# Will IG Analyses Scale from ne30-->ne1024?

|         | 2D     | 3DL72  | h0 Month | Factor |
|---------|--------|--------|----------|--------|
| ne30    | 200 KB | 14 MB  | 1.1 GB   | x1     |
| ne120   | 3.1 MB | 220 MB | 15 GB    | x16    |
| ne512   | 57 MB  | 4.1 GB | ?        | x291   |
| ne1024  |        |        | ?        |        |
| 1km     |        |        |          |        |
|         |        |        |          |        |

# High Resolution Analysis Bottlenecks & Issues

- Post-processing strategies must scale ne30-->ne512
  - Regridding changes
    - Currently `ncremap` uses OpenMP over variables, same sparse matrix times entire variable
    - Will re-thread over levels, timesteps per variable
  - Climatology changes
    - Old `ncclimo` spawns 12 background jobs
    - New granularity `--job_nbr=12,6,4,3,2,1`
- Native output may (will?) be ADIOS
  - Where in workflow to do netCDF conversion?
  - Leverage other PP tasks during conversion?
- Timeline for support of resolutions > ne120?
  - Sample datasets for testing

# E3SM for CMIP6: Format, Grids, and Generation

*Charlie Zender, UC Irvine*

CMIP6 **Requires**:

1. Ocean data on structured 2D grids
2. All other models (atm, lnd, sea-ice) can provide data to CMIP6 on any grid, including E3SM native unstructured grids
3. Map-files to regrid submitted data to *standard grids*: two equiangular (1x1 and 2.5x2.5), three cap/FV (361x576, 241x480, and 145x288)
4. Conservative regridding (preferred)
5. netCDF4-classic with compression

E3SM — Energy Exascale Earth System Model

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# E3SM for CMIP6: Format, Grids, and Generation

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E3SM will **Provide**:
1. See below
2. 1x1 (standard) 0.25x0.25 (hi-res) for all four components
3. All of these
4. ESMF "aave"
5. DEFLATE = 1

E3SM
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# CMIP6 generation for Atmosphere & Ocean

```
# 500-yr DECK PI Atmosphere:
drc_in='/p/user_pub/work/E3SM/1_0/piControl/1deg_atm_60-30km_ocean/atmos
/native/model-output/mon/ens1/v1'
cmip6_opt='-7 --dfl_lvl=1 --no_cll_msr --no_frm_trm --no_stg_grd'
spl_opt='--yr_srt=1 --yr_end=500 --ypf=500' # 2D
cd ${drc_in};ls *.cam.h0.0???-*.nc | \
ncclimo --var=${vars} ${cmip6_opt} ${spl_opt} \
--map=${DATA}/maps/map_ne30np4_to_cmip6_180x360_aave.20181001.nc \
--drc_out=${DATA}/ne30/clm --drc_rgr=${DATA}/ne30/rgr

# 500-yr DECK PI Ocean:
drc_in='/p/user_pub/work/E3SM/1_0/piControl/1deg_atm_60-30km_ocean/ocean
/native/model-output/mon/ens1/v1'
cmip6_opt='-7 --dfl_lvl=1 --no_cll_msr --no_frm_trm --no_stg_grd'
spl_opt='--yr_srt=1 --yr_end=500 --ypf=25' # 3D
mpas_opt='-m mpas --d2f'
cd ${drc_in};ls mpaso.hist.am.timeSeriesStatsMonthly.0???-*.nc | \
ncclimo --var=${vars} ${cmip6_opt} ${spl_opt} ${mpas_opt} \
--map=${DATA}/maps/map_oEC60to30v3_to_cmip6_180x360_aave.20181001.nc \
--drc_out=${DATA}/ne30/clm --drc_rgr=${DATA}/ne30/rgr
```

# CMIP6 generation for Land

```
# 500-yr DECK PI Land:
drc_in='/p/user_pub/work/E3SM/1_0/piControl/1deg_atm_60-30km_ocean/land
/native/model-output/mon/ens1/v1' # Raw data
drc_out="${DATA}/ne30/clm" # Native grid
drc_rgr="${DATA}/ne30/rgr" # Regridded
cmip6_opt='-7 --dfl_lvl=1 --no_cll_msr --no_frm_trm --no_stg_grd'
spl_opt='--yr_srt=1 --yr_end=500 --ypf=500'
vars='FSDS,TBOT,SOILWATER_10CM,QOVER,QRUNOFF,QINTR,QVEGE,QSOIL,QVEGT,LA
ISUN,LAISHA,SOILICE,SOILLIQ,TSOI' # 2D+3D
# Create SGS map, then split all raw files, then regrid all split files
ncremap -a aave -P sgs \
--grd_src=${DATA}/grids/ne30np4_pentagons.091226.nc \
--grd_dst=${DATA}/grids/cmip6_180x360_scrip.20181001.nc \
--map=${DATA}/maps/map_ne30np4_to_cmip6_180x360_sgs_elm.20190301.nc \
${drc_in}/20180129.DECKv1b_piControl.ne30_oEC.edison.clm2.h0.0001-01.nc
# Native Land
cd ${drc_in}; /bin/ls *.clm2.h0.0???-*.nc | ncclimo --var=${vars}
${cmip6_opt} ${spl_opt} --drc_out=${drc_out}
# Regridded Land
cd ${drc_out};/bin/ls *_000101_050012.nc | ncremap ${cmip6_opt}
--map=${DATA}/maps/map_ne30np4_to_cmip6_180x360_sgs_elm.20190301.nc
--drc_out=${drc_rgr}
```

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# CMIP6 generation for Sea Ice

```
# 165-yr DECK Historical Sea Ice: nsm_nm='H1'
drc_in='/p/user_pub/work/E3SM/1_0/historical_${nsm_nm}/1deg_atm_60-30km
_ocean/sea-ice/native/model-output/mon/ens1/v1' # Raw data
drc_sgs="${DATA}/ne30/ice/${nsm_nm}" # 1x1 SGS data
cmip6_opt='-7 --dfl_lvl=1 --no_cll_msr --no_frm_trm --no_stg_grd'
spl_opt='--yr_srt=1 --yr_end=165 --ypf=165' # 2D
mpas_opt='-P mpascice --d2f'
vars='timeMonthly_avg_icePresent,timeMonthly_avg_iceAreaCell,timeMonthl
y_avg_surfaceTemperatureCell,timeMonthly_avg_iceVolumeCell' # 2D
# Regrid all input to SGS directory, then split
fl_lst=`ls mpascice.hist.am.timeSeriesStatsMonthly.0???-??-01.nc`
for fl in ${fl_lst}; do
    ncremap --var=${vars} -a aave ${mpas_opt} --drc_out=${drc_sgs} \
    --grd_src=${DATA}/grids/ocean.oEC60to30v3.scrip.161222.nc \
    --grd_dst=${DATA}/grids/cmip6_180x360_scrip.20181001.nc ${fl}
done
# Native Sea-Ice
cd ${drc_in}; echo ${fl_lst}  | ncclimo --var=${vars} ${cmip6_opt}
${spl_opt} --drc_out=${drc_out}
# Regridded Sea-Ice
cd ${drc_sgs}; echo ${fl_lst} | ncclimo --var=${vars} ${cmip6_opt}
${spl_opt} --drc_out=${drc_rgr}
```

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