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In [16]: import matplotlib.pyplot as plt
import cartopy.crs as ccrs
import cartopy.feature as cfeature
import pandas as pd

#读取数据
data = pd.read_csv("usgs_earthquakes.csv")
#提取前50数据
top50 = data.sort_values("mag", ascending=False).head(50)

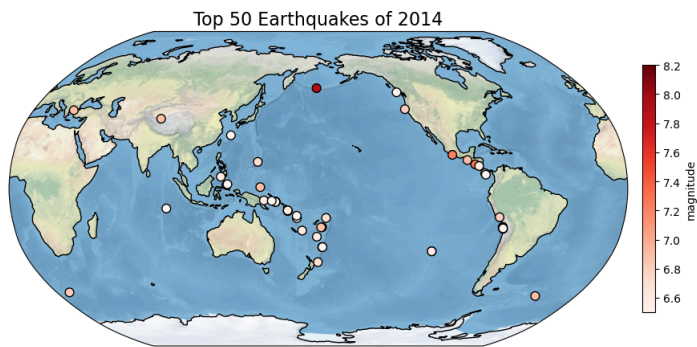
#设置画布
plt.figure(figsize=(12, 8))

#设置投影
ax = plt.axes(projection=ccrs.Robinson(central_longitude=180))
#添加背景, 来自gemini
ax.stock_img()
ax.coastlines()

#绘制散点
sc = ax.scatter(
    top50['longitude'],
    top50['latitude'],
    c=top50['mag'], #颜色根据震级
    cmap='Reds', #红色系
    s=60, #点的大小
    edgecolors='k', #黑色描边
    transform=ccrs.PlateCarree(),
    zorder=10
)

#添加图例
cbar = plt.colorbar(sc, orientation='vertical', pad=0.02, shrink=0.5)
cbar.set_label('magnitude')

plt.title('Top 50 Earthquakes of 2014', fontsize=16)
plt.show()
```



```
In [18]: #2.1

import matplotlib.pyplot as plt
import cartopy.crs as ccrs
import cartopy.feature as cfeature
import xarray as xr
import numpy as np

car = xr.open_dataset("CMSFluxOcean201001_202212_v3.nc", engine="netcdf4", decode_times=False)

#取时间平均值
data_to_plot = car['ocean_post'].mean(dim='time')

#设置画布
fig = plt.figure(figsize=(12, 8))

#设置投影
proj = ccrs.PlateCarree(central_longitude=180)
ax = plt.axes(projection=proj)

#绘制数据
plot = data_to_plot.plot.contourf(
    ax=ax,
    transform=ccrs.PlateCarree(),
    levels=20,
    cmap='RdBu_r',
    add_colorbar=False
)

#Masks/Features]设置陆地为灰色
ax.add_feature(cfeature.LAND, facecolor='lightgray', edgecolor='black', zorder=10)
ax.add_feature(cfeature.COASTLINE, linewidth=0.5, zorder=11)

#Gridlines]添加网格线
gl = ax.gridlines(draw_labels=True, linestyle='--', alpha=0.5, color='gray')
gl.top_labels = False
gl.right_labels = False

#Labels]
ax.set_xlabel("Longitude", fontsize=12)
ax.set_ylabel("Latitude", fontsize=12)

#Title]
plt.title("Global Ocean Carbon Flux (Average 2010-2022)", fontsize=16, pad=20)

#Colorbar]
cbar = plt.colorbar(plot, ax=ax, orientation='horizontal', pad=0.08, fraction=0.05)
cbar.set_label("Carbon Flux (gC/m²/day)", fontsize=10)

#Annotations] 添加箭头注释
ax.annotate('Equatorial Pacific',
    xy=(-150, 15),
    xycoords=ccrs.PlateCarree().as_mpl_transform(ax),
    xytext=(-120, -25),
    textcoords=ccrs.PlateCarree().as_mpl_transform(ax),
    arrowprops=dict(facecolor='black', shrink=0.05, width=2, headwidth=10),
    zorder=20, color='black', fontsize=12, fontweight='bold')

#Text Box]
textstr = "Data Source: CMS Ocean Flux Range: 2010-2022"

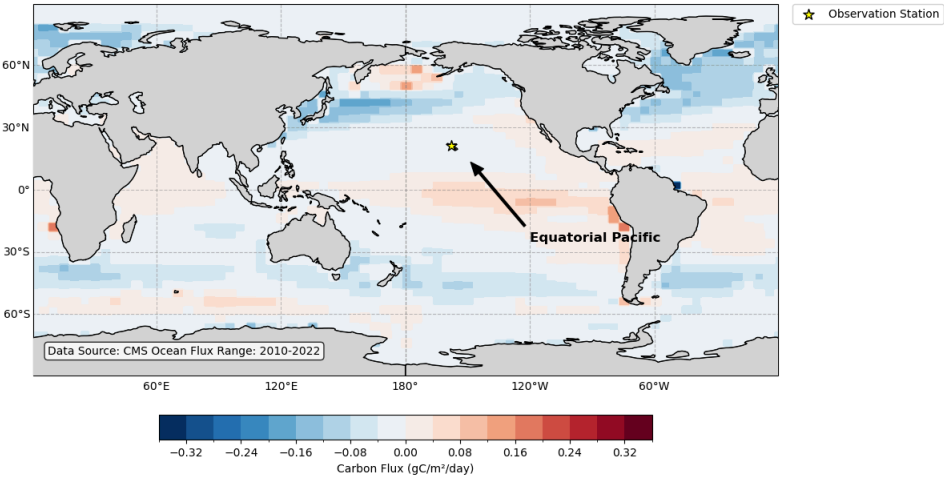
props = dict(boxstyle='round', facecolor='white', alpha=0.8)
ax.text(0.02, 0.05, textstr, transform=ax.transAxes, fontsize=10,
    verticalalignment='bottom', bbox=props, zorder=20)

#Legend]
ax.scatter(-158, 21, color='yellow', s=100, marker='*', transform=ccrs.PlateCarree(),
    label='Observation Station', zorder=20, edgecolor='black')

#将图例放在外面, 防止遮挡
ax.legend(loc='upper left', bbox_to_anchor=(1.02, 1), borderaxespad=0)

plt.show()
```

Global Ocean Carbon Flux (Average 2010-2022)



```
In [20]: #2.2

data_to_plot = car['ocean_post'].mean(dim='time')

#创建画布
fig = plt.figure(figsize=(10, 8))

#设置墨卡托投影: 来自gemini
proj = ccrs.Mercator()
ax = plt.axes(projection=proj)

#设置显示的区域范围
ax.set_extent([-90, -10, 15, 60], crs=ccrs.PlateCarree())

#画图
plot = data_to_plot.plot.contourf(
    ax=ax,
    transform=ccrs.PlateCarree(),
    levels=25,
    cmap='RdBu_r',
    add_colorbar=False
)

#Masks or Features
ax.add_feature(cfeature.LAND, facecolor='wheat', edgecolor='black', zorder=10)
ax.add_feature(cfeature.COASTLINE, linewidth=0.8, zorder=11)
ax.add_feature(cfeature.BORDERS, linestyle=':', zorder=11)

#GridLines
gl = ax.gridlines(draw_labels=True, linestyle='--', alpha=0.5, color='gray', zorder=12)
gl.top_labels = False
gl.right_labels = False
gl.xlabel_style = {'size': 10}
gl.ylabel_style = {'size': 10}

#X/Y Labels
ax.text(-0.07, 0.55, 'Latitude', va='bottom', ha='center',
        rotation='vertical', rotation_mode='anchor',
        transform=ax.transAxes, fontsize=12)
ax.text(0.5, -0.07, 'Longitude', va='bottom', ha='center',
        rotation='horizontal', rotation_mode='anchor',
        transform=ax.transAxes, fontsize=12)

#Title
plt.title("Regional Analysis: North Atlantic Carbon Flux", fontsize=15, pad=15)

#Colorbar
cbar = plt.colorbar(plot, ax=ax, orientation='vertical', pad=0.02, shrink=0.8)
cbar.set_label("Carbon Flux (gC/m²/day)", fontsize=10)

#Annotations
annotation_text = "Gulf Stream Region"
ax.annotate(annotation_text,
            xy=(-62, 30),
            xycoords=ccrs.PlateCarree().as_mpl_transform(ax),
            xytext=(-50, 25),
            textcoords=ccrs.PlateCarree().as_mpl_transform(ax),
            arrowprops=dict(facecolor='black', shrink=0.05, width=1),
            zorder=20, color='darkblue', fontsize=10, fontweight='bold')

#Text Box
textstr = "Region: North Atlantic Scale: Regional View"
props = dict(boxstyle='square', facecolor='white', alpha=0.9)
ax.text(0.02, 0.95, textstr, transform=ax.transAxes, fontsize=10,
        verticalalignment='top', bbox=props, zorder=20)

#Legend
ax.scatter(-64, 32, color='red', s=80, marker='^', transform=ccrs.PlateCarree(),
            label='Bermuda Station', zorder=20, edgecolor='black')
ax.legend(loc='upper right')

plt.show()
```

Regional Analysis: North Atlantic Carbon Flux

