## b.day4.001

set case=b.day4.001

## Create new case

cd /glade/p/cesm/tutorial/cesm1_2_2.tutorial/scripts
./create_newcase -case ~/cases/${case} -res T31_gx3v7 -mach yellowstone -compset B_1850_CN

## Invoke cesm_setup

cd ~/cases/${case}
./cesm_setup

# edit user_nl_cam and add the variables

fincl2='T:I','Q:I','U:I','V:I'
fincl3='T:A','Q:A','U:A','V:A'
nhtfrq=0,-3,-24
mfilt=1,8,1

# Change length of the run

./xmlchange STOP_OPTION=nmonths
./xmlchange STOP_N=1

## Build an submit the job

./${case}.build
./${case}.submit

## Look at the output

cd /glade/scratch/$USER/archive/$case
There should be:
b.day4.001.cam.h0.0001-01.nc
b.day4.001.cam.h1.0001-01-01-00000.nc
...
b.day4.001.cam.h1.0001-02-01-00000.nc
b.day4.001.cam.h2.0001-01-01-00000.nc
...
b.day4.001.cam.h2.0001-02-01-00000.nc

You can use ncdump/ncview to look at the files

Differences between the files:
h0 => monthly mean
h1 => instantaneous values
h2 => daily means

Look at the differences between the attribute in h1 and h2.

h2 attribute: cell_methods = "time: mean" which means it is mean
h1: there is no cell methods attribute which means it is instantaneous
## b.day4.002

set case=b.day4.002

## Create new case

cd /glade/p/cesm/tutorial/cesm1_2_2.tutorial/scripts
./create_newcase -case ~/cases/${case} -res T31_gx3v7 -mach yellowstone -compset B_1850_CN

## Invoke cesm_setup

cd ~/cases/${case}
./cesm_setup

## Locate the subroutine containing zlnd and copy it into SourceMods/src.clm/

cp /glade/p/cesm/tutorial/cesm1_2_2.tutorial/models/Ind/clm/src/clm4_0/main/clm_varcon.F90 SourceMods/src.clm/

## Make your source modifications.

Edit SourceMods/src.clm/clm_varcon.F90
Change zlnd from 0.01_r8 to 0.02_r8
In the code:
real(r8) :: zlnd = 0.02_r8 !Roughness length for soil [m]

## set the length of the run to 1 month

/xmlchange STOP_OPTION=nmonths
/xmlchange STOP_N=1

## Build and submit

./${case}.build
./${case}.submit

## Tools to look at output

Output is in: /glade/scratch/$USER/archive/$case

Use ncdiff to look at the difference between the 2 runs.
ncdiff /glade/scratch/$USER/archive/b.day4.002/lnd/hist/b.day4.002.clm2.h0.0001-01.nc /glade/scratch/$USER/archive/b.day4.001/lnd/hist/b.day4.001.clm2.h0.0001-01.nc  diff.nc

Look at snow cover with ncview
ncview diff.nc
## b.day4.003

set case=b.day4.003

### create new case

cd /glade/p/cesm/tutorial/cesm1_2_2.tutorial/scripts
./create_newcase -case ~/cases/${case} -res T31_gx3v7 -mach yellowstone -compset B_1850_CN

### Invoke cesm_setup

cd ~/cases/${case}
./cesm_setup

### locate the subroutine where you can add T750 and copy it into SourceMods/src.cam/

cp /glade/p/cesm/tutorial/cesm1_2_2.tutorial/models/atm/src/physics/cam/cam_diagnostics.F90 SourceMods/src.cam/

### Make your source modifications.

Edit `SourceMods/src.cam/cam_diagnostics.F90` add code to output T750 (use T850 as a clue). Basically you need to:

- add the field T750 to the history files
  
  add the line (around line 236):
  
  `call addfld('T750  ', 'K       ', 1,   'A', 'Temperature at 850 mbar pressure surface', phys_decomp)`

- interpolate on 750mb level
  
  add the following lines (around line 1002)
  
  `if (hist_fld_active('T750')) then
      call vertinterp(ncol, pcols, state%pmid, 75000._r8, state%t, p_surf)
   end if`

- output the field T750
  
  add the following an outfld call just after the interpolation (previous step)
  
  `if (hist_fld_active('T750')) then
      call vertinterp(ncol, pcols, pver, state%pmid, 75000._r8, state%t, p_surf)
      call outfld('T750  ', p_surf, pcols, lchnk )
   end if`

### edit user_nl_cam and add the variable T750

`fincl2='T750', 'T500'`

`nhtfrq = 0,-24`

### set the length of the run to 1 month

`./xmlchange STOP_OPTION=nmonths`

`./xmlchange STOP_N=1`

### Build and submit

`./${case}.build`

`./${case}.submit`

### Look at output

When the run is completed, look at the output. Output is in: `/glade/scratch/$USER/archive/${case}`

Check the CAM history output
- check the field T750 and T500 are in the file h1
- create a file with the difference between T750-T500

For instance, you can use:

`ncap2 -s 'T750_minus_T500=T750-T500' b.day4.003.cam.h1.0001-01-01-0000.nc T750-T500.nc`

Look at the difference with ncvview.