of a few fields so we can see what is changing

Exercises

Then choose one or more exercises to try:

- 1a. Use historical SSTs/forcings instead of fixed (*compset change*)
- 1b Try running starting 1850 with spun-up pre-industrial model (*compset change*)
- 2a. Increase orographic height over the western US (*dataset change*)
- 2b. Modify sea surface temperature in the tropics (*dataset change*)
- 3. Increase the triggering threshold for deep convection over land (*code change--simple*)
- 4. Add a (fake) physics parameterization (*code change--advanced*)

Compare your test exercise to your control

Solutions to the exercises

My own recommendation:

DON'T LOOK AT THE SOLUTIONS DURING THE LAB !!!

Exercise 0: Control

Run a control case: CAM6, data ocean, climatological forcings from around year 2000. Run for 5 days only, with 3-hourly instantaneous output of a few fields so we can see what is changing

Solution to exercise 0

set variables

```
set CASENAME = f2000
set CASEDIR = /glade/u/home/$USER/cases/$CASENAME
set RUNDIR = /glade/scratch/$USER/$CASENAME/run
set COMPSET = F2000climo
set RESOLUTION = f19_f19_mg17
```

create new case

```
cd /glade/p/cesm/tutorial/cesm2.1_tutorial2022/cime/scripts/
./create_newcase --case $CASEDIR --res $RESOLUTION --compset $COMPSET --run-unsupported --project
UESM0011
```

setup

```
cd $CASEDIR
./xmlchange JOB_QUEUE=regular,PROJECT=UESM0011 # if needed after 5pm
./case.setup
./preview_namelists
```

user_nl_cam

```
echo "NHTFRQ(2) = -3">> user_nl_cam
echo "MFILT(2) = 240">> user_nl_cam
echo "FINCL2 = 'TS:I','PS:I', 'U850:I','T850:I','PRECT:I','LHFLX:I','SHFLX:I','FLNT:I','FLNS:I'">> user_nl_cam
echo "">> user_nl_cam
```

compile

```
qcmd -A UESM0011 -- ./case.build
```

submit job

```
./case.submit
```

Exercise 1a

Create, configure, build and run a case called `fhist` with the compset `FHIST` at the resolution `f09_f09_mg17` using the same history file output as in the control.

- How can you check that there is a difference between the set up of this and your control?
- How can you check that it is running the way you intended: using ssts & ghg forcings from time-varying, historical files?
- What year is the model running?

Solution to exercise 1a

set variables

```
set CASENAME = fhist
set CASEDIR = /glade/u/home/$USER/cases/$CASENAME
set RUNDIR = /glade/scratch/$USER/$CASENAME/run
set COMPSET = FHIST
set RESOLUTION = f19_f19_mg17
```

create new case

```
cd /glade/p/cesm/tutorial/cesm2.1_tutorial2022/cime/scripts/
./create_newcase --case $CASEDIR --res $RESOLUTION --compset $COMPSET --run-unsupported --project
UESM0011
```

setup

```
cd $CASEDIR
./xmlchange JOB_QUEUE=regular,PROJECT=UESM0011 # if needed after 5pm
./case.setup
./preview_namelists
```

user_nl_cam

```
echo "NHTFRQ(2) = -3">> user_nl_cam
echo "MFILT(2) = 240">> user_nl_cam
echo "FINCL2 = 'TS:I','PS:I','U850:I','T850:I','PRECT:I','LHFLX:I','SHFLX:I','FLNT:I','FLNS:I'">> user_nl_cam
echo "">> user_nl_cam
```

compile

```
qcmd -A UESM0011 -- ./case.build
```

submit job

```
./case.submit
```

Exercise 1b

Create, configure, build and run a case called `fhist` with the compset `FHIST` at the resolution `f09_f09_mg17` using the same history file output as in the control. Start model in 1850.

- How can you check that there is a difference between the set up of this and your control?
- How can you check that it is running the way you intended: using ssts & ghg forcings from time-varying, historical files?
- What year is the model running?

Solution to exercise 1a

set variables

```
set CASENAME = fhist.1850
set CASEDIR = /glade/u/home/$USER/cases/$CASENAME
set RUNDIR = /glade/scratch/$USER/$CASENAME/run
set COMPSET = FHIST
set RESOLUTION = f19_f19_mg17
```

create new case

```
cd /glade/p/cesm/tutorial/cesm2.1_tutorial2022/cime/scripts/
./create_newcase --case $CASEDIR --res $RESOLUTION --compset $COMPSET --run-unsupported --project
UESM0011
```

setup

```
cd $CASEDIR
./xmlchange JOB_QUEUE=regular,PROJECT=UESM0011 # if needed after 5pm
./case.setup
./preview_namelists
```

user_nl_cam

```
echo "NHTFRQ(2) = -3">> user_nl_cam
echo "MFILT(2) = 240">> user_nl_cam
echo "FINCL2 = 'TS:I','PS:I','U850:I','T850:I','PRECT:I','LHFLX:I','SHFLX:I','FLNT:I','FLNS:I'">> user_nl_cam
echo "">> user_nl_cam
```

change starting date and ref case

```
./xmlchange RUN_STARTDATE=1850-01-01
./xmlchange RUN_REFCASE=b.e21.B1850.f19_g17.CMIP6-piControl-2deg.001
./xmlchange RUN_REFDATE=0321-01-01
```

compile

```
qcmd -A UESM0011 -- ./case.build
```

submit job

```
./case.submit
```

Exercise 2a

Create a case similar to control case but change input boundary datasets by increasing surface geopotential height by 50% in the western USA

Solution to exercise 2a

set variables

```
set CASENAME = f2000.oro
set CASEDIR = /glade/u/home/$USER/cases/$CASENAME
set RUNDIR = /glade/scratch/$USER/$CASENAME/run
set COMPSET = F2000climo
set RESOLUTION = f19_f19_mg17
```

create new case

```
cd /glade/p/cesm/tutorial/cesm2.1_tutorial2022/cime/scripts/
./create_newcase --case $CASEDIR --res $RESOLUTION --compset $COMPSET --run-unsupported --project
UESM0011
```

setup

```
cd $CASEDIR
./xmlchange JOB_QUEUE=regular,PROJECT=UESM0011 # if needed after 5pm
./case.setup
./preview_namelists
```

modify orography

```
cp \
/glade/p/cesmdata/cseg/inputdata/atm/cam/topo/fv_1.9x2.5_nc3000_Nsw084_Nrs016_Co120_Fi001_
ZR_GRNL_031819.nc .

ncap2 -O -s 'lat2d[lat,lon]=lat ; lon2d[lat,lon]=lon' \
-s 'omask=(lat2d >= 30. && lat2d <= 50.) && (lon2d >= 235. && lon2d <= 260.)' \
-s 'PHIS=(PHIS*(1.+omask*0.5))' \
fv_1.9x2.5_nc3000_Nsw084_Nrs016_Co120_Fi001_ZR_GRNL_031819.nc \
fv_1.9x2.5_nc3000_Nsw084_Nrs016_Co120_Fi001_ZR_GRNL_031819.oro50.nc
```

user_nl_cam

```
echo "NHTFRQ(2) = -3">> user_nl_cam
echo "MFILT(2) = 240">> user_nl_cam
echo "FINCL2 = 'TS:I','PS:I','U850:I','T850:I','PRECT:I','LHFLX:I','SHFLX:I','FLNT:I','FLNS:I'">> user_nl_cam
echo "bnd_topo =
'$CASEDIR/fv_1.9x2.5_nc3000_Nsw084_Nrs016_Co120_Fi001_ZR_GRNL_031819.oro50.nc' ">>
user_nl_cam
echo "">> user_nl_cam
```

compile

```
qcmd -A UESM0011 -- ./case.build
```

submit job
./case.submit

Exercise 2b

Create a case similar to control case but change input boundary datasets by increasing surface geopotential height by 50% in the western USA

Solution to exercise 2a

set variables

```
set CASENAME = f2000.sst
set CASEDIR = /glade/u/home/$USER/cases/$CASENAME
set RUNDIR = /glade/scratch/$USER/$CASENAME/run
set COMPSET = F2000climo
set RESOLUTION = f19_f19_mg17
```

create new case

```
cd /glade/p/cesm/tutorial/cesm2.1_tutorial2022/cime/scripts/
./create_newcase --case $CASEDIR --res $RESOLUTION --compset $COMPSET --run-unsupported --project
UESM0011
```

setup

```
cd $CASEDIR
./xmlchange JOB_QUEUE=regular,PROJECT=UESM0011 # if needed after 5pm
./case.setup
./preview_namelists
```

modify sst file

```
cp /glade/p/cesmdata/cseg/inputdata/atm/cam/sst/sst_HadOIBI_bc_1.9x2.5_2000climo_c180511.nc .
```

```
ncap2 -O -s 'lat2d[lat,lon]=lat ; lon2d[lat,lon]=lon' \
-s 'omask=(lat2d >= -10. && lat2d <= 10.) && (lon2d >= 180. && lon2d <= 240.)' \
-s 'SST_cpl=(SST_cpl+omask*2.)' \
sst_HadOIBI_bc_1.9x2.5_2000climo_c180511.nc \
sst_HadOIBI_bc_1.9x2.5_2000climo_c180511.nc.warmtcp.nc
```

```
./xmlchange \
SSTICE_DATA_FILENAME="$CASEDIR/sst_HadOIBI_bc_1.9x2.5_2000climo_c180511.nc.warmtcp.nc"
```

user_nl_cam

```
echo "NHTFRQ(2) = -3">> user_nl_cam
echo "MFILT(2) = 240">> user_nl_cam
echo "FINCL2 = 'TS:I','PS:I','U850:I','T850:I','PRECT:I','LHFLX:I','SHFLX:I','FLNT:I','FLNS:I'">> user_nl_cam
echo "">> user_nl_cam
```

compile

```
qcmd -A UESM0011 -- ./case.build
```

submit job
./case.submit

Exercise 3

Create a case similar to control case. Add code change to examine the mean effects of delaying the initiation of convection by increasing the minimum required convective available potential energy (CAPE) to initiate convection over land;

Solution to exercise 3

set variables

```
set CASENAME = f2000.cape
set CASEDIR = /glade/u/home/$USER/cases/$CASENAME
set RUNDIR = /glade/scratch/$USER/$CASENAME/run
set COMPSET = F2000climo
set RESOLUTION = f19_f19_mg17
```

create new case

```
cd /glade/p/cesm/tutorial/cesm2.1_tutorial2022/cime/scripts/
./create_newcase --case $CASEDIR --res $RESOLUTION --compset $COMPSET --run-unsupported --project
UESM0011
```

setup

```
cd $CASEDIR
./xmlchange JOB_QUEUE=regular,PROJECT=UESM0011 # if needed after 5pm
./case.setup
./preview_namelists
```

user_nl_cam

```
echo "NHTFRQ(2) = -3">> user_nl_cam
echo "MFILT(2) = 240">> user_nl_cam
echo "FINCL2 = 'TS:I','PS:I','U850:I','T850:I','PRECT:I','LHFLX:I','SHFLX:I','FLNT:I','FLNS:I'">> user_nl_cam
echo "">> user_nl_cam
```

modify code: copy and modify zm_conv.F90

```
cp /glade/p/cesm/tutorial/cesm2.1_tutorial2022/components/cam/src/physics/cam/zm_conv.F90 \
SourceMods/src.cam
```

Edit SourceMods/src.cam/zm_conv.F90 to include your mods

Change the following section of code in sub-routine zm_convr

```
    if (cape(i) > capelmt) then
        lengath = lengath + 1
        ideep(lengath) = i
    end if
```

To

```
    if (landfrac(i) > 0.5_r8) then
        capelmt_mask = 10._r8*capelmt
    else
        capelmt_mask = capelmt
```

```
end if
if (cape(i) > capelmt_mask) then
    lengath = lengath + 1
    ideep(lengath) = i
end if
write(iulog, *) 'HELLO WORLD'
```

Near the top of subroutine zm_conv, right after:

```
real(r8) pblt(pcols)
Add real(r8) :: capelmt_mask
```

compile

```
qcmd -A UESM0011 -- ./case.build
```

submit job

```
./case.submit
```

Exercise 4

Add a fake parameterization. Please follow guidance from the slides.