ShankleEtAlGetModelData

July 18, 2021

[6]:
```
%reset -f
# Loading libraries
import matplotlib.pyplot as plt
import numpy as np
import xarray as xr
import xesmf as xe
import pandas as pd
import cftime
import matplotlib.colors as mcolors
import Ngl
```

[7]:
```
# PI Control
PI_CISO_Data = xr.open_dataset('/glade/p/univ/p93300190/nburls/
 ↪PreInd_ciso_T31_gx3v7/ocn/hist/CLIM/PreInd_ciso_T31_gx3v7_ALL.2901-3000.
 ↪nc',decode_times=True)

# PlioB17_ciso_T31_gx3v7_branch - Exp A
#ExpA_CISO_Data = xr.open_dataset('/glade/p/univ/p93300190/nburls/
 ↪PlioB17_ciso_T31_gx3v7_branch/ocn/hist/CLIM/
 ↪PlioB17_ciso_T31_gx3v7_branch_ALL.2901-3000.nc',decode_times=True)
PlioMio_CISO_Data = xr.open_dataset('/glade/p/univ/p93300190/nburls/
 ↪PlioB17_ciso_T31_gx3v7_branch/ocn/hist/CLIM/
 ↪PlioB17_ciso_T31_gx3v7_branch_ALL.2901-3000.nc',decode_times=True)

# Plio_ciso_T31_gx3v7 - Exp B
#ExpB_CISO_Data = xr.open_dataset('/glade/p/univ/p93300190/nburls/
 ↪Plio_ciso_T31_gx3v7/ocn/hist/CLIM/Plio_ciso_T31_gx3v7_ALL.2901-3000.
 ↪nc',decode_times=True)
```

[5]:
```
# Define pH variables
PI_pH = PI_CISO_Data.pH_3D
PlioMio_pH = PlioMio_CISO_Data.pH_3D
# Save pH variables
PI_pH.to_netcdf('/glade/work/nburls/CISO_Analysis/ShankleEtAlModelFigureData/
 ↪PI_pH.nc')
PlioMio_pH.to_netcdf('/glade/work/nburls/CISO_Analysis/
 ↪ShankleEtAlModelFigureData/PlioMio_pH.nc')
```

[13]:
```
# Define Basin Mask variable
basin_mask = PI_CISO_Data.REGION_MASK
# Save Basin Mask variable
basin_mask.to_netcdf('/glade/work/nburls/CISO_Analysis/
 ↪ShankleEtAlModelFigureData/basin_mask.nc')
```

[22]:
```
# Define IAGE variables
PI_IAGE = PI_CISO_Data.IAGE
PlioMio_IAGE = PlioMio_CISO_Data.IAGE
# Save IAGE variables
PI_IAGE.to_netcdf('/glade/work/nburls/CISO_Analysis/ShankleEtAlModelFigureData/
 ↪PI_IAGE.nc')
PlioMio_IAGE.to_netcdf('/glade/work/nburls/CISO_Analysis/
 ↪ShankleEtAlModelFigureData/PlioMio_IAGE.nc')
```

[10]:
```
# Define Stream Function variables
PI_Global_Total_SF = PI_CISO_Data.MOC[0,0,0,:,:]+PI_CISO_Data.MOC[0,0,1,:,:
 ↪]+PI_CISO_Data.MOC[0,0,2,:,:]
PI_Atlantic_Total_SF = PI_CISO_Data.MOC[0,1,0,:,:]+PI_CISO_Data.MOC[0,1,1,:,:
 ↪]+PI_CISO_Data.MOC[0,1,2,:,:]
PI_Pacific_Total_SF =  PI_Global_Total_SF - PI_Atlantic_Total_SF

PlioMio_Global_Total_SF = PlioMio_CISO_Data.MOC[0,0,0,:,:]+PlioMio_CISO_Data.
 ↪MOC[0,0,1,:,:]+PlioMio_CISO_Data.MOC[0,0,2,:,:]
PlioMio_Atlantic_Total_SF = PlioMio_CISO_Data.MOC[0,1,0,:,:]+PlioMio_CISO_Data.
 ↪MOC[0,1,1,:,:]+PlioMio_CISO_Data.MOC[0,1,2,:,:]
PlioMio_Pacific_Total_SF =  PlioMio_Global_Total_SF - PlioMio_Atlantic_Total_SF
# Save Stream Function variables
PI_Global_Total_SF.to_netcdf('/glade/work/nburls/CISO_Analysis/
 ↪ShankleEtAlModelFigureData/PI_Global_MOC.nc')
PlioMio_Global_Total_SF.to_netcdf('/glade/work/nburls/CISO_Analysis/
 ↪ShankleEtAlModelFigureData/PlioMio_Global_MOC.nc')
PI_Atlantic_Total_SF.to_netcdf('/glade/work/nburls/CISO_Analysis/
 ↪ShankleEtAlModelFigureData/PI_Atlantic_MOC.nc')
PlioMio_Atlantic_Total_SF.to_netcdf('/glade/work/nburls/CISO_Analysis/
 ↪ShankleEtAlModelFigureData/PlioMio_Atlantic_MOC.nc')
PI_Pacific_Total_SF.to_netcdf('/glade/work/nburls/CISO_Analysis/
 ↪ShankleEtAlModelFigureData/PI_Pacific_MOC.nc')
PlioMio_Pacific_Total_SF.to_netcdf('/glade/work/nburls/CISO_Analysis/
 ↪ShankleEtAlModelFigureData/PlioMio_Pacific_MOC.nc')
```

[19]:
```
# Lagrangian Pathways already saved in single netcdf file
#Exp_trajectory_Data = xr.open_dataset('/glade/work/nburls/CISO_Analysis/
 ↪PMOC_pacific_trajectories_yz.nc',decode_times=True)
```

[11]:
```
from scipy.io import loadmat
```

[133]:
```
year = loadmat('Ocean_pHgrad_PreInd_ciso_T31_gx3v7.mat')['year']
grad_pH = loadmat('Ocean_pHgrad_PreInd_ciso_T31_gx3v7.mat')['grad_pH']
grad_SST = loadmat('Ocean_SSTgrad_PreInd_ciso_T31_gx3v7.mat')['grad_SST']
PMOC = loadmat('PMOC_and_AMOC_max_stmfunct_PreInd_ciso_T31_gx3v7.
↪mat')['PMOC_max_strmfunct']

year_PI=year.squeeze(axis=None)
grad_pH_PI=grad_pH.squeeze(axis=None)
grad_SST_PI=grad_SST.squeeze(axis=None)
PMOC_PI=PMOC.squeeze(axis=None)
```

[54]:
```
# create dataset
ds = xr.Dataset({
    'delta_pH': xr.DataArray(
                data   = grad_pH_PI,
                dims   = ['year'],
                coords = {'year': year_PI},
                attrs  = {
                    'units'     : 'pH'
                    }
                ),
    'delta_SST': xr.DataArray(
                data   = grad_SST_PI,
                dims   = ['year'],
                coords = {'year': year_PI},
                attrs  = {
                    'units'     : 'degC'
                    }
                ),
    'PMOC_max': xr.DataArray(
                data   = PMOC_PI,
                dims   = ['year'],
                coords = {'year': year_PI},
                attrs  = {
                    'units'     : 'Sv'
                    }
                ),
            },
    )
```

[56]:
```
# save dataset
ds.to_netcdf('/glade/work/nburls/CISO_Analysis/ShankleEtAlModelFigureData/
↪PreInd_Adjustment_Timeseries.nc')
```

[128]:
```
year = loadmat('Ocean_pHgrad_PlioB17_ciso_T31_gx3v7.mat')['year']
grad_pH = loadmat('Ocean_pHgrad_PlioB17_ciso_T31_gx3v7.mat')['grad_pH']
grad_SST = loadmat('Ocean_SSTgrad_PlioB17_ciso_T31_gx3v7.mat')['grad_SST']
```

```
PMOC = loadmat('PMOC_and_AMOC_max_stmfunct_PlioB17_ciso_T31_gx3v7.
 ↪mat')['PMOC_max_strmfunct']

year_PlioMio_begin=year.squeeze(axis=None)
grad_pH_PlioMio_begin=grad_pH.squeeze(axis=None)
grad_SST_PlioMio_begin=grad_SST.squeeze(axis=None)
PMOC_PlioMio_begin=PMOC.squeeze(axis=None)

#plt.plot(year_PlioMio,PMOC_PlioMio)
```

[129]:
```
year_branch = loadmat('Ocean_pHgrad_PlioB17_ciso_T31_gx3v7_branch.mat')['year']
grad_pH_branch = loadmat('Ocean_pHgrad_PlioB17_ciso_T31_gx3v7_branch.
 ↪mat')['grad_pH']
grad_SST_branch = loadmat('Ocean_SSTgrad_PlioB17_ciso_T31_gx3v7_branch.
 ↪mat')['grad_SST']
PMOC_branch = loadmat('PMOC_and_AMOC_max_stmfunct_PlioB17_ciso_T31_gx3v7_branch.
 ↪mat')['PMOC_max_strmfunct']

year_PlioMio_branch=year_branch.squeeze(axis=None)
grad_pH_PlioMio_branch=grad_pH_branch.squeeze(axis=None)
grad_SST_PlioMio_branch=grad_SST_branch.squeeze(axis=None)
PMOC_PlioMio_branch=PMOC_branch.squeeze(axis=None)
```

[130]:
```
year_PlioMio=np.concatenate((year_PlioMio_begin[0:2490],␣
 ↪year_PlioMio_branch[2490:]), axis=0)
grad_pH_PlioMio=np.concatenate((grad_pH_PlioMio_begin[0:2490],␣
 ↪grad_pH_PlioMio_branch[2490:]), axis=0)
grad_SST_PlioMio=np.concatenate((grad_SST_PlioMio_begin[0:2490],␣
 ↪grad_SST_PlioMio_branch[2490:]), axis=0)
PMOC_PlioMio=np.concatenate((PMOC_PlioMio_begin[0:2490],␣
 ↪PMOC_PlioMio_branch[2490:]), axis=0)
```

[131]:
```
# create dataset
ds = xr.Dataset({
    'delta_pH': xr.DataArray(
                data   = grad_pH_PlioMio,
                dims   = ['year'],
                coords = {'year': year_PlioMio},
                attrs  = {
                    'units'     : 'pH'
                    }
                ),
    'delta_SST': xr.DataArray(
                data   = grad_SST_PlioMio,
                dims   = ['year'],
                coords = {'year': year_PlioMio},
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                attrs  = {
                    'units'     : 'degC'
                    }
                ),
    'PMOC_max': xr.DataArray(
                data   = PMOC_PlioMio,
                dims   = ['year'],
                coords = {'year': year_PI},
                attrs  = {
                    'units'     : 'Sv'
                    }
                ),
            },
    )
```

[132]:
```
# save dataset
ds.to_netcdf('/glade/work/nburls/CISO_Analysis/ShankleEtAlModelFigureData/
 ↪PlioMio_Adjustment_Timeseries.nc')
```