12232248 刘苞擘 PS3

[6]:
```
import numpy as np
import pandas as pd
import xarray as xr
from matplotlib import pyplot as plt
%matplotlib inline
```

[2]:
```
import matplotlib as mpl
import matplotlib.pyplot as plt
import matplotlib.gridspec as gridspec
```

[4]:
```
ds= xr.open_dataset("200301_202006-C3S-L3_GHG-PRODUCTS-OBS4MIPS-MERGED-v4.3.nc")
ds
```

[4]: xarray.Dataset

► Dimensions: (**time**: 210, bnds: 2, **lat**: 36, **lon**: 72, pressure: 10)

▼ Coordinates:

time	(time)	datetime64[ns]	2003-01-16T12:00:00 ... 2020-06-16
lat	(lat)	float64	-87.5 -82.5 -77.5 ... 82.5 87.5
lon	(lon)	float64	-177.5 -172.5 ... 172.5 177.5

▼ Data variables:

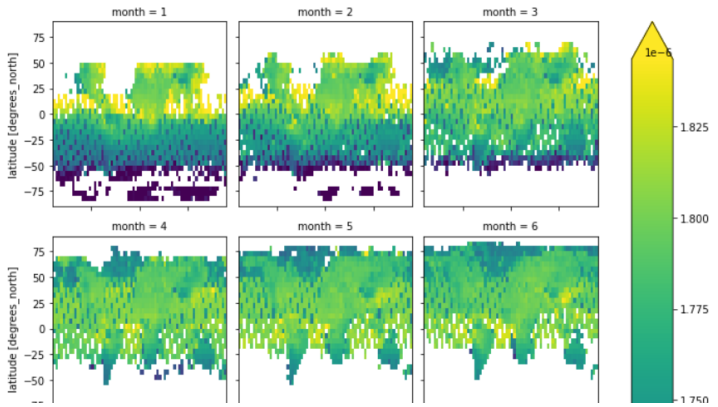
time_bnds	(time, bnds)	datetime64[ns]	...
lat_bnds	(lat, bnds)	float64	...
lon_bnds	(lon, bnds)	float64	...
pre	(pressure)	float64	...
pre_bnds	(pressure, bnds)	float64	...
land_fraction	(lat, lon)	float64	...
xch4	(time, lat, lon)	float32	...
xch4_nobs	(time, lat, lon)	float64	...
xch4_stderr	(time, lat, lon)	float32	...

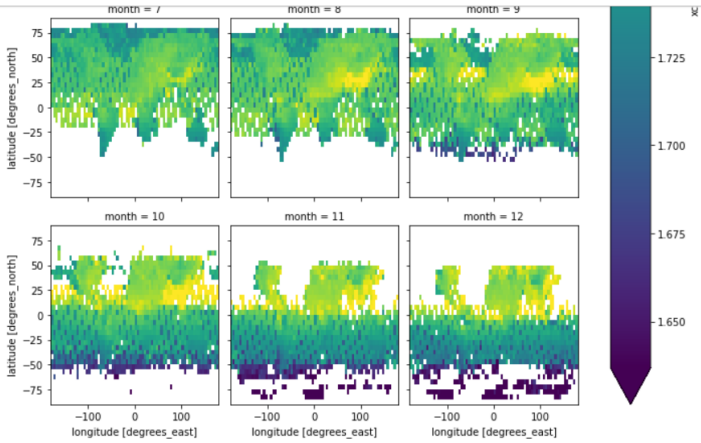
xch4	(time, lat, lon)	float32	...
xch4_nobs	(time, lat, lon)	float64	...
xch4_stderr	(time, lat, lon)	float32	...
xch4_stddev	(time, lat, lon)	float32	...
column_averagin...	(time, pressure, lat, lon)	float32	...
vmr_profile_ch4_...	(time, pressure, lat, lon)	float32	...

► Attributes: (28)

[13]:
```
# 1.1
ds.xch4.groupby('time.month').mean().plot(col="month", col_wrap=3, robust=True)
```

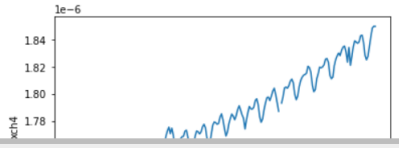
[13]:
```
<xarray.plot.facetgrid.FacetGrid at 0x1e50b5b8700>
```



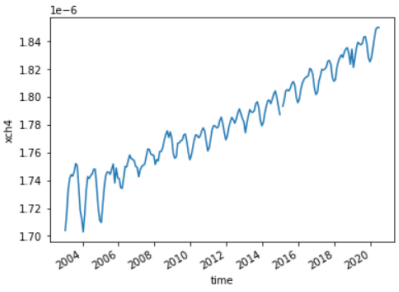


[15]:
```
# 1.2
ds.xch4.sel(time=slice('2003-01','2020-06')).mean(dim=['lon','lat']).plot()
```

[15]:
```
[<matplotlib.lines.Line2D at 0x1e50c01d040>]
```



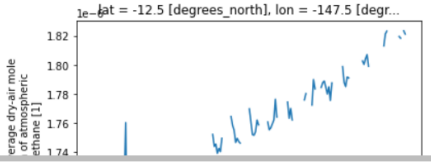
[15]:
[<matplotlib.lines.Line2D at 0x1e50c01d040>]

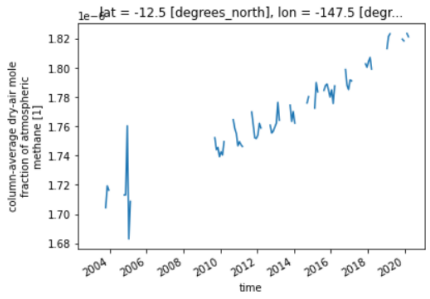


[17]:
```
# 1.3
ds.xch4.sel(time=slice('2003-01','2020-06')).sel(lon=-150,lat=-15,method='nearest').plot()
```

```
D:\ANACONDA\lib\site-packages\xarray\core\indexes.py:234: FutureWarning: Passing method to Float64Index.get_loc is deprecated and will raise in a future version. Use index.get_indexer([item], method=...) instead.
  indexer = self.index.get_loc(
D:\ANACONDA\lib\site-packages\xarray\core\indexes.py:234: FutureWarning: Passing method to Float64Index.get_loc is deprecated and will raise in a future version. Use index.get_indexer([item], method=...) instead.
  indexer = self.index.get_loc(
```

[17]:
```
[<matplotlib.lines.Line2D at 0x1e5109023a0>]
```





[119]:
```
# 2.1
ds_2= xr.open_dataset("NOAA_NCDC_ERSST_v3b_SST.nc")
ds_2
```

[119]: xarray.Dataset

- Dimensions: (**lat**: 89, **lon**: 180, **time**: 684)
- Coordinates:

lat	(lat)	float32	-88.0 -86.0 -84.0 ... 86.0 88.0
lon	(lon)	float32	0.0 2.0 4.0 ... 354.0 356.0 358.0
time	(time)	datetime64[ns]	1960-01-15 ... 2016-12-15

- Data variables:

sst	(time, lat, lon)	float32	...

- Attributes:

Conventions :	IRIDL

lat	(lat)	float32	-88.0 -86.0 -84.0 ... 86.0 88.0
lon	(lon)	float32	0.0 2.0 4.0 ... 354.0 356.0 358.0
time	(time)	datetime64[ns]	1960-01-15 ... 2016-12-15

- Data variables:

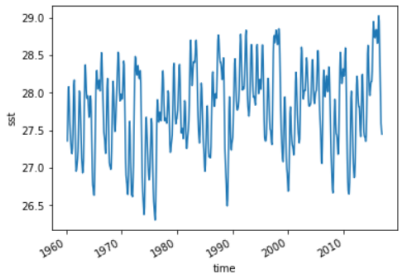
sst	(time, lat, lon)	float32	...

- Attributes:

Conventions :	IRIDL
source :	https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCDC/.ERSST/.version3b/.sst/
history :	extracted and cleaned by Ryan Abernathey for Research Computing in Earth Science

[131]:
```
ds_2.sst.sel(lon=['190','240'],lat=['-6','6']).rolling(time=3).mean().mean(dim=['lon','lat']).plot()
```

[131]: [<matplotlib.lines.Line2D at 0x1e511f3b190>]



[137]:
```
subtract=ds_2.sst.sel(lon=['190','240'],lat=['-6','6']).rolling(time=3).mean()-ds_2.sst.sel(lon=['190','240'],lat=['-6','6']).mean()
subtract
```

[137]: xarray.DataArray 'sst' (**time**: 684, **lat**: 2, **lon**: 2)

[137]:
```
subtract=ds_2.sst.sel(lon=['190','240'],lat=['-6','6']).rolling(time=3).mean()-ds_2.sst.sel(lon=['190','240'],lat=['-6','6']).mean()
subtract
```

[137]:
xarray.DataArray 'sst' (**time**: 684, **lat**: 2, **lon**: 2)

```
array([[[        nan,         nan],
        [        nan,         nan]],

       [[        nan,         nan],
        [        nan,         nan]],

       [[ 0.8321419 , -1.4950333 ],
        [-0.40036774, -0.64657974]],

       ...,

       [[ 1.2160168 , -2.6099186 ],
        [ 1.3334293 , -0.7062893 ]],

       [[ 1.2324429 , -2.6276512 ],
        [ 1.1617756 , -0.912426  ]],

       [[ 1.2956429 , -2.4825268 ],
        [ 0.8325443 , -0.99769783]]], dtype=float32)
```

▼ Coordinates:

lat	(lat)	float32	-6.0 6.0
lon	(lon)	float32	190.0 240.0
time	(time)	datetime64[ns]	1960-01-15 ... 2016-12-15

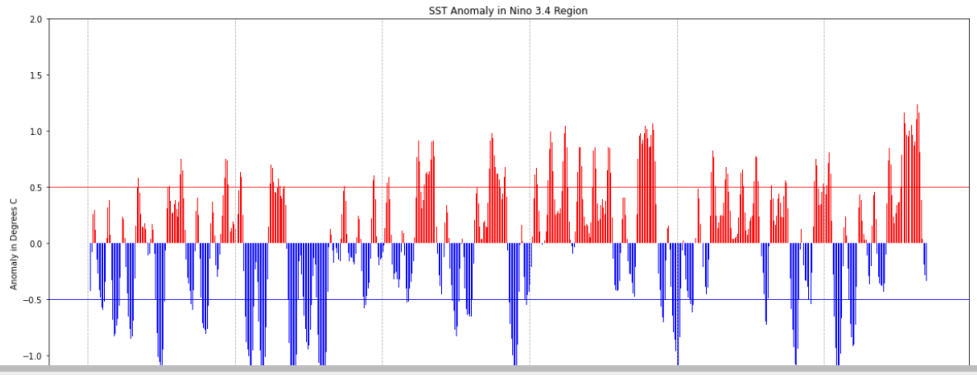
► Attributes: (0)

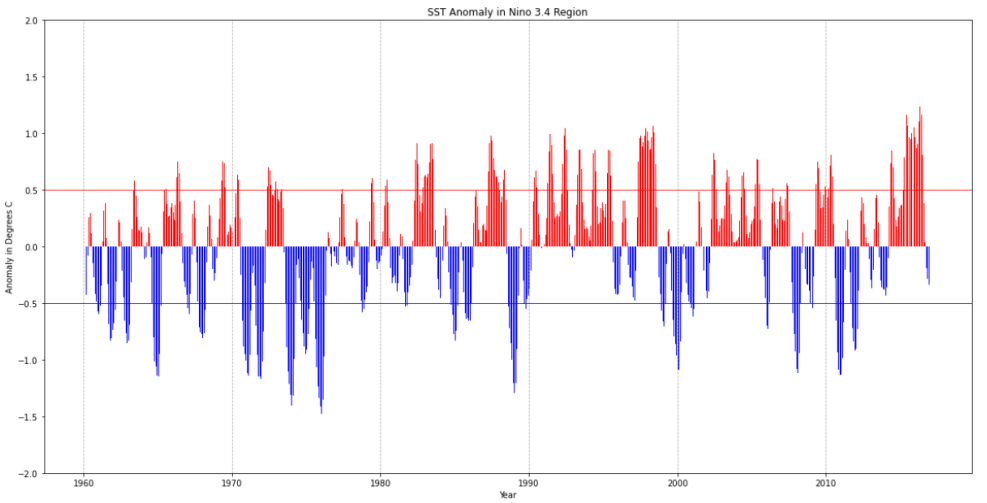
[139]:
```
# 2.2
ds2_2=subtract.mean(dim=['lat', 'lon'])
ds2_2=ds2_2.to_dataframe()
```

[139]:
```
# 2.2
ds2_2=subtract.mean(dim=['lat', 'lon'])
ds2_2=ds2_2.to_dataframe()
```

[144]:
```
# ds2_2['sign']=ds2_2['sst'] > 0
fig, ax = plt.subplots(figsize=(20, 10))
ax.yaxis.set_ticks_position('left')
ax.set(title = 'SST Anomaly in Nino 3.4 Region',
       xlabel = 'Year',
       ylabel = 'Anomaly in Degrees C')
ax.bar(ds2_2.index, ds2_2['sst'],width=20,
       color=ds2_2.sign.map({True: 'r', False: 'b'}))
ax.grid(ls = 'dashed', axis = 'x')
ax.set_ylim(-2.0,2.0)
ax.axhline(0.5,linewidth=0.8,color='red')
ax.axhline(-0.5,linewidth=0.8,color='blue')
```

[144]:
```
<matplotlib.lines.Line2D at 0x1e5141822e0>
```





[147]:
```
#3.1
ds_3= xr.open_dataset("NOAA_NCDC_ERSST_v3b_SST.nc")
ds_3
```

[147]: xarray.Dataset

▸ Dimensions: (**lat**: 89, **lon**: 180, **time**: 684)

[147]:
```
#3.1
ds_3= xr.open_dataset("NOAA_NCDC_ERSST_v3b_SST.nc")
ds_3
```

[147]: xarray.Dataset

▸ Dimensions: (**lat**: 89, **lon**: 180, **time**: 684)

▾ Coordinates:

lat	(lat)	float32	-88.0 -86.0 -84.0 ... 86.0 88.0	
lon	(lon)	float32	0.0 2.0 4.0 ... 354.0 356.0 358.0	
time	(time)	datetime64[ns]	1960-01-15 ... 2016-12-15	

▾ Data variables:

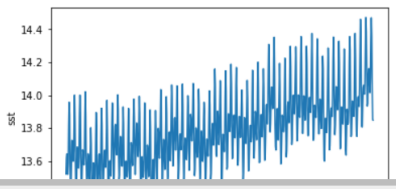
sst	(time, lat, lon)	float32	...

▾ Attributes:

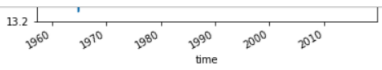
Conventions :	IRIDL
source :	https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCDC/.ERSST/.version3b/.sst/
history :	extracted and cleaned by Ryan Abernathey for Research Computing in Earth Science

[149]:
```
ds_3.sst.mean(dim=['lon','lat']).plot()
```

[149]:
```
[<matplotlib.lines.Line2D at 0x1e514a43760>]
```

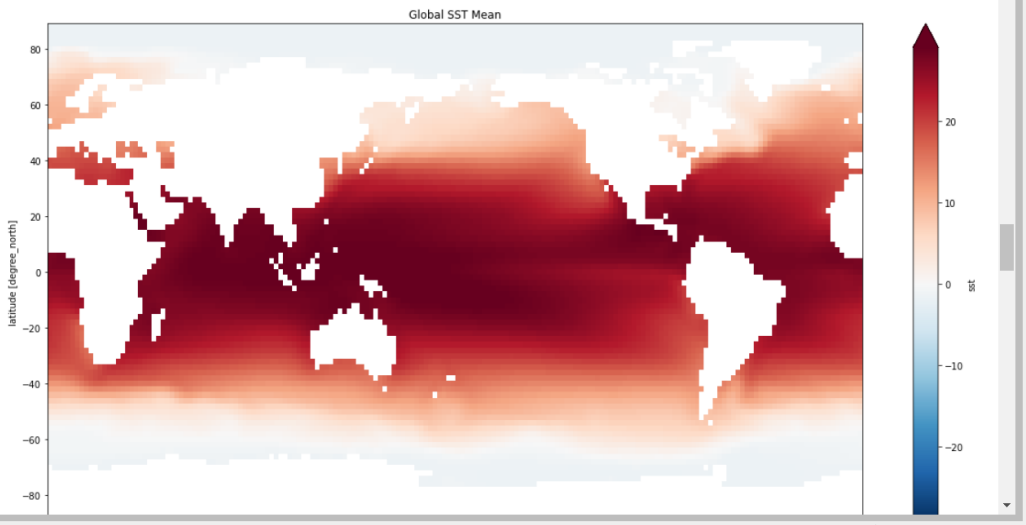


kernel) | Connecting Mode: Command Ln 1, Col 1 PS3.ipynb



[153]:
```
# 3.2
ds_3.sst.mean(dim=['time']).plot(robust=True, figsize=(20, 10))
plt.title('Global SST Mean')
```

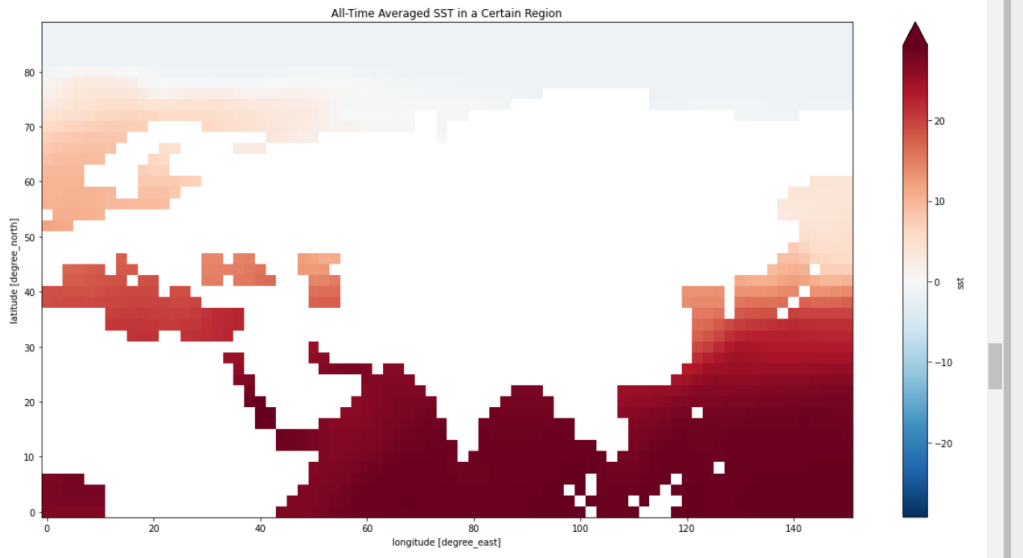
[153]: Text(0.5, 1.0, 'Global SST Mean')



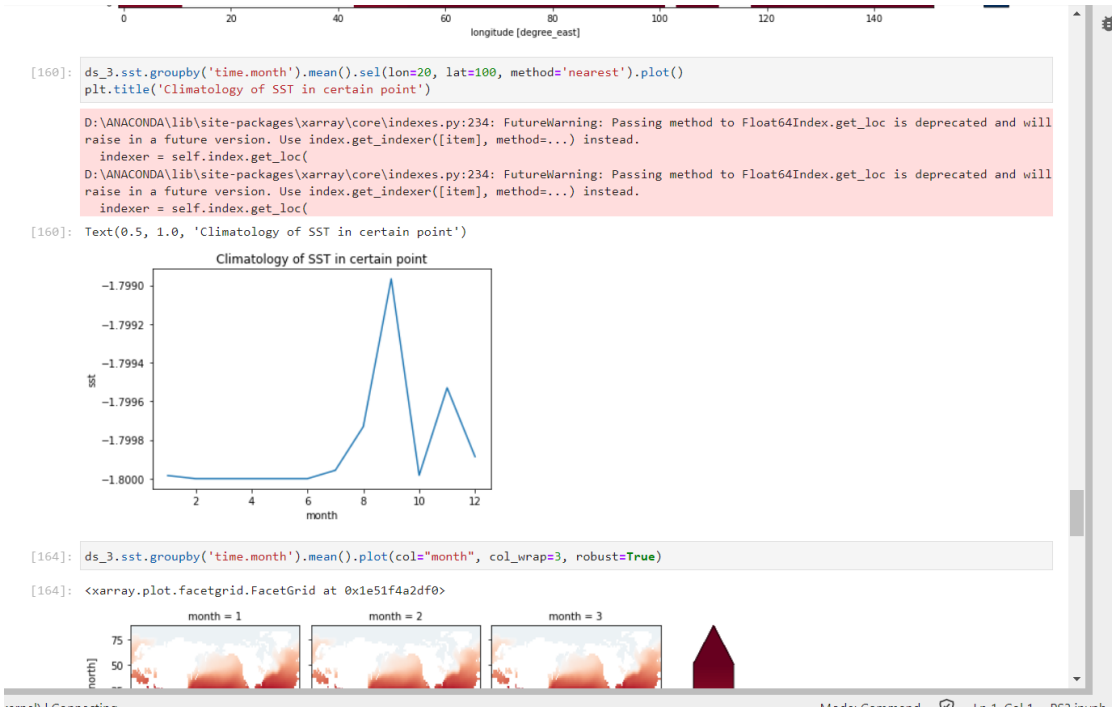
ykernel) | Connecting Mode: Command Ln 1, Col 1 PS3.ipyr

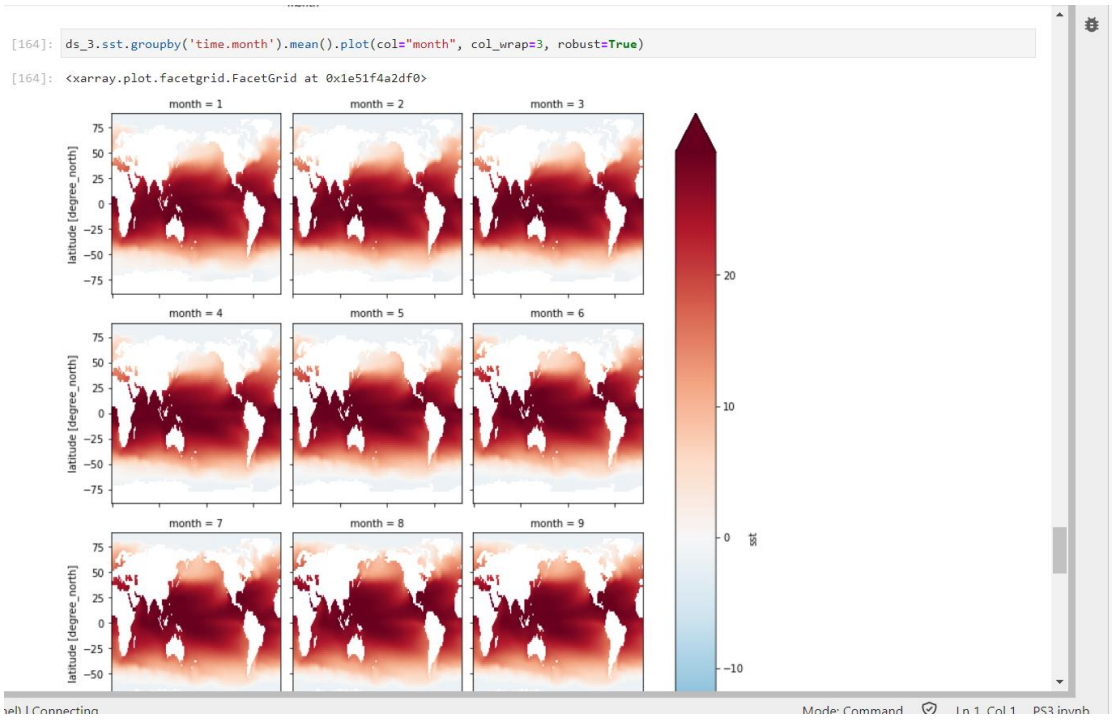
[154]:
```
ds_3.sst.mean(dim=['time']).sel(lon=slice(0,150),lat=slice(0,100)).plot(robust=True, figsize=(20, 10))
plt.title('All-Time Averaged SST in a Certain Region')
```

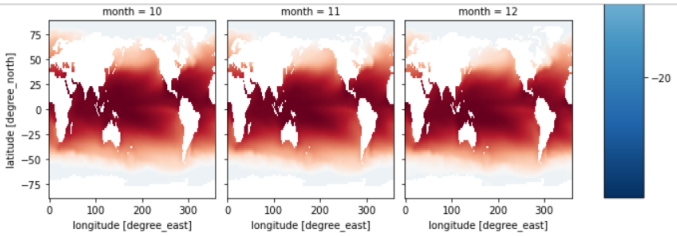
[154]: Text(0.5, 1.0, 'All-Time Averaged SST in a Certain Region')



[160]: ds_3.sst.groupby('time.month').mean().sel(lon=20, lat=100, method='nearest').plot()


0
20
40
60
80
100
120
140
longitude [degree_east]
[160]:
ds_3.sst.groupby('time.month').mean().sel(lon=20, lat=100, method='nearest').plot()
plt.title('Climatology of SST in certain point')
D:\ANACONDA\lib\site-packages\xarray\core\indexes.py:234: FutureWarning: Passing method to Float64Index.get_loc is deprecated and will raise in a future version. Use index.get_indexer([item], method=...) instead.
indexer = self.index.get_loc(
D:\ANACONDA\lib\site-packages\xarray\core\indexes.py:234: FutureWarning: Passing method to Float64Index.get_loc is deprecated and will raise in a future version. Use index.get_indexer([item], method=...) instead.
indexer = self.index.get_loc(
[160]:
Text(0.5, 1.0, 'Climatology of SST in certain point')
Climatology of SST in certain point
−1.7990
−1.7992
−1.7994
−1.7996
−1.7998
−1.8000
sst
2
4
6
8
10
12
month
[164]:
ds_3.sst.groupby('time.month').mean().plot(col="month", col_wrap=3, robust=True)
[164]:
<xarray.plot.facetgrid.FacetGrid at 0x1e51f4a2df0>
month = 1
month = 2
month = 3
75
50
north]


[164]:
ds_3.sst.groupby('time.month').mean().plot(col="month", col_wrap=3, robust=True)
[164]:
<xarray.plot.facetgrid.FacetGrid at 0x1e51f4a2df0>
month = 1
month = 2
month = 3
month = 4
month = 5
month = 6
month = 7
month = 8
month = 9
latitude [degree_north]
75
50
25
0
−25
−50
−75
20
10
0
−10
sst
Mode: Command
Ln 1, Col 1
PS3.ipynb

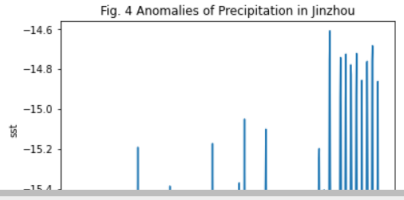


[170]:

```
# ds_3.sst.sel(lon=100,lat=150,method='nearest').plot()
subtract=ds_3.sst-ds_3.sst.mean()
subtract.sel(lon=130,lat=80,method='nearest').plot()
plt.title('Fig. 4 Anomalies of Precipitation in Jinzhou')
```

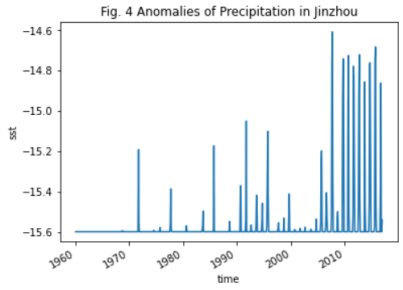
```
D:\ANACONDA\lib\site-packages\xarray\core\indexes.py:234: FutureWarning: Passing method to Float64Index.get_loc is deprecated and will
raise in a future version. Use index.get_indexer([item], method=...) instead.
  indexer = self.index.get_loc(
D:\ANACONDA\lib\site-packages\xarray\core\indexes.py:234: FutureWarning: Passing method to Float64Index.get_loc is deprecated and will
raise in a future version. Use index.get_indexer([item], method=...) instead.
  indexer = self.index.get_loc(
```

[170]: Text(0.5, 1.0, 'Fig. 4 Anomalies of Precipitation in Jinzhou')



[170]:

```
# ds_3.sst.sel(lon=100,lat=150,method='nearest').plot()
subtract=ds_3.sst-ds_3.sst.mean()
subtract.sel(lon=130,lat=80,method='nearest').plot()
plt.title('Fig. 4 Anomalies of Precipitation in Jinzhou')
```

```
D:\ANACONDA\lib\site-packages\xarray\core\indexes.py:234: FutureWarning: Passing method to Float64Index.get_loc is deprecated and will
raise in a future version. Use index.get_indexer([item], method=...) instead.
  indexer = self.index.get_loc(
D:\ANACONDA\lib\site-packages\xarray\core\indexes.py:234: FutureWarning: Passing method to Float64Index.get_loc is deprecated and will
raise in a future version. Use index.get_indexer([item], method=...) instead.
  indexer = self.index.get_loc(
```

[170]: Text(0.5, 1.0, 'Fig. 4 Anomalies of Precipitation in Jinzhou')