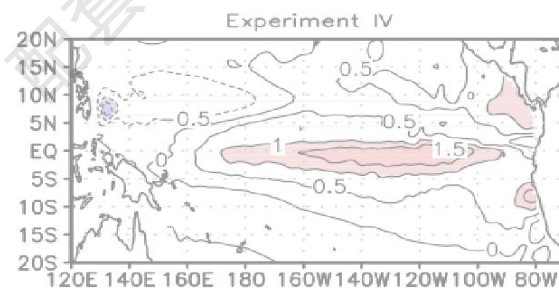
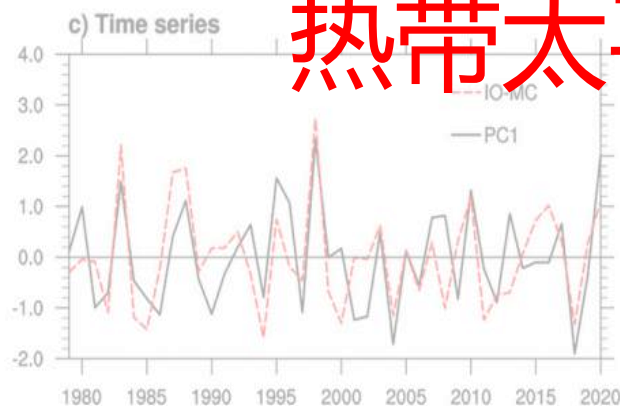
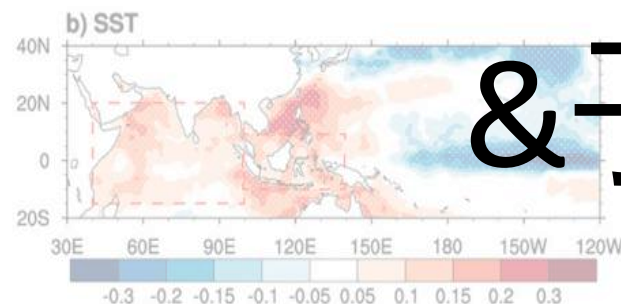
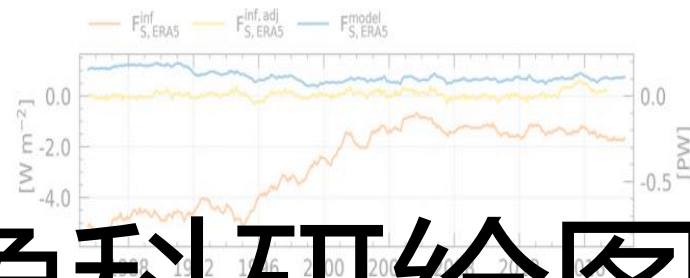


# 气象科研绘图2：一页多图 &子图布局 and 美化

热带太平洋区域海温(SST) EOF分析



python™



气象科研绘图1：把作业做成sci插图风格！

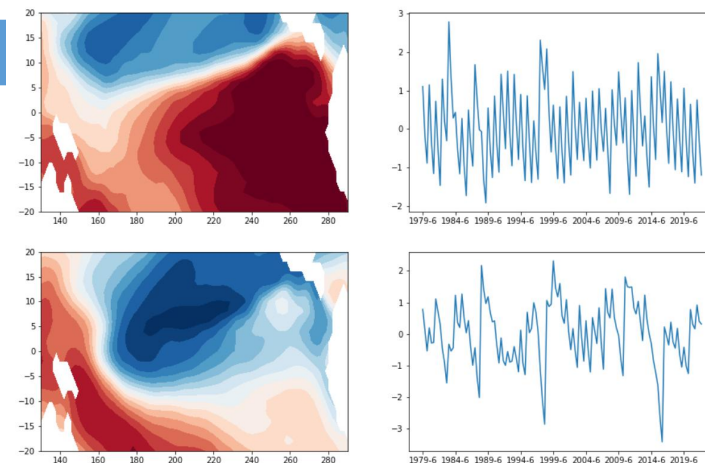
往期视频：Python期末考试

气象科研绘图2：一页多图&子图布局 and 美化

气象科研绘图3：地图叠加&cartopy基础应用

气象科研绘图4：等高线图contourf&colorbar

气象科研绘图5：折线图plot&时间序列处理



本期内容简介：（1）Python一页多图绘制方法 （2）子图布局 and 美化  
（3）修改&调整热带太平洋区域海温(SST) EOF分析 （4）获取代码&数据

本期所有内容均基于 **matplotlib**

配套教程视频·站【啵啵鼠宝】

# (1) Python一页多图绘制方法

配套教程视频：[Python一页多图绘制方法](#)【啾啾鼠宝】

- `plt.subplot()`或`fig.add_subplot()`
- `fig.add_axes()`

配套教程视频：b站【啵啵鼠宝】

# ➤ plt.subplot()

## matplotlib.pyplot.subplot

```
matplotlib.pyplot.subplot(*args, **kwargs) #
```

[\[source\]](#)

Add an Axes to the current figure or retrieve an existing Axes.

This is a wrapper of `Figure.add_subplot` which provides additional behavior when working with the implicit API (see the notes section).

Call signatures:

```
subplot(nrows, ncols, index, **kwargs)  
subplot(pos, **kwargs)  
subplot(**kwargs)  
subplot(ax)
```



行	列	索引	参数
subplot(nrows, ncols, index, **kwargs)			

subplot(nrows, ncols, index, \*\*kwargs)

## 行 列 索引

```
import matplotlib.pyplot as plt
```

导入plt

```
x = [i for i in range(5)]  
y = [i**2 for i in range(5)]
```

数据

```
fig = plt.figure(figsize=(8,8))
```

创建画布

```
ax1 = plt.subplot(2,2,1)  
ax1.plot(x,y)
```

图1

```
ax2 = plt.subplot(2,2,2)  
ax2.plot(x,y,c='k')
```

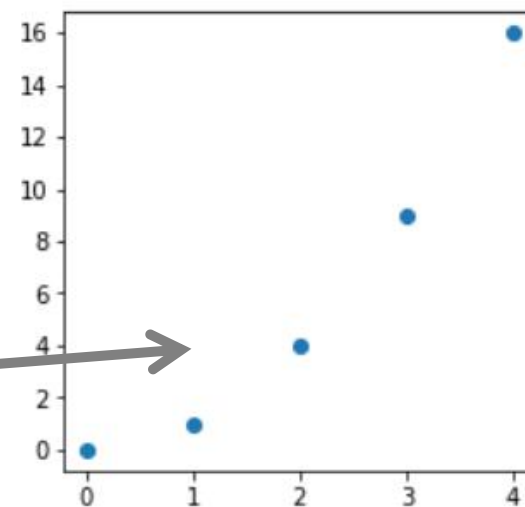
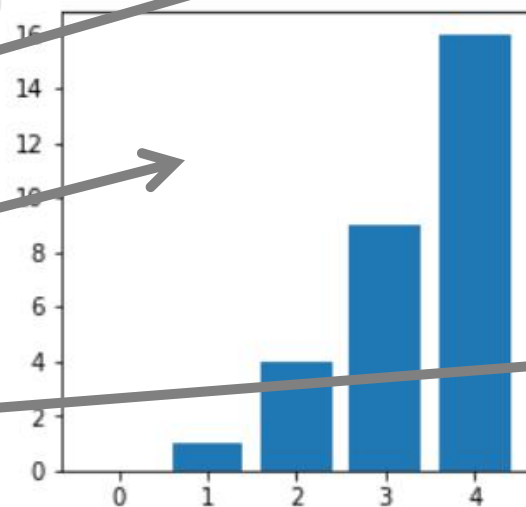
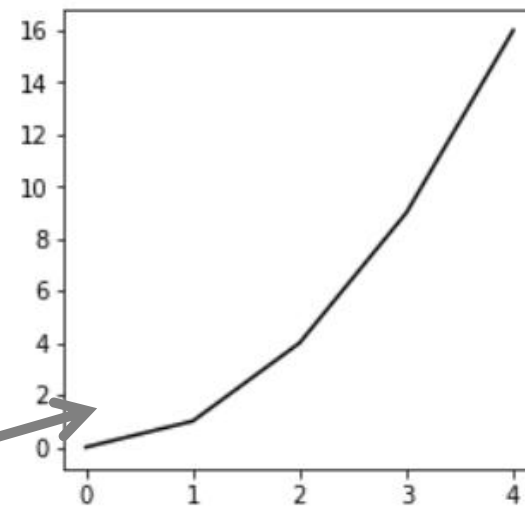
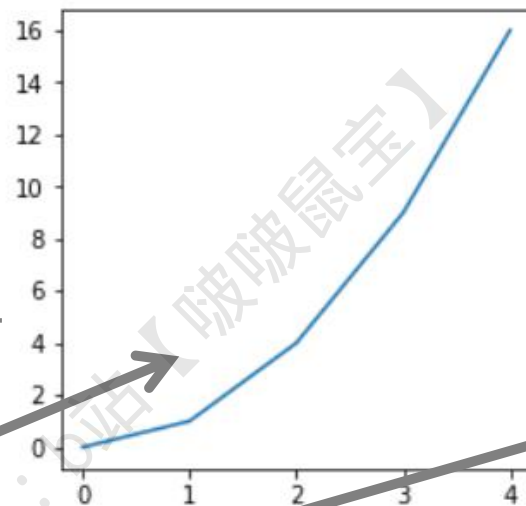
图2

```
ax3 = plt.subplot(2,2,3)  
ax3.bar(x,y)
```

图3

```
ax4 = plt.subplot(2,2,4)  
ax4.scatter(x,y)
```

图4



`subplot(nrows, ncols, index, **kwargs)`

把ax1和ax2看作 (2, 1, 1)

行 列 索引

```
import matplotlib.pyplot as plt
```

导入plt

```
x = [i for i in range(5)]
```

数据

```
y = [i**2 for i in range(5)]
```

```
fig = plt.figure(figsize=(8,8))
```

创建画布

```
ax1 = plt.subplot(2,2,1)
```

```
ax1.plot(x, y)
```

图1

```
ax2 = plt.subplot(2,2,2)
```

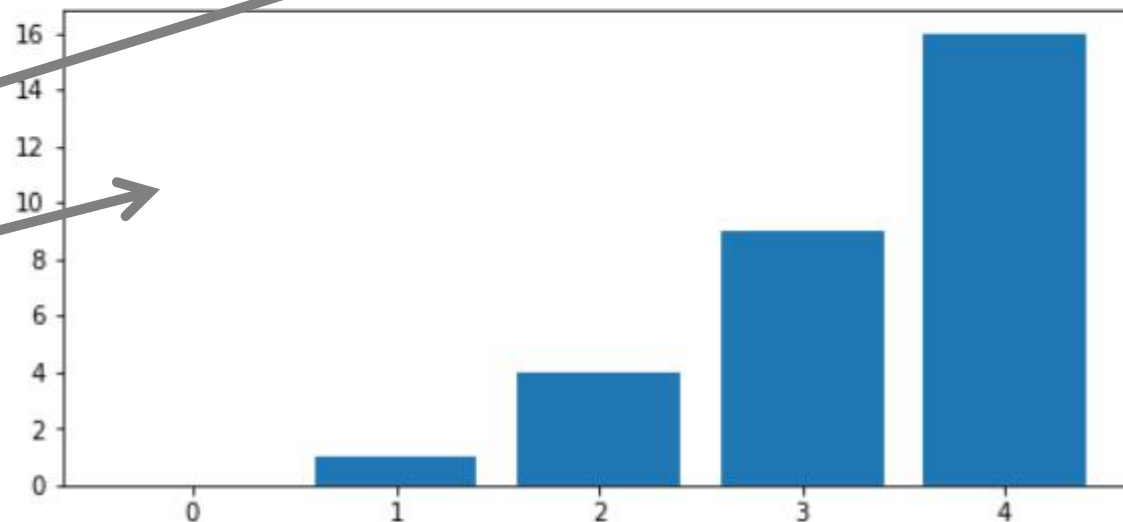
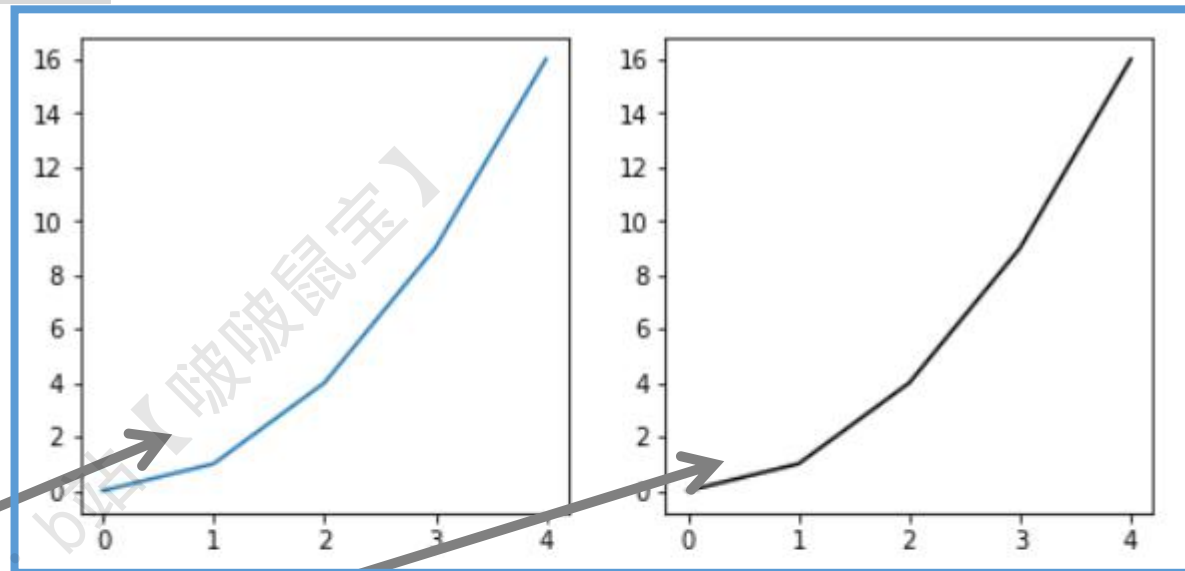
```
ax2.plot(x, y, c='k')
```

图2

```
ax3 = plt.subplot(2,1,2)
```

```
ax3.bar(x, y)
```

图3





## ➤ fig.add\_axes()

```
add_axes(*args, **kwargs) #
```

[\[source\]](#)

Add an Axes to the figure.

Call signatures:

```
add_axes(rect, projection=None, polar=False, **kwargs)  
add_axes(ax)
```



范围

投影类型

极坐标

参数

```
add_axes(rect, projection=None, polar=False, **kwargs)
```

`add_axes(rect, projection=None, polar=False, **kwargs)`

[左, 底, 宽, 高]

```
import matplotlib.pyplot as plt

x = [i for i in range(5)]
y = [i**2 for i in range(5)]

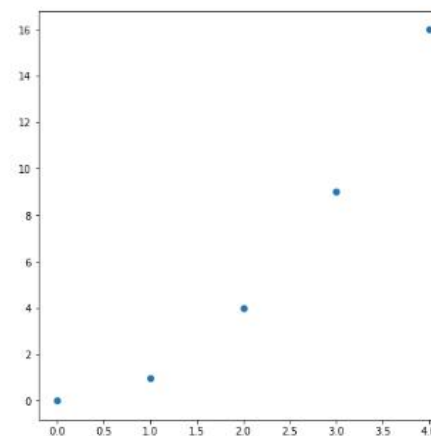
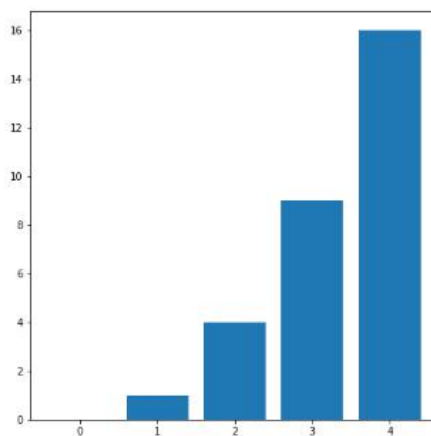
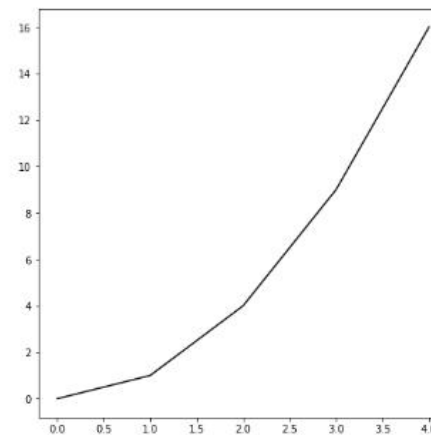
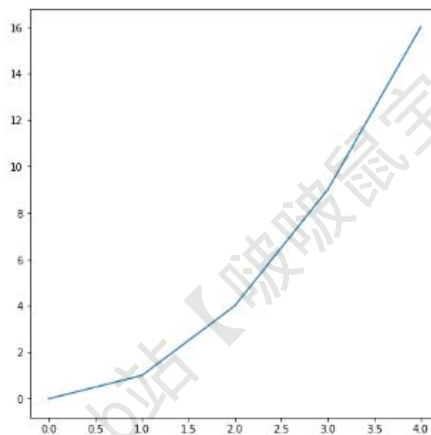
fig = plt.figure(figsize=(8,8))

ax1 = fig.add_axes([0, 1, 0.7, 0.7])
ax1.plot(x, y)

ax2 = fig.add_axes([1, 1, 0.7, 0.7])
ax2.plot(x, y, c='k')

ax3 = fig.add_axes([0, 0, 0.7, 0.7])
ax3.bar(x, y)

ax4 = fig.add_axes([1, 0, 0.7, 0.7])
ax4.scatter(x, y)
```



0

1

0

`add_axes(rect, projection=None, polar=False, **kwargs)`

投影类型，配合cartopy可画地图（下期视频内容）

```
import matplotlib.pyplot as plt

x = [i for i in range(5)]
y = [i**2 for i in range(5)]

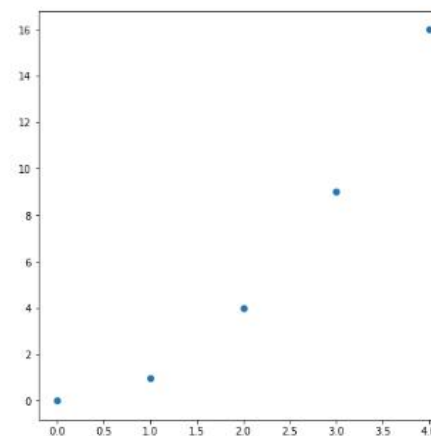
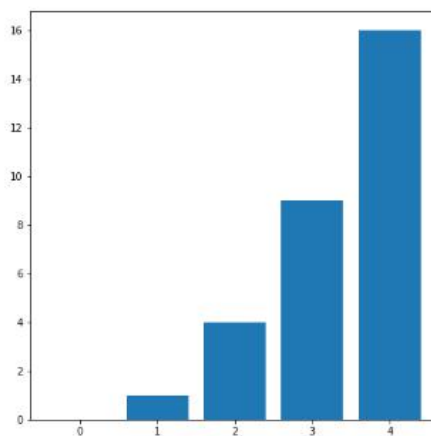
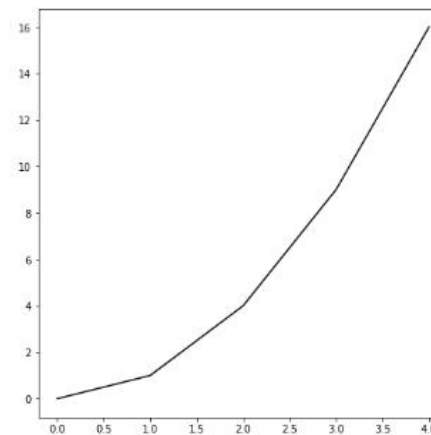
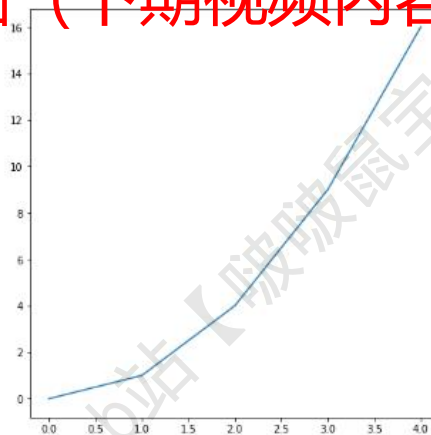
fig = plt.figure(figsize=(8,8))

ax1 = fig.add_axes([0,1,0.7,0.7])
ax1.plot(x,y)

ax2 = fig.add_axes([1,1,0.7,0.7])
ax2.plot(x,y,c='k')

ax3 = fig.add_axes([0,0,0.7,0.7])
ax3.bar(x,y)

ax4 = fig.add_axes([1,0,0.7,0.7])
ax4.scatter(x,y)
```



## 总结：

➤ `plt.subplot()`或`fig.add_subplot()`

适合：每个子图尺寸相同/成比例，方便快捷，参数简单

➤ `fig.add_axes()`

适合：对子图的位置&尺寸有要求/带地图

## (2) 子图布局 and 美化

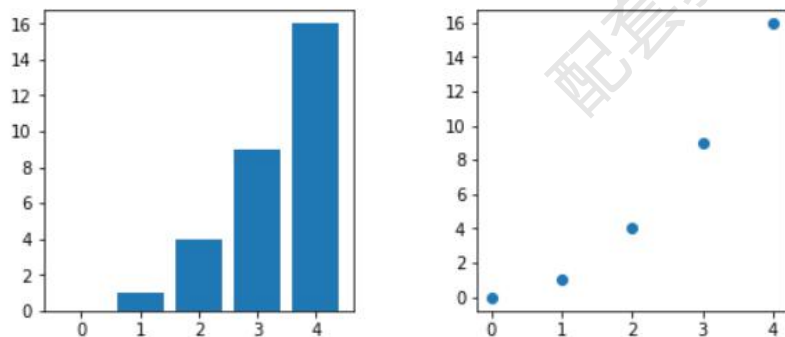
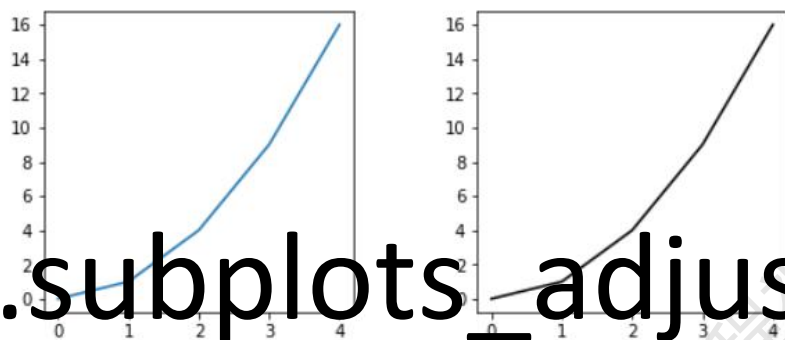
## 1) 子图间距

### ➤ plt.subplot()

```
subplots_adjust(left=None, bottom=None, right=None, top=None, wspace=None, hspace=None) #
```

```
plt.subplots_adjust(wspace=0.4, hspace=0.4)
```

# plt.subplots\_adjust()



### ➤ fig.add\_axes()

在画图的时候，直接设置子图的rect（范围）

# 以下内容在plt.subplot() & fig.add\_axes()通用

2) 主刻度(major)&副刻度(minor)设置

3) 刻度(ticks)&刻度标签(ticklabels)设置

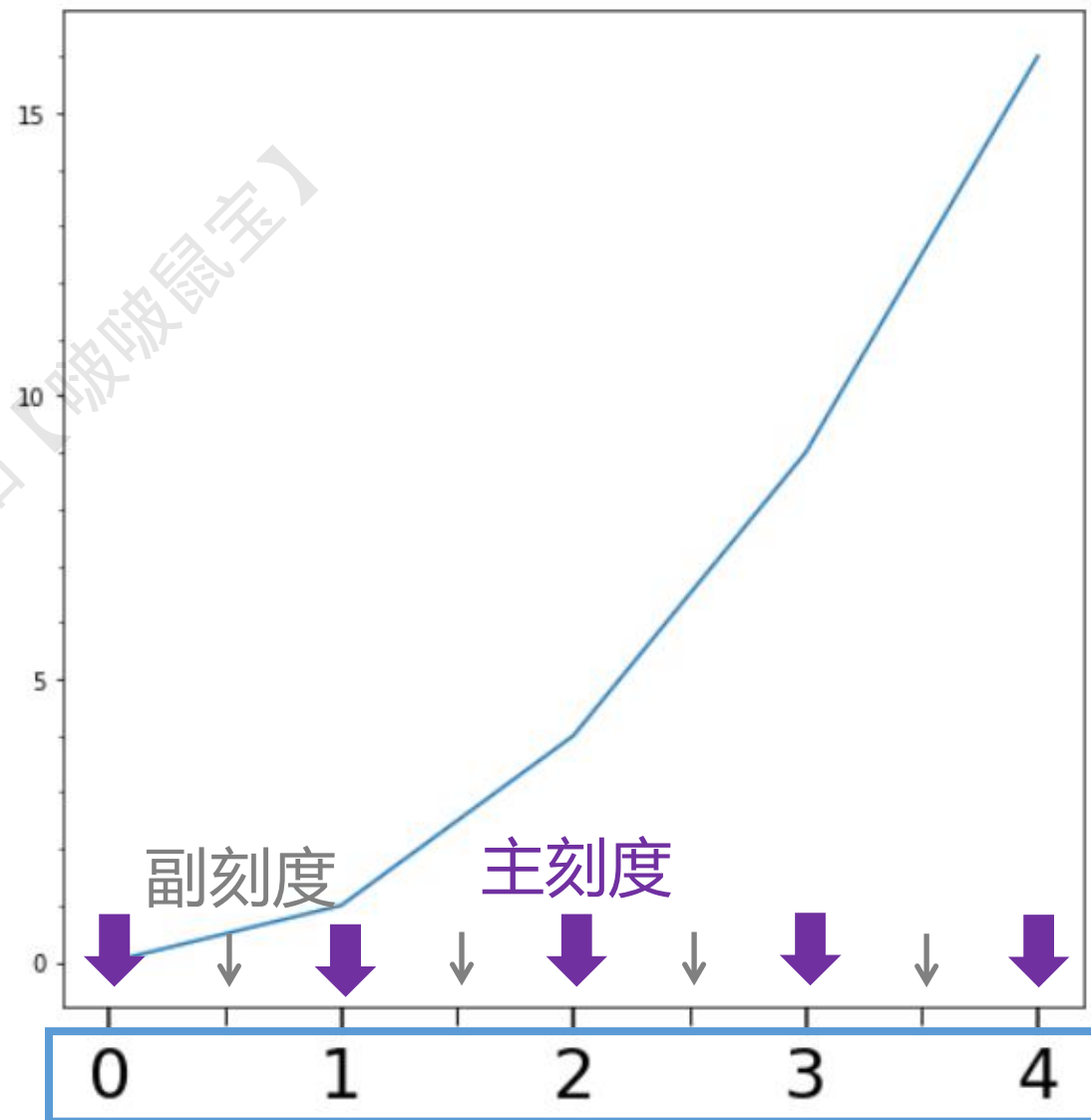
4) 子图标题(title)&总标题(sup title)设置

5) 图例(legend)设置-总图图例

## 2) 主刻度(major)&副刻度(minor)设置

主刻度：有刻度标签label的刻度  
副刻度：没有刻度标签label的刻度

刻度标签label





## 2) 主刻度(major)&副刻度(minor)设置

```
from matplotlib.pyplot import MultipleLocator
```

```
ax1.xaxis.set_major_locator(MultipleLocator(1))  
ax1.xaxis.set_minor_locator(MultipleLocator(0.5))  
ax1.yaxis.set_major_locator(MultipleLocator(5))  
ax1.yaxis.set_minor_locator(MultipleLocator(1))
```

```
ax1.tick_params(axis='x', which='major', direction='out', length=12, width=1.5, labelsz=30)  
ax1.tick_params(axis='x', which='minor', direction='out', length=8, width=1)
```

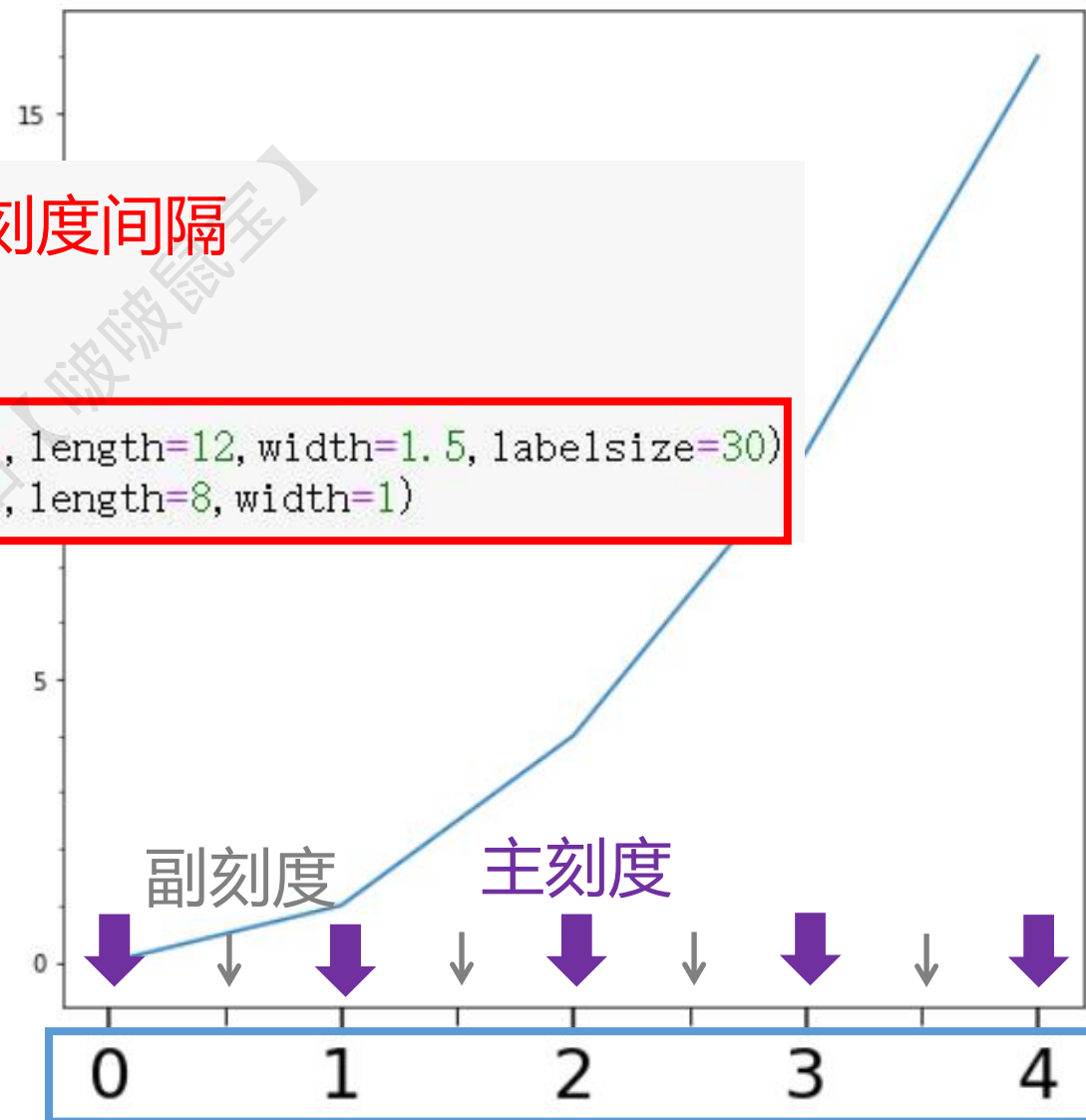
刻度间隔

刻度参数

主刻度：有刻度标签label的刻度

副刻度：没有刻度标签label的刻度

刻度标签label



### 3) 刻度(ticks)&刻度标签(ticklabels)设置

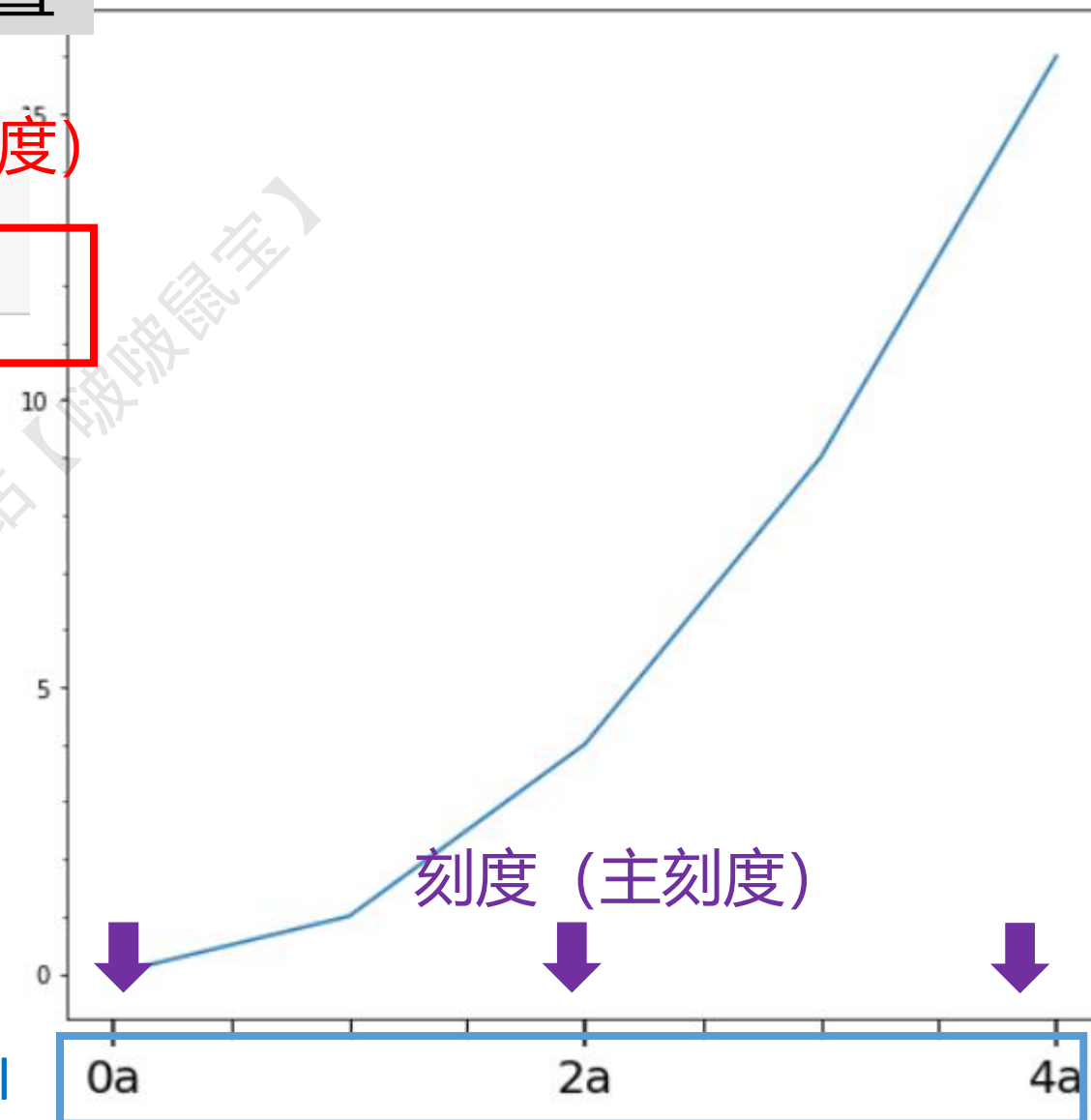
```
ax1.set_xticks([0, 2, 4])
```

刻度 (显示的主刻度)

```
ax1.set_xticklabels(['0a', '2a', '4a'], fontsize=20)
```

刻度标签

刻度标签label



## 4) 子图标题(title)&总标题(supitle)设置

```
ax1.set_title('ax1', fontsize=20)  
ax2.set_title('ax2', fontsize=20)  
ax3.set_title('ax3', fontsize=20)  
ax4.set_title('ax4', fontsize=20)
```

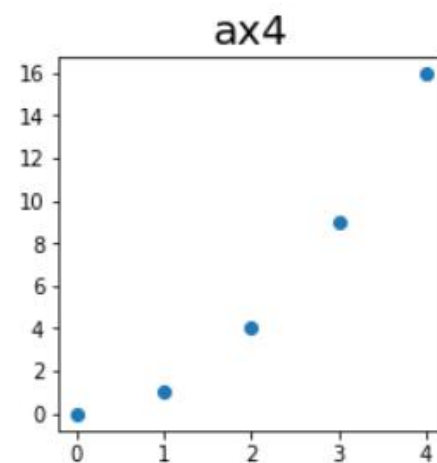
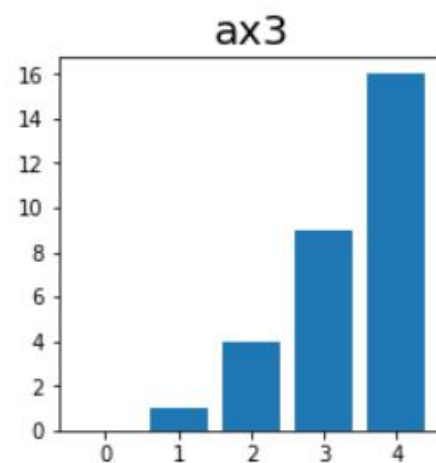
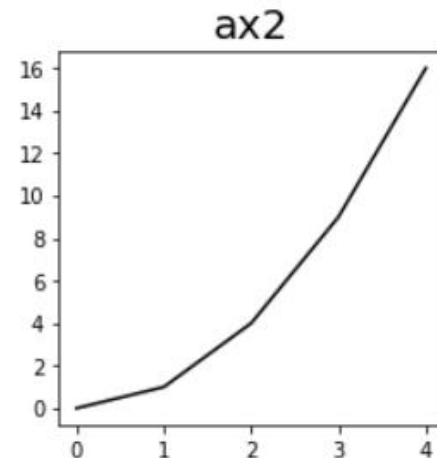
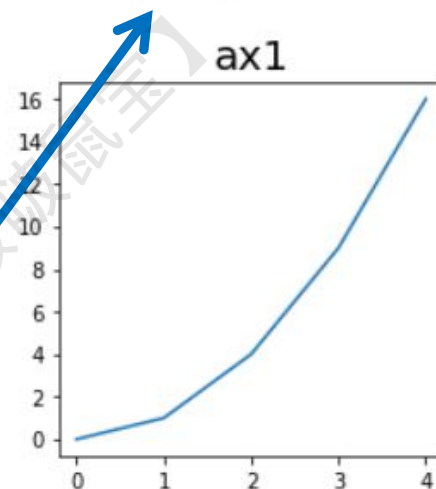
子图标题

```
fig.suptitle('My Figure', fontsize=25, x=0.25, y=1.0)
```

总标题

x, y参数决定标题在图中的位置

My Figure



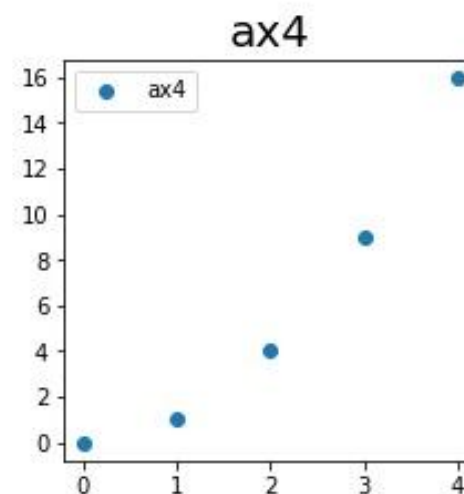
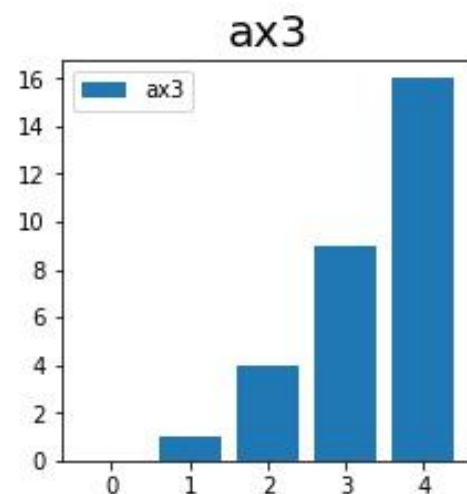
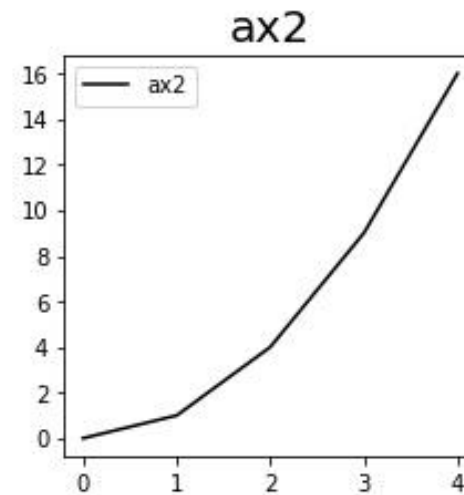
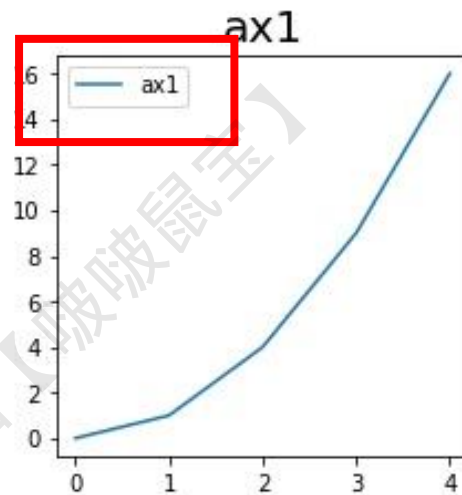
## 5) 图例(legend)设置-子图图例

```
ax1 = plt.subplot(2, 2, 1)
ax1.plot(x, y, label='ax1')
ax1.legend()
```

```
ax2 = plt.subplot(2, 2, 2)
ax2.plot(x, y, c='k', label='ax2')
ax2.legend()
```

.....

My Figure



## 5) 图例(legend)设置-总图图例

```
ax1 = plt.subplot(2, 2, 1)
ax1.plot(x, y, label='ax1')
```

```
ax2 = plt.subplot(2, 2, 2)
ax2.plot(x, y, c='k', label='ax2')
```

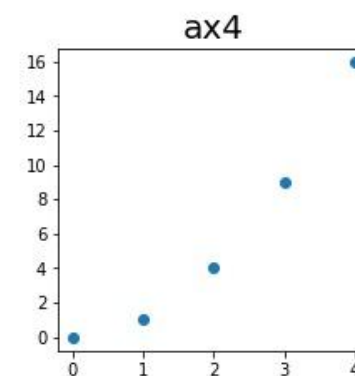
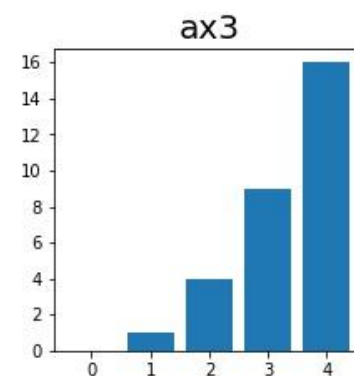
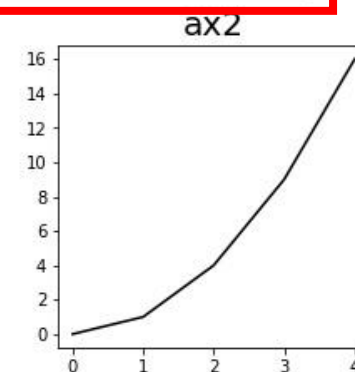
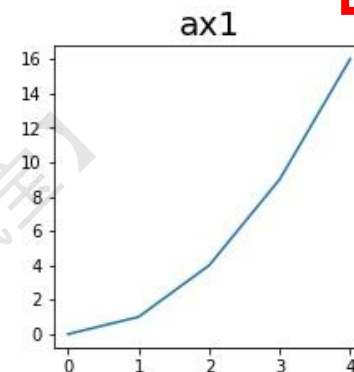
.....

```
fig.legend(bbox_to_anchor=[0.85, 1.05], fontsize=18, ncol=2)
```

位置

列数

My Figure



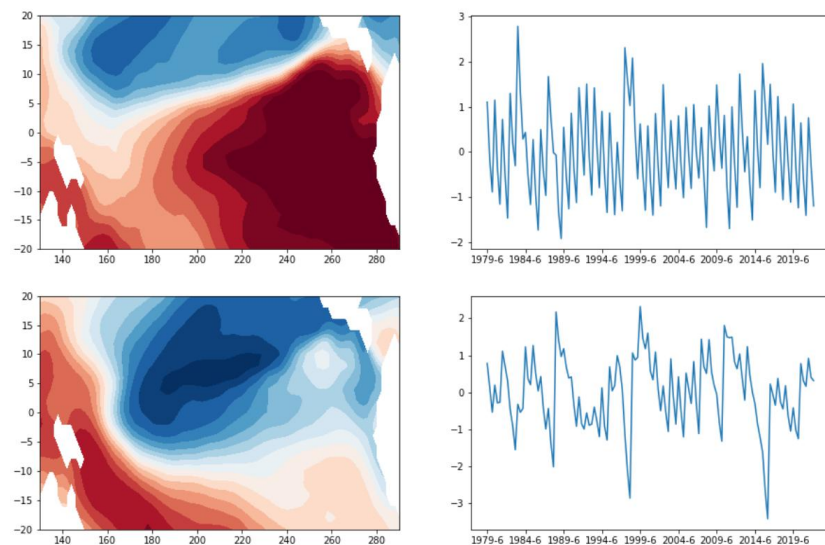
# 总结：

- (1) 分清fig（总图）和ax（子图）
- (2) 掌握子图间距、刻度、标题和图例的基本设置方法（至少是会搜索关键词）

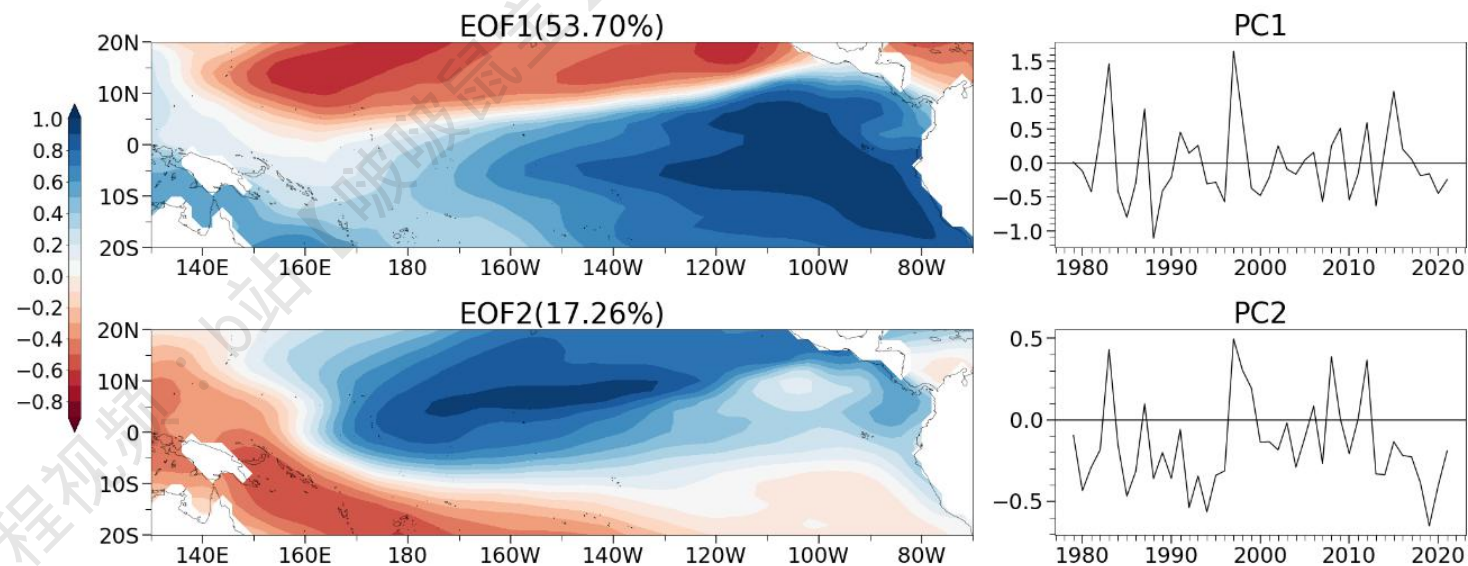
### (3) 修改&调整热带太平洋区域海温(SST) EOF分析

配套教程视频：【鼠宝】

# Before



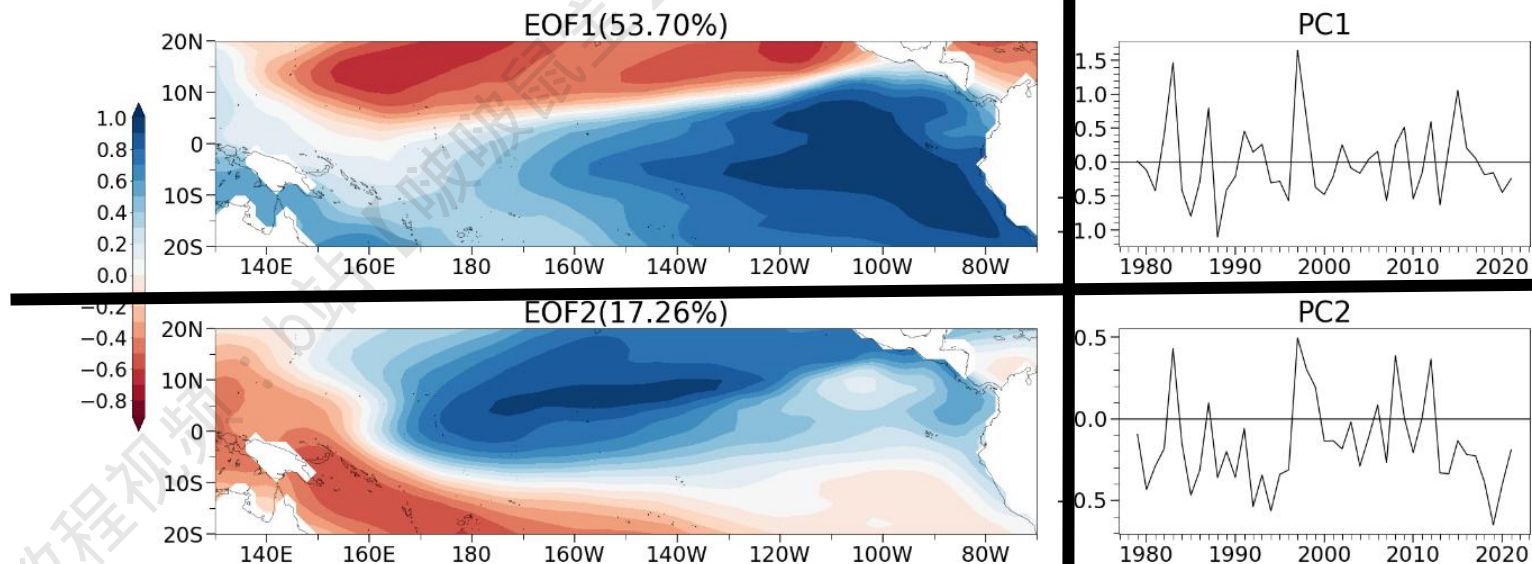
# After





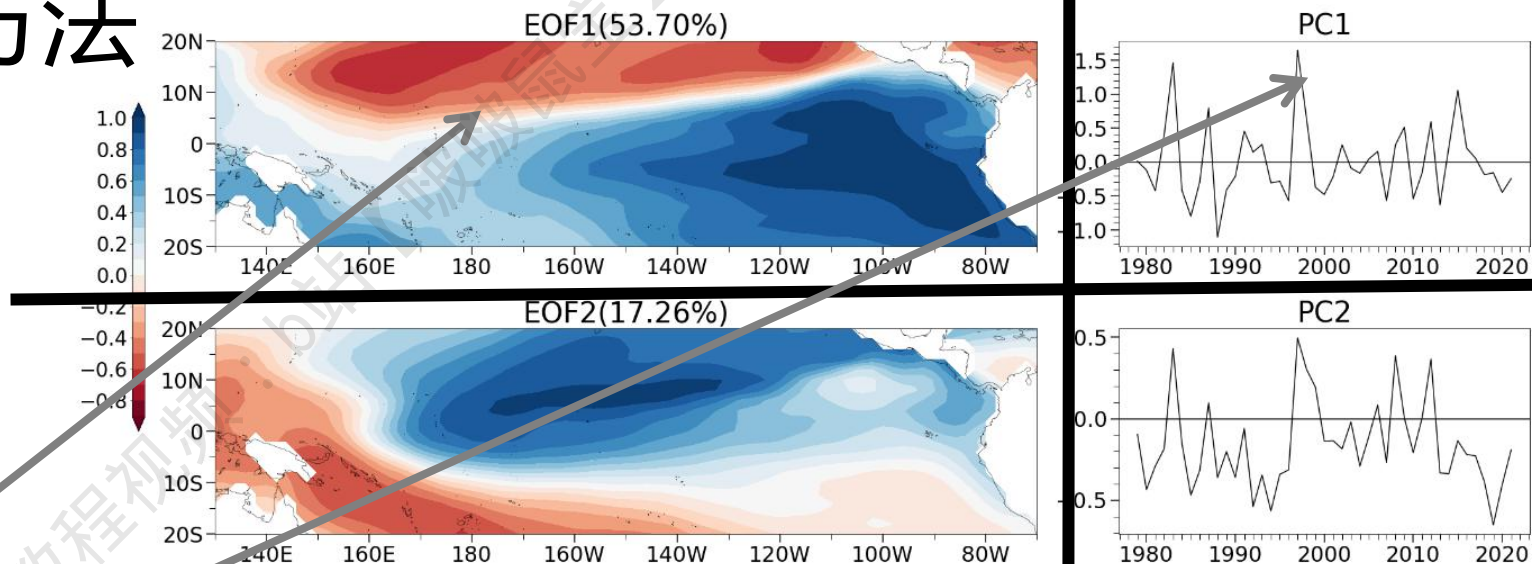
## 1) 创建子图

### 子图尺寸不规则/带地图



## 1) 创建子图

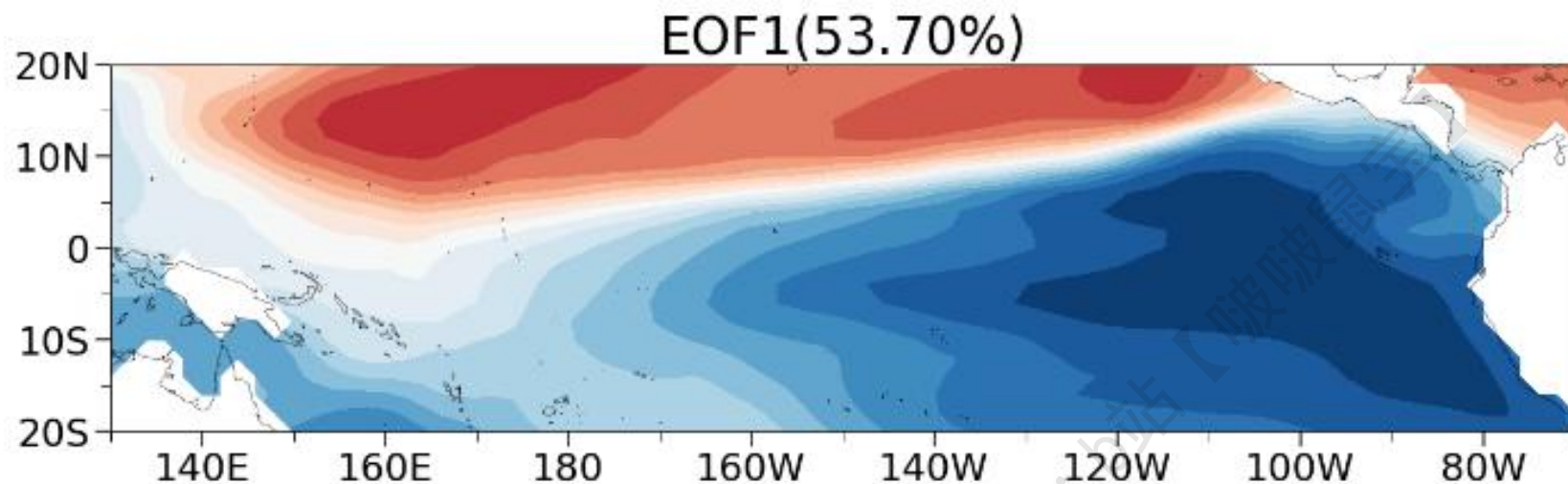
子图尺寸不规则/带地图  
→使用`fig.add_axes()`方法



```
ax1 = fig.add_axes([0, 0.7, 1, 1], projection=ccrs.PlateCarree(central_longitude=180))
```

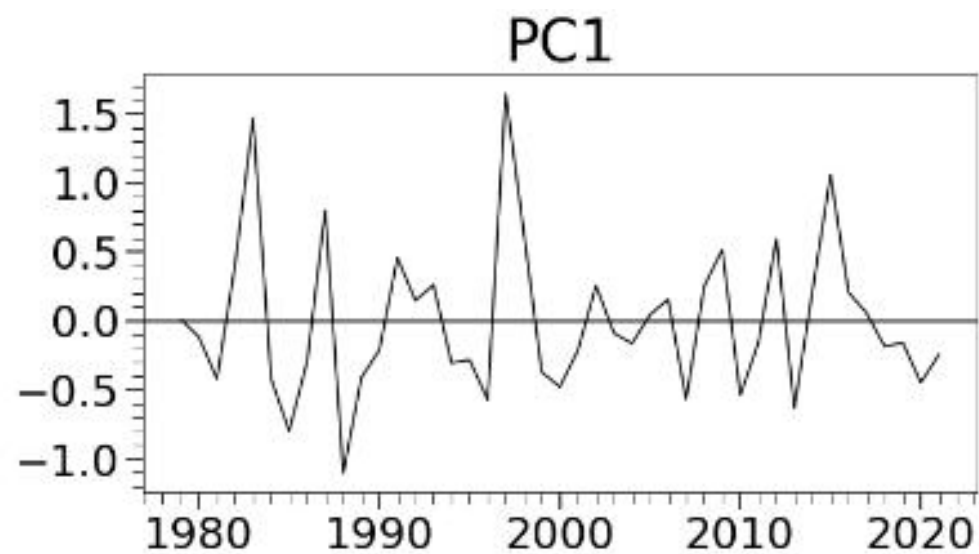
```
ax2 = fig.add_axes([1.1, 0.95, 0.5, 0.5])
```

## 2) 设置细节



```
ax1.set_xticks([-40, -20, 0, 20, 40, 60, 80, 100])
ax1.set_xticklabels(['140E', '160E', '180', '160W', '140W', '120W', '100W', '80W'], fontsize=30)
ax1.xaxis.set_minor_locator(MultipleLocator(10))
ax1.tick_params(axis='x', which='major', direction='out', length=12, width=1.5)
ax1.tick_params(axis='x', which='minor', direction='out', length=8, width=1)
ax1.set_yticks([-20, -10, 0, 10, 20])
ax1.set_yticklabels(['20S', '10S', '0', '10N', '20N'], fontsize=30)
ax1.yaxis.set_minor_locator(MultipleLocator(5))
ax1.tick_params(axis='y', which='major', direction='out', length=12, width=1.5)
ax1.tick_params(axis='y', which='minor', direction='out', length=8, width=1)
ax1.set_title('EOF1(53.70%)', fontsize=40)
```

## 2) 设置细节



```
ax2.xaxis.set_major_locator(MultipleLocator(10))
ax2.xaxis.set_minor_locator(MultipleLocator(1))
ax2.yaxis.set_major_locator(MultipleLocator(0.5))
ax2.yaxis.set_minor_locator(MultipleLocator(0.1))
ax2.tick_params(axis='x', which='major', direction='out', length=12, width=1.5, labelsz=30)
ax2.tick_params(axis='x', which='minor', direction='out', length=8, width=1)
ax2.tick_params(axis='y', which='major', direction='out', length=12, width=1.5, labelsz=30)
ax2.tick_params(axis='y', which='minor', direction='out', length=8, width=1)
ax2.set_title('PC1', fontsize=40)
```

## (4) 获取代码&数据

热带太平洋区域海温(SST) EOF分析

# 代码&数据获取方法

## 1.和鲸社区【啵啵鼠宝】

<https://www.heywhale.com/home/user/profile/61dd828ee0dd020017f5a7cc>

本期项目名称：《气象科研绘图1-5：把作业做成sci插图风格！》

气象科研绘图1-5：把作业做成sci插图风格！ 34 分钟前

Python数据分析和可视化，热带太平洋区域海温(SST) EOF分析，插图修改&美化



啵啵鼠宝

LV2

</> Python

🔖 0

👁 2

💬 0

气象

海洋

Python教程



## 2.github仓库【Boboshubao】

<https://github.com/orange-Nan/Boboshubao>

本期项目名称：《气象科研绘图1-5：把作业做成sci插图风格！》

1 repository result

orange-Nan/Boboshubao

气象&海洋数据分析与可视化

python

python3

meteorology

climatology

atmospheric-sciences

marine-science

Jupyter Notebook Updated 1 minute ago

orange-Nan Add files via upload 19aff90 now 12 commits

气象科研绘图1-5：把作业做成sci插... Add files via upload now

README.md Update README.md 2 hours ago

README.md

### 欢迎来到【啵啵鼠宝】的代码&数据仓库

视频版教程：b站【啵啵鼠宝】<https://space.bilibili.com/508439345>

图文版教程：和鲸社区【啵啵鼠宝】<https://www.heywhale.com/home/user/profile/61dd828ee0dd020017f5a7cc>

注意：由于本期数据过大，github提供的是裁剪过经纬度的【sst测试数据】，原数据请移步和鲸社区

# 代码&数据内容

- 课件：气象科研绘图1-5期ppt（.pdf文件）
- 图文版课件&代码：热带太平洋区域海温(SST) EOF分析.ipynb
- 代码：Before&After代码（.py文件）
- 数据：sstmnmean.nc/sst测试数据.zip

如果没法下载or找不到可以b站私信我QvQ

- 📄 After代码.py
- 📄 Before原始代码.py
- 📄 sst测试数据.zip
- 📄 本期的数据有点大没法上传至github，请移步【和鲸社区...】
- 📄 气象科研绘图1：把作业做成sci插图风格！.pdf
- 📄 热带太平洋区域海温(SST) EOF分析.ipynb