

checkpoint_ctrl

March 13, 2019

```
In [1]: import xmitgcm
import MITgcm_recipes
import numpy as np
from matplotlib import cm, colors
import cartopy as cart
```

```
In [2]: %matplotlib inline
```

0.1 Model datasets

```
In [3]: # ASTE grid information
# we need extra metadata for xmitgcm to figure it out
astemd = xmitgcm.utils.get_extra_metadata(domain='aste', nx=270)
```

0.1.1 Run with/without checkpoints

```
In [ ]: dirroot = '/rigel/ocpbgc/users/rd2847/tmpdir_runs/ASTE/'
```

```
In [4]: dir_run_nocheck = dirroot + 'tmpdir_ASTE-testchkpt_ref/'
```

```
In [5]: dir_run_check = dirroot + 'tmpdir_ASTE-testchkpt_sens/'
```

```
In [6]: ds_nocheck = xmitgcm.open_mdsdataset(dir_run_nocheck + 'diags/',
prefix=['state_3d_set1',
'state_2d_set1'],
geometry='llc', nx=270, read_grid=True,
grid_dir=dir_run_nocheck, extra_metadata=astemd,
delta_t=1200, ref_date="2002-1-1 0:0:0")
```

```
In [7]: ds_check = xmitgcm.open_mdsdataset(dir_run_check + 'diags/',
prefix=['state_3d_set1',
'state_2d_set1'],
geometry='llc', nx=270, read_grid=True,
grid_dir=dir_run_check, extra_metadata=astemd,
delta_t=1200, ref_date="2002-1-1 0:0:0")
```

0.2 Problem with checkpoint and pkg/ctrl

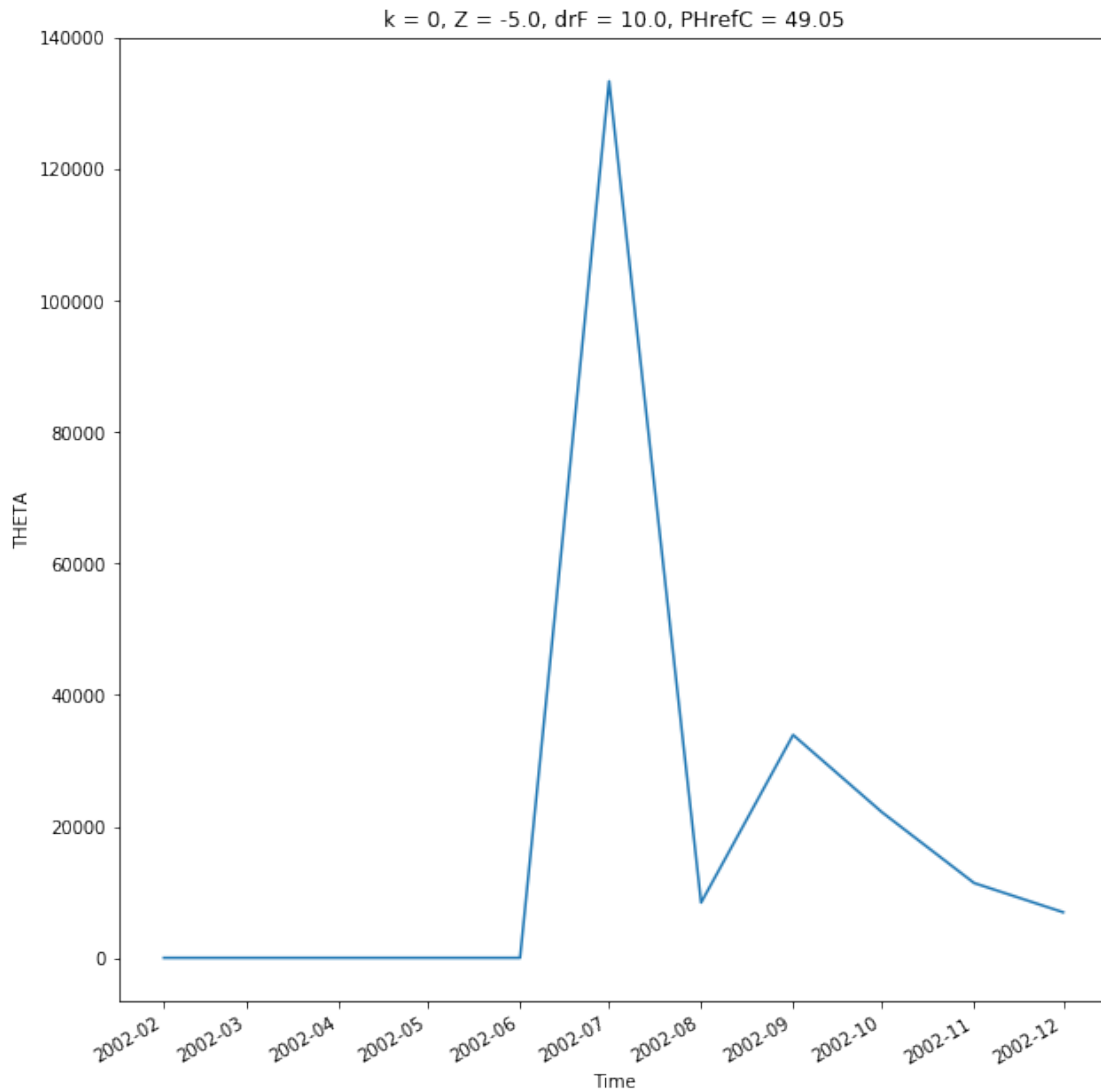
When checkpointing with pkg/ctrl, it seems that the ctrl are not applied after the checkpoint. To show this, I am running a single 360 days job versus 2 jobs of 180 days with a checkpoint at timestep=12960 (dt=1200s). After the checkpoint, we observe large discrepancies. We compute the difference of the dataset with and without checkpoints:

```
In [23]: # BIAS
         SSTbias = ((ds_check['THETA'].sel(k=0) -
                    ds_nocheck['THETA'].sel(k=0))**2).sum(dim=['i','j','face'])
```

```
In [24]: SSSbias = ((ds_check['SALT'].sel(k=0) -
                    ds_nocheck['SALT'].sel(k=0))**2).sum(dim=['i','j','face'])
```

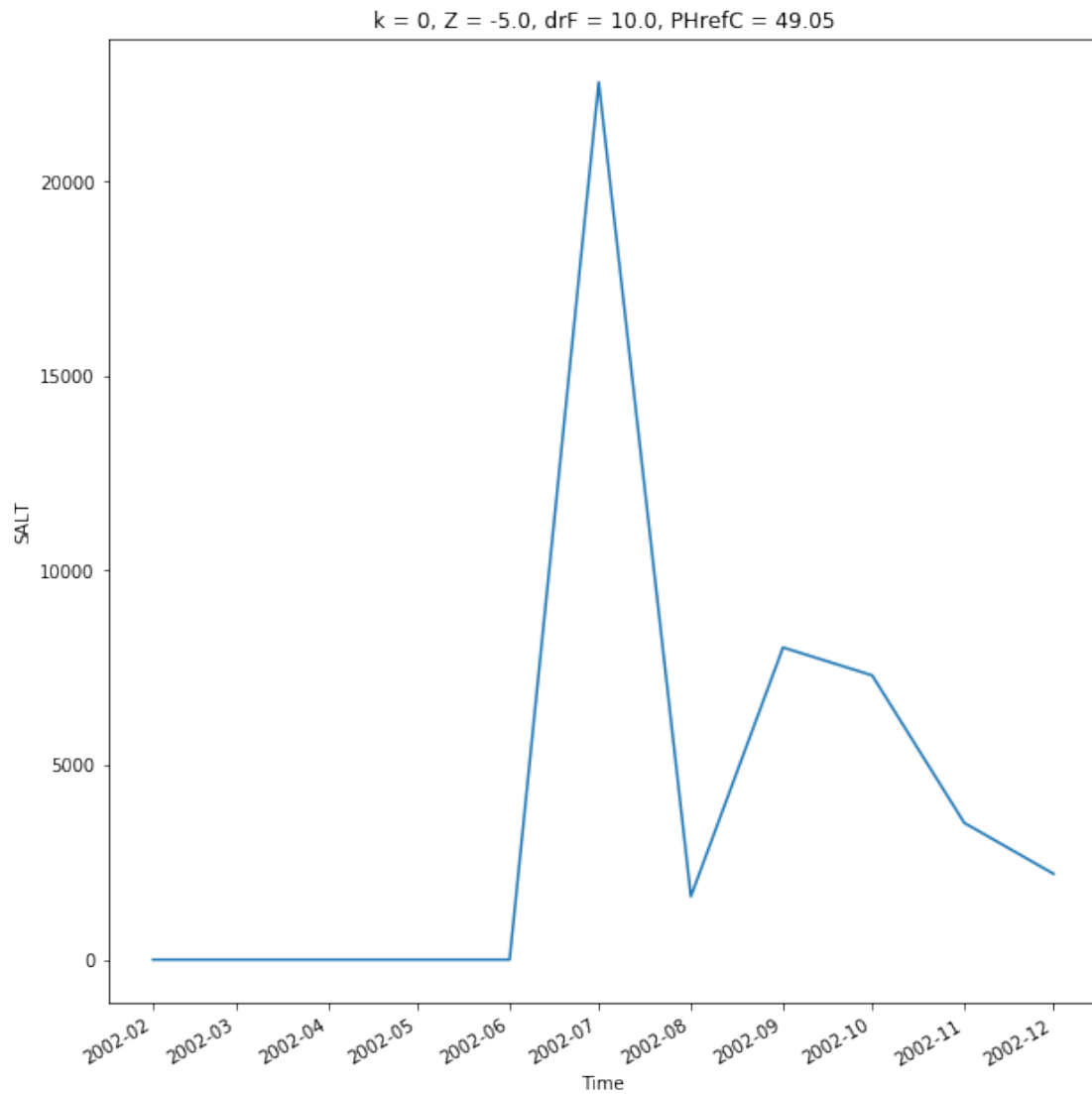
```
In [25]: SSTbias.plot(figsize=[10,10])
```

```
Out[25]: [<matplotlib.lines.Line2D at 0x2aabc0f99208>]
```



```
In [26]: SSSbias.plot(figsize=[10,10])
```

```
Out[26]: [<matplotlib.lines.Line2D at 0x2aaba9942908>]
```



In the first 6 month, both runs are exactly the same. We observe a large jump right after the checkpoint.

SST/SSS errors after the checkpoint

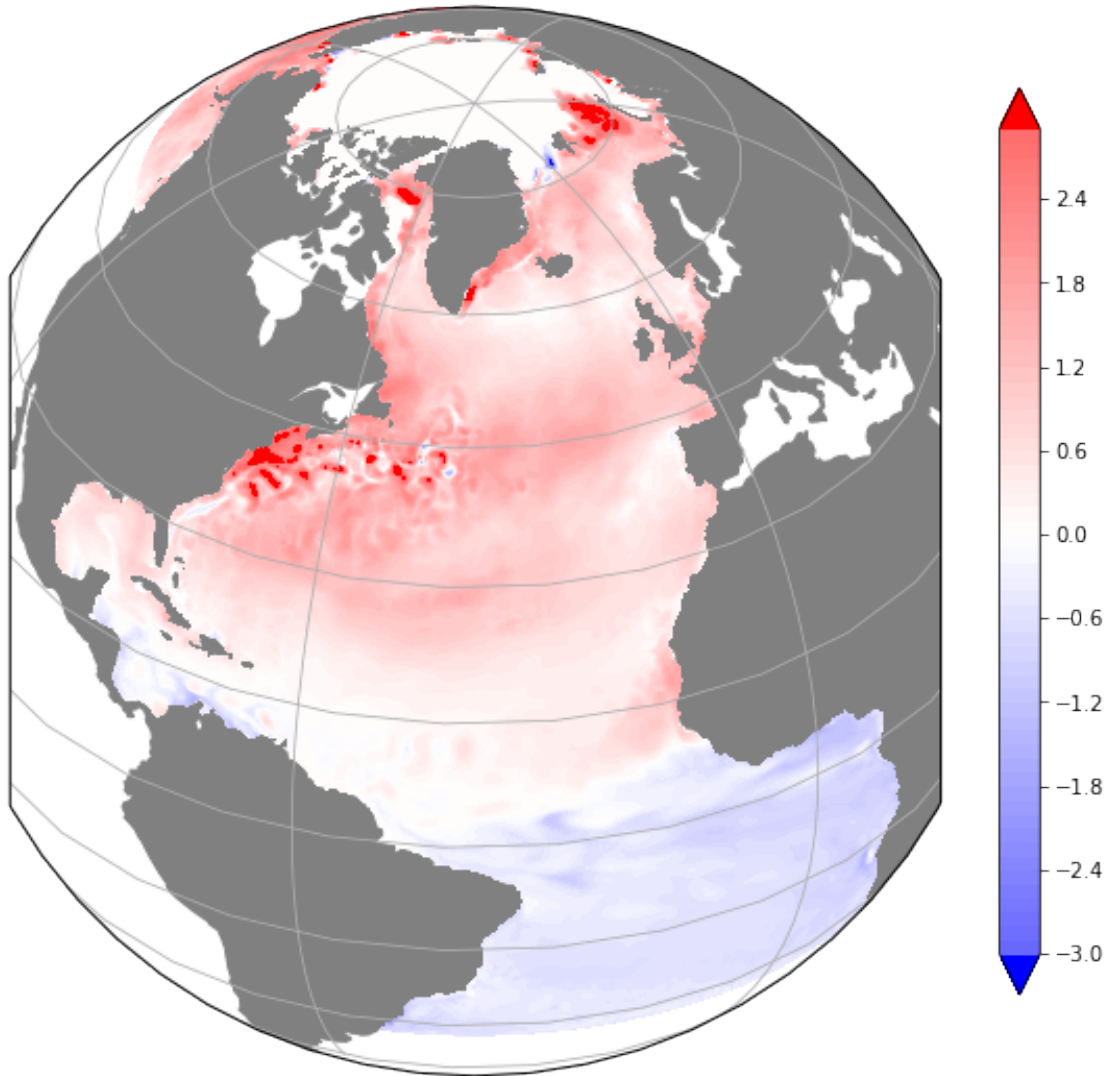
```
In [27]: bias = ds_check - ds_nocheck
```

```
In [28]: dict_plt_temp_diff = {'figsize': [10, 10], 'vmin': -5, 'vmax': 5,  
                              'contours': np.arange(-3,3,0.1),
```

```

        'cmap': cm.bwr, 'cbar size': 0.8,
        'title': 'SST bias'}
asteproject = cart.crs.Orthographic(central_longitude=-40, central_latitude=35)
fig = MITgcm_recipes.plot_ASTE_pyresample(bias['THETA'].sel(k=0, time='2002-07'),
                                          dict_plt_temp_diff,
                                          proj=asteproject)

```



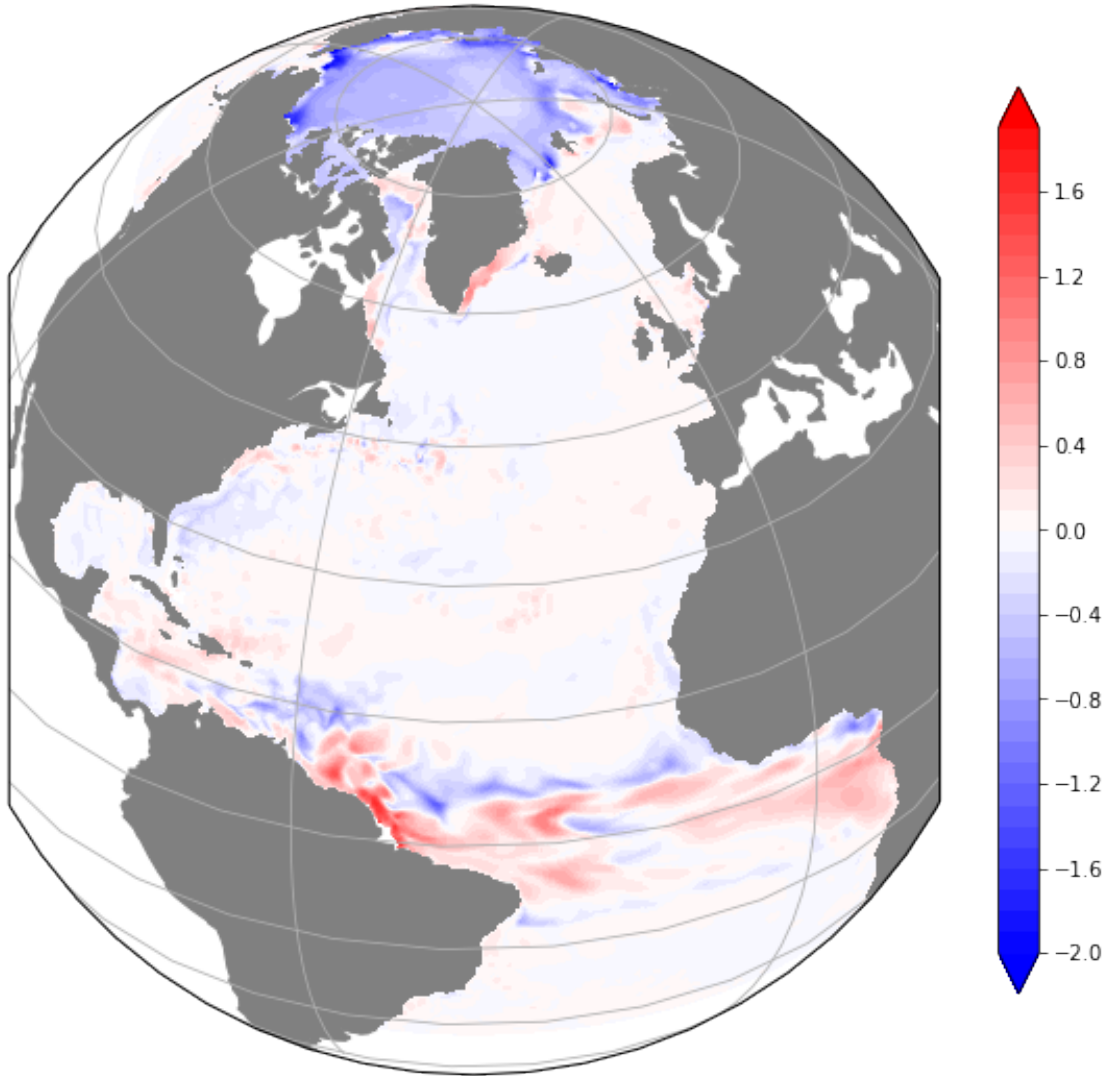
```

In [29]: dict_plt_temp_diff = {'figsize': [10, 10], 'vmin': -2, 'vmax': 2,
                              'contours': np.arange(-2, 2, 0.1),
                              'cmap': cm.bwr, 'cbar size': 0.8,
                              'title': 'SST bias'}

asteproject = cart.crs.Orthographic(central_longitude=-40, central_latitude=35)
fig = MITgcm_recipes.plot_ASTE_pyresample(bias['SALT'].sel(k=0, time='2002-07'),

```

```
dict_plt_temp_diff,  
proj=asteproj)
```



0.2.1 Comparison with An Nguyen official Release1

```
In [15]: dir_release1 = '/rigel/ocpbgc/users/rd2847/ASTE/Release1/diags/STATE/'
```

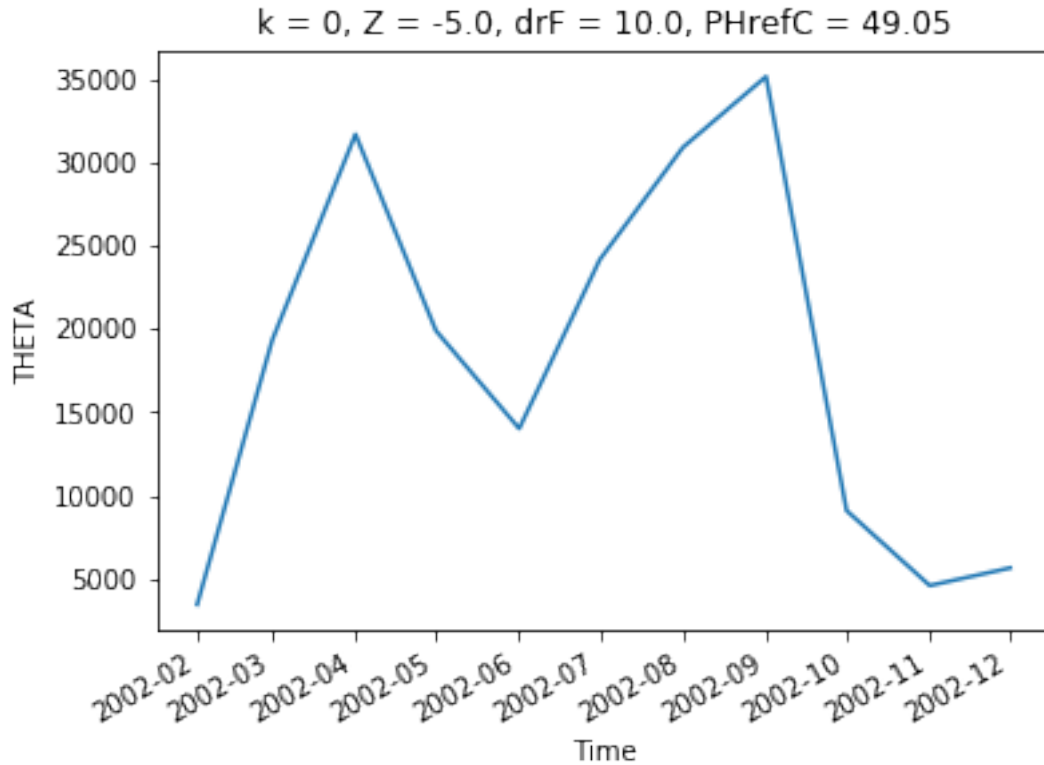
```
In [16]: ds_release = xmitgcm.open_mdsdataset(dir_release1, prefix=['state_3d_set1',  
                                                                    'state_2d_set1'],  
                                              geometry='llc', nx=270, read_grid=True,  
                                              grid_dir=dir_run_nocheck, extra_metadata=astemd,  
                                              delta_t=1200, ref_date="2002-1-1 0:0:0")
```

```
In [17]: ds_release_2002 = ds_release.sel(time=slice('2002-02', '2002-12'))
```

```
SSTbias_r = ((ds_nocheck['THETA'].sel(k=0) -
              ds_release_2002['THETA'].sel(k=0))**2).sum(dim=['i','j','face'])
```

```
In [18]: SSTbias_r.plot()
```

```
Out[18]: [<matplotlib.lines.Line2D at 0x2aab77f78518>]
```

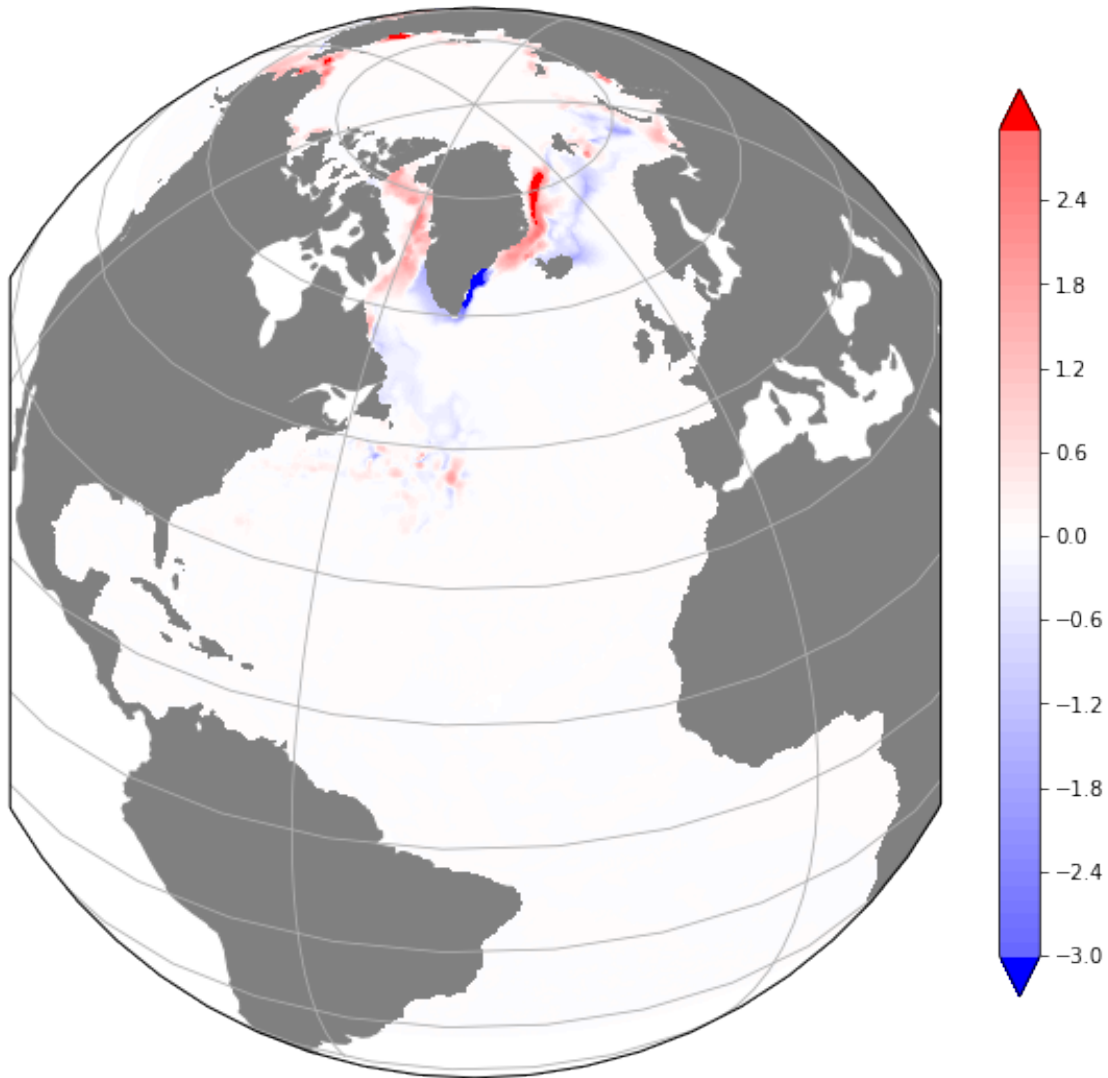


There is some expected discrepancies between my run and An's but of smaller amplitude than the July peak observed between checkpoint and no checkpoint.

```
In [19]: bias_r1 = ds_nocheck - ds_release
```

```
In [20]: dict_plt_temp_diff = {'figsize': [10, 10], 'vmin': -5, 'vmax': 5,
                              'contours': np.arange(-3, 3, 0.1),
                              'cmap': cm.bwr, 'cbar_size': 0.8,
                              'title': 'SST bias'}
```

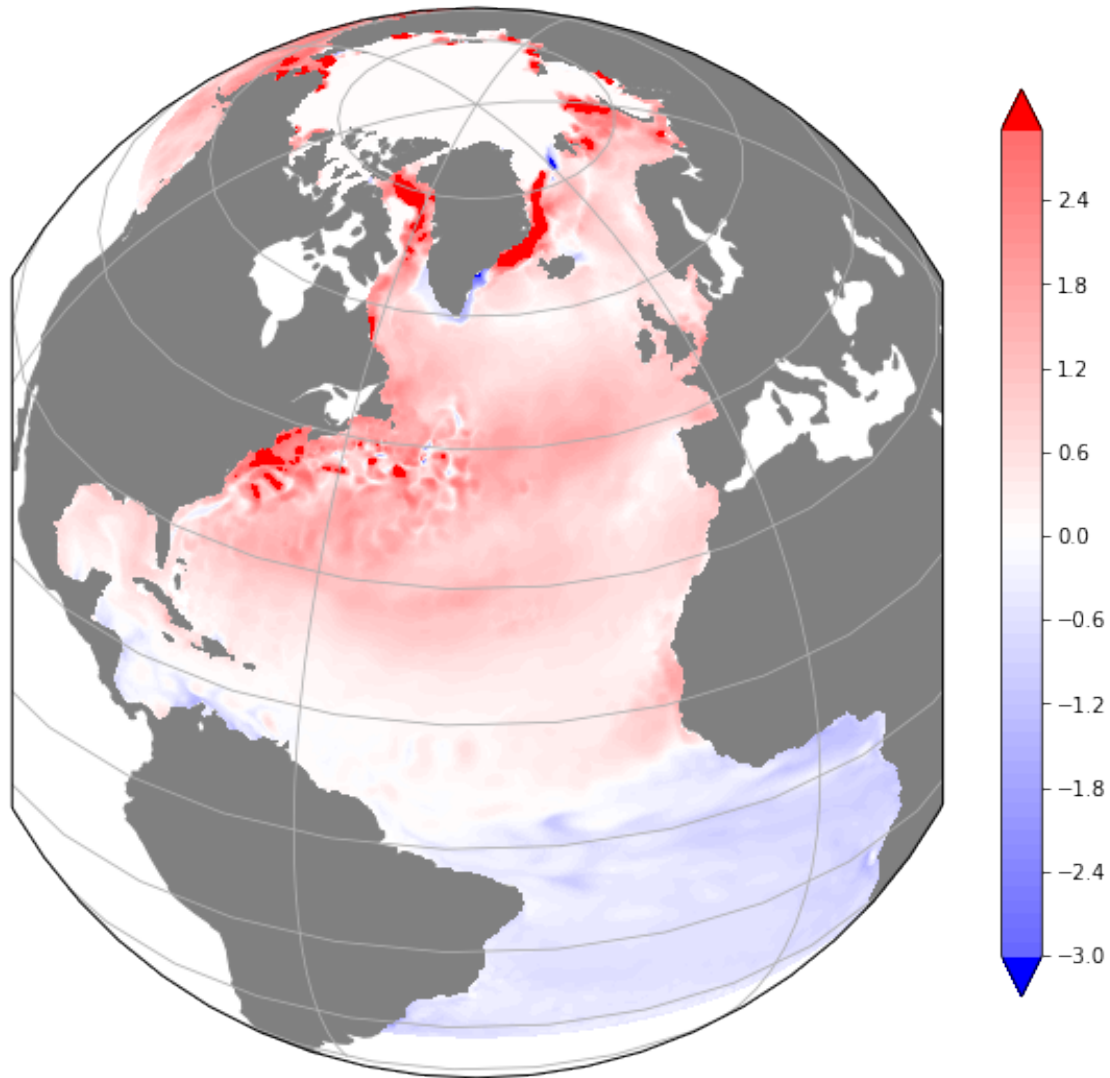
```
asteproject = cart.crs.Orthographic(central_longitude=-40, central_latitude=35)
fig = MITgcm_recipes.plot_ASTE_pyresample(bias_r1['THETA'].sel(k=0, time='2002-07'),
                                           dict_plt_temp_diff,
                                           proj=asteproject)
```



```
In [21]: bias_r2 = ds_check - ds_release
```

```
In [22]: dict_plt_temp_diff = {'figsize': [10, 10], 'vmin': -5, 'vmax': 5,
                              'contours': np.arange(-3,3,0.1),
                              'cmap': cm.bwr, 'cbar_size': 0.8,
                              'title': 'SST bias'}
```

```
asteproject = cart.crs.Orthographic(central_longitude=-40, central_latitude=35)
fig = MITgcm_recipes.plot_ASTE_pyresample(bias_r2['THETA'].sel(k=0, time='2002-07'),
                                           dict_plt_temp_diff,
                                           proj=asteproject)
```



The run without checkpoint shows little changes (consistent with different machine/compiler). The run with checkpoint is completely off.