The Community Land Model tutorial session

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CLM4.0 and CLM4.5 Offline – "I" compsets

Compsets are shortcuts designed for specific cases… treat them as starting points for all cases

"I" compsets run the clm/datm and no ice/ocean/atm models

Short Name	Description
I	CLM4SP, Qian atm, 2000 pfts, CO_2, $aerosol_{dep}$
I1850CLM45	CLM45SP, Qian atm, 1850 pfts, CO_2, $aerosol_{dep}$
I4804CLM45	CLM45SP, Qian 1948-2004 atm, 2000 pfts, CO_2, $aerosol_{dep}$
I20TRCRUCLM45BGC	CLM45BGC, CRU 1901-2010 atm, 1850-2005 pfts, $aerosol_{dep}$ + N_{dep}

SP = Satellite Phenology; BGC = Biogeochemistry

Atmospheric forcing for these compsets are either from Qian et al. (2006) which is bias corrected reanalysis and observed data for 1948-2004, or CRUNCNEP (Viovy 2011) for 1901-2010 .

In exercise A, you will try the I1850CLM45 compset

In exercise B, you will try the I20TRCRUCLM45BGC compset

In exercise C, you will again use the I1850CLM45 compset and modify input data

Exercise A. Basic CLM4 usage

Goal: Run the CLM45SP at ~1° lat/lon horizontal resolution for five days using Qian atm data

In this exercise you will try the I1850CLM45 compset.

Exercise B. Differences between compsets

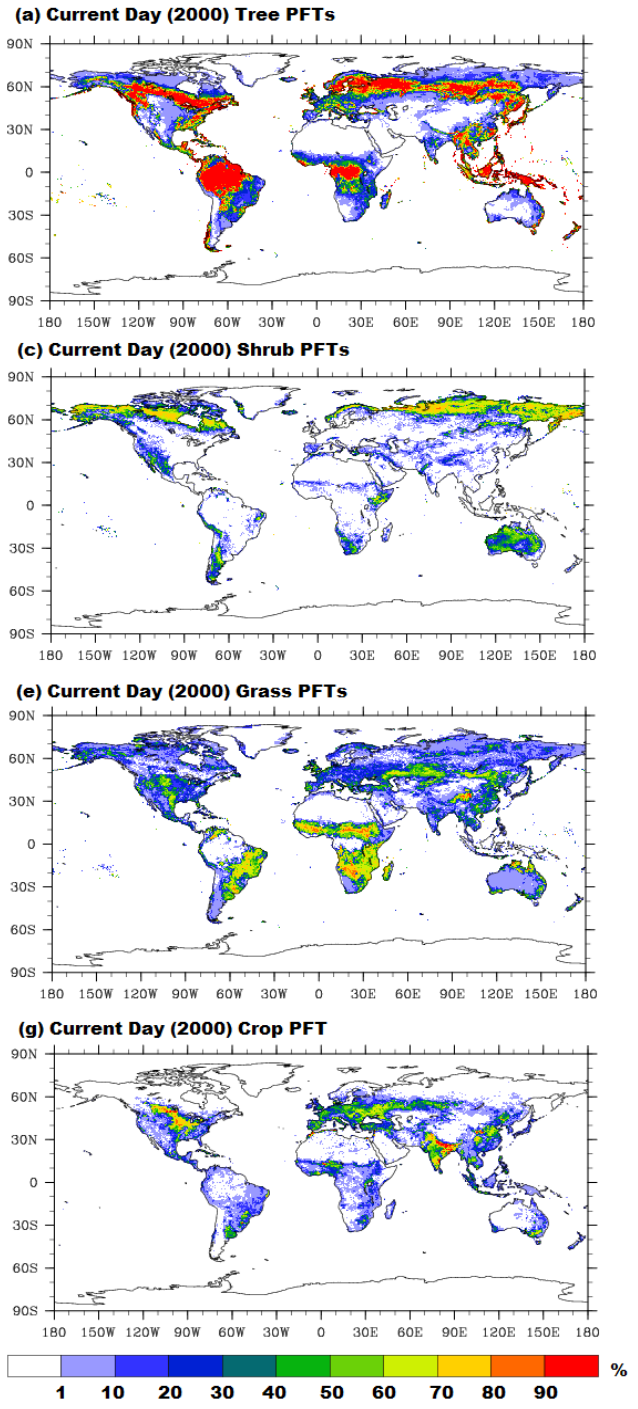
Goal: Create a case with a different compset and see how settings change automatically for you. Contrast the history files from exercise (A) and (B).

In this exercise you will try the I20TRCRUCLM45BGC compset which is a 20th century transient run using CRUNCEP atmospheric forcing and the biogeochemistry model.

Exercise C. Understanding and modifying input data

Goal: Learn what inputs CLM needs and what they look like

Here we will again use the I1850CLM45 compset, modify one of the plant functional type properties, and compare results to exercise A.



Exercise A. detailed steps

1) Create the case…

```
cd /glade/p/cesm/tutorial/cesm1_2_2.tutorial/scripts
./create_newcase -case  ~/cases/i.day5.a  -compset I1850CLM45 -res f09_g16 -mach yellowstone

#./create_newcase  -help                                          …for documentation
#./create_newcase  -list compsets (OR) grids (OR) machines       …for available options
```

2) Setup the case…

```
cd ~/cases/i.day5.a
# You need not change env_build.xml for this case to work, but now would be the time to make
      such changes
# Execute setup
./cesm_setup
```

Exercise A. detailed steps

3) Change the clm namelist…

#Since we are running just five days and history output default is monthly averages, we will change the clm namelist to get daily average output

#Add hist_nhtfrq and set to -24 (i.e., 24 hrs, daily average) in the clm namelist

$EDITOR user_nl_clm

#Add this line:

hist_nhtfrq = -24

4) Build the case and compile the code…

./i.day.a.build

Exercise A. detailed steps

5) Submit the run…

```
./i.day5.a.submit
# to see the $jobID and whether the job is pending or running
bjobs
# to kill the job if necessary
bkill $jobID
# run executes in /glade/scratch/$USER/i.day5.a/run
# land history output at the end of the run will be moved to
# /glade/scratch/$USER/archive/i.day5.a/lnd/hist

# look at the history file in this directory, e.g., using ncview (module load ncview) \
# ncview  i.day5.a.clm2.h0.0001-01-01-00000.nc
# note that there will be six time samples in this file, ignore the first one, it is an initialization step
      and is not a daily average
```

Exercise B. detailed steps

1) Create the case…

```
cd /glade/p/cesm/tutorial/cesm1_2_2.tutorial/scripts
./create_newcase  -case  ~/cases/i.day5.b  -compset I20TRCRUCLM45BGC –res f09_g16 -mach
    yellowstone
```

2) Note differences between this case and the case created in (A)

```
cd ~/cases
#For example,
diff  i.day5.a/env_case.xml  i.day5.b/env_case.xml
diff  i.day5.a/env_run.xml  i.day5.b/env_run.xml
```

3) Setup the case…

```
cd ~/cases/i.day5.b
#Execute setup
./cesm_setup
```

Exercise B. detailed steps

4) Change the clm namelist…

#Since we are running just five days and history output default is monthly averages, we will change the clm namelist to get daily average output

#Add hist_nhtfrq and set to -24 (i.e., 24 hrs) in the clm namelist

$EDITOR user_nl_clm

#Add this line:

hist_nhtfrq = -24

5) Build the case and compile the code…

./i.day5.b.build

6) Now compare the CaseDocs directories in i.day5.b and i.day5.a (in particular you could compare lnd_in and datm_atm_in) and note the differences, e.g.,

diff CaseDocs/lnd_in ../i.day5.a/CaseDocs/lnd_in

Exercise B. detailed steps

7) Submit the run…

./i.day5.b.submit

8) Compare the history files from these two runs (e.g., side by side using "ncview"). Note the extra variables in the file produced from exercise B (biogeochemistry variables). Other specific fields to compare (leaf and stem area index [TLAI, TSAI], transpiration and canopy evaporation [FCTR, FCEV, FGEV). What do you think negative values of FCEV and FGEV mean?

Exercise C. detailed steps

1) Look at lnd_in in the exercise (A) case for the list of input files read in by the CLM

Go to the directories containing these files and examine the data with, e.g., ncdump, ncview

In particular, look at the pft physiology file specified by the "fpftcon" namelist item (and look at variable rholvis).

2) Create a case like the one in (A) but with a different case name (i.e., i.day5.a_pft), e.g.,

```
./create_clone   -case  ~/cases/i.day5.a_pft  -clone  ~/cases/i.day5.a
```

3) Modify a parameter in the pft-physiology file.

Use nco or ncl to modify the pft-physiology file. Change the visible leaf reflectance (variable rholvis) for pft #7 (tropical broadleaf evergreen tree).

First, make a copy of the file, e.g., in your scratch directory

```
cd /glade/scratch/$USER
cp /glade/p/cesmdata/cseg/inputdata/lnd/clm2/pftdata/pft-physiology.c130503.nc  ./
chmod u+w pft-physiology.c130503.nc
```

Exercise C. detailed steps

You can use either of a couple of ways to change the file:

E.g., could use ncap2 (module load nco):

```
mv  pft-physiology.c130503.nc pft-physiology.c130503.nc.new
ncap2 -v -s  'rholvis(6)=0.4' pft-physiology.c130503.nc.new pft-physiology.c130503.nc
ncks -A pft-physiology.c130503.nc pft-physiology.c130503.nc.new
```

E.g., could use NCL (module load ncl):

Save the following ncl script to filename.ncl and type ncl filename.ncl:

```
begin
        a = addfile("pft-physiology.c130503.nc","w")
        rholvis = a->rholvis
        rholvis(6) = 0.4d
        a->rholvis = rholvis
end
```

Rename file:

```
mv pft-physiology.c130503.nc pft-physiology.c130503.nc.new
```

Exercise C. detailed steps

4) Follow exercise A to setup model (./cesm_setup) for i.day5.a_pft, change the clm namelist to point to new pft-physiology file (using user_nl_clm), then build and run.

Compare history output against that generated in (A), e.g., use ncdiff. What differences do you see? Specific fields to compare (FSRVD, FSRVI, FSR, FSA, FSH, FCTR, TV, TSA).

Namelist lnd_in from exercise A (which can be found in CaseDocs and your run directory)

```
&clm_inparm
 albice = 0.60,0.40
 co2_ppmv = 284.7
 co2_type = 'constant'
 create_crop_landunit = .false.
 dtime = 1800
 fatmlndfrc = '/glade/p/cesmdata/cseg/inputdata/share/domains/domain.lnd.fv0.9x1.25_gx1v6.090309.nc'
 finidat = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/initdata_map/clmi.I1850CRUCLM45SP.0521-01-01.0.9x1.25_g1v6_simyr1850_c130506.nc'
 fpftcon = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/pftdata/pft-physiology.c130503.nc'
 fsnowaging = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/snicardata/snicar_drdt_bst_fit_60_c070416.nc'
 fsnowoptics = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/snicardata/snicar_optics_5bnd_c090915.nc'
 fsurdat = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/surfdata_map/surfdata_0.9x1.25_simyr1850_c130415.nc'
 hist_nhtfrq = -24
 maxpatch_glcmec = 0
 more_vertlayers = .false.
 nsegspc = 20
 urban_hac = 'ON'
 urban_traffic = .false.
/
&ndepdyn_nml
/
&popd_streams
/
&light_streams
/
&clm_hydrology1_inparm
/
&clm_soilhydrology_inparm
/
```

Namelist lnd_in from exercise B

```
&clm_inparm
 albice = 0.60,0.40
 co2_type = 'diagnostic'
 create_crop_landunit = .false.
 dtime = 1800
 fatmlndfrc = '/glade/p/cesmdata/cseg/inputdata/share/domains/domain.lnd.fv0.9x1.25_gx1v6.090309.nc'
 finidat = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/initdata_map/clmi.I1850CRUCLM45BGC.0241-01-01.0.9x1.25_g1v6_simyr1850_c130531.nc'
 fpftcon = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/pftdata/pft-physiology.c130503.nc'
 fpftdyn = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/surfdata_map/surfdata.pftdyn_0.9x1.25_rcp8.5_simyr1850-2100_c130415.nc'
 fsnowaging = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/snicardata/snicar_drdt_bst_fit_60_c070416.nc'
 fsnowoptics = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/snicardata/snicar_optics_5bnd_c090915.nc'
 fsurdat = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/surfdata_map/surfdata_0.9x1.25_simyr1850_c130415.nc'
 hist_nhtfrq = -24
 maxpatch_glcmec = 0
 more_vertlayers = .false.
 nsegspc = 20
 spinup_state = 0
 urban_hac = 'ON'
 urban_traffic = .false.
/
&ndepdyn_nml
 model_year_align_ndep = 1850
 ndepmapalgo = 'bilinear'
 stream_fldfilename_ndep = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/ndepdata/fndep_clm_hist_simyr1849-2006_1.9x2.5_c100428.nc'
 stream_year_first_ndep = 1850
 stream_year_last_ndep = 2005
/
&popd_streams
 model_year_align_popdens = 1850
 popdensmapalgo = 'bilinear'
 stream_fldfilename_popdens = '/glade/p/cesmdata/cseg/inputdata/lnd/clm2/firedata/clmforc.Li_2012_hdm_0.5x0.5_AVHRR_simyr1850-
2010_c130401.nc'
 stream_year_first_popdens = 1850
 stream_year_last_popdens = 2010
/
&light_streams
 lightngmapalgo = 'bilinear'
 stream_fldfilename_lightng = '/glade/p/cesmdata/cseg/inputdata/atm/datm7/NASA_LIS/clmforc.Li_2012_climo1995-2011.T62.lnfm_c130327.nc'
 stream_year_first_lightng = 0001
 stream_year_last_lightng = 0001
ETC….
```