

# Changing Output: Frequency, Species and Regions

The history files (those that contain model output) can be defined in the `user_nl_cam` file under the `finclX` namelist variable, where X may be 1, 2, 3 etc. up to 9. Each '`finclX`' will tell the model to write a new file that includes the specified variables. Recommended procedure is to keep `fincl1` as the default, because this tells the model to write out month average values of all species that are needed for the automated diagnostics. Therefore, best practice is to write your own history files beginning with `fincl2` onwards.

## Example:

Adding the following species to `user_nl_cam` will write out files with a h1 suffix.

```
&cam_history_nl
fincl2           =
'PS', 'OH', 'H2O', 'H2O2', 'HO2', 'O3', 'NO3', 'NO', 'NO2', 'CO', 'ISOP', 'PHIS', 'CH2O', 'T', 'PAN', 'P
M25', 'PDELDRY', 'AODDUST', 'AODVISdn', 'Z3'
```

The temporal resolution of the output files is also specified via the `user_nl_cam`:

```
avgflag_pertape = 'A','A'
mfilt           = 1,4
nhtfrq         = 0,-6
/
```



### Tip for New Users:

A list of all possible history file variables can be found here: [https://www.cesm.ucar.edu/models/cesm2/atmosphere/docs/ug6/hist\\_flds\\_fv\\_cam4\\_waccm.html](https://www.cesm.ucar.edu/models/cesm2/atmosphere/docs/ug6/hist_flds_fv_cam4_waccm.html)

Where columns correspond to `finclX` in order. The namelist variables define:

`avgflag_pertape` = either averages (A) or instantaneous (I) output.

`mfilt` = number of time entries in a history file.

`nhtfrq` = time resolution in a file with <0 specifying hours. For example -6 specifies output every 6 hours. The default is to have `fincl1` (h0) output to have monthly means, but that is not a requirement, and any output file can have monthly means (the namelist variable definition saying only the first file can have monthly means is incorrect).

Therefore, the above example outputs month average at one month per file and 6-hour averages at 1 file per day.

Output files can also be defined to save output only within user-defined region. This is done by using the `fincl*lonlat` namelist variable, with a corresponding `fincl*` list in the `user_nl_cam` file, as shown below.

```
fincl3           = 'O3', 'O3S', 'NO', 'NO2', 'CO', 'E90', 'T', 'U', 'V', 'Z3', 'PSL', 'PS', 'TS',
'O3_Prod', 'O3_Loss'
fincl3lonlat     = '70e:110e_20n:40n'
```

Where this defines the model output for the species shown to be written out for just the region bounded by a box with the corners at 70E, 20N and 110E, 40N. All other flags such as `avgflag_pertape`, `nhtfreq`, and `mfilt` apply to this file as defined above.

If you wanted to save a region with a west longitude, for example CONUS, the region would be defined in 0 to 360 longitude (e.g. CONUS = 250e:290e\_25n:49n).

Note, if your simulation ends within a month, the partial monthly average is stored in the `$CASENAME.cam.rh0.*` file, so you can continue the simulation from that date and get the monthly average when the simulation completes that month.

## Saving output along aircraft or satellite tracks

It is possible to save output along a time-varying track to match aircraft or satellite observations using the 'sathist' namelist variables. The user must create a netcdf file with the time, latitude and longitude of the desired track and the model profile is saved for the closest locations for the closest timestep (s). If sathist\_ntimestep and sathist\_nclosest are set to 1 only the closest profile in time and space will be saved. If values greater than 1 are used, the user can interpolate the output to the actual observation location. As many variables as desired can be specified in the 'fincl'; when the file gets too large, a new file will be automatically started. NOTE: the aircraft output file is NOT automatically copied to your 'archive' directory at the completion of the run.

```
sathist_track_infile = '/glade/p/acom/MUSICA/flight_tracks/aircraft_profilelist_20180724_20190905_wecan-  
firexaq_togamrg_c20210316.nc'  
sathist_ntimestep = 2  
sathist_nclosest = 4  
sathist_hfilename_spec = '%c.cam.aircraft_togamrg_4closest2tstep.%y-%m-%d-%s.nc'  
sathist_fincl = 'PS', 'PMID', 'Z3', 'M_dens', 'T', 'U', 'V', 'Q', 'H2O', 'RELHUM',  
                'O3', 'O3S', 'NO', 'NO2', 'CO', 'O3_Prod', 'O3_Loss'
```

## Saving output for a given local time for comparison to satellite observations

In the example below, the first file contains monthly means of results averaged over 10:15 to 10:45 local time (to coincide with Terra) and the second file contains daily composites of averages over 13:15 to 13:45 (to coincide with Aqua). Note that there is no indication in the output files that these are Local Time averages, so you must keep track of that yourself.

```
avgflag_pertape      = 'L', 'L'  
mfilt               = 12, 30  
nhtfrq              = 0, -24  
lcltod_start        = 36800, 47600  
lcltod_stop         = 38800, 49600
```