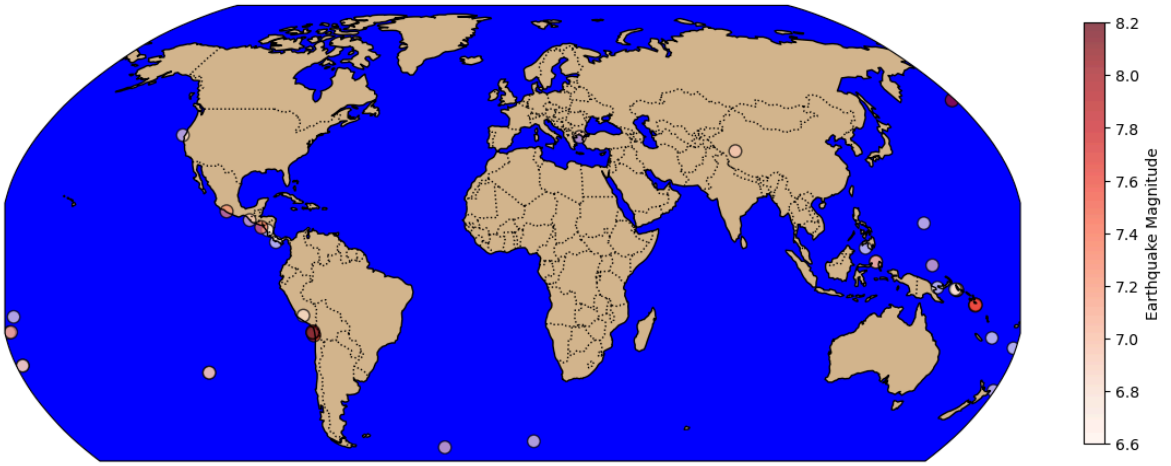
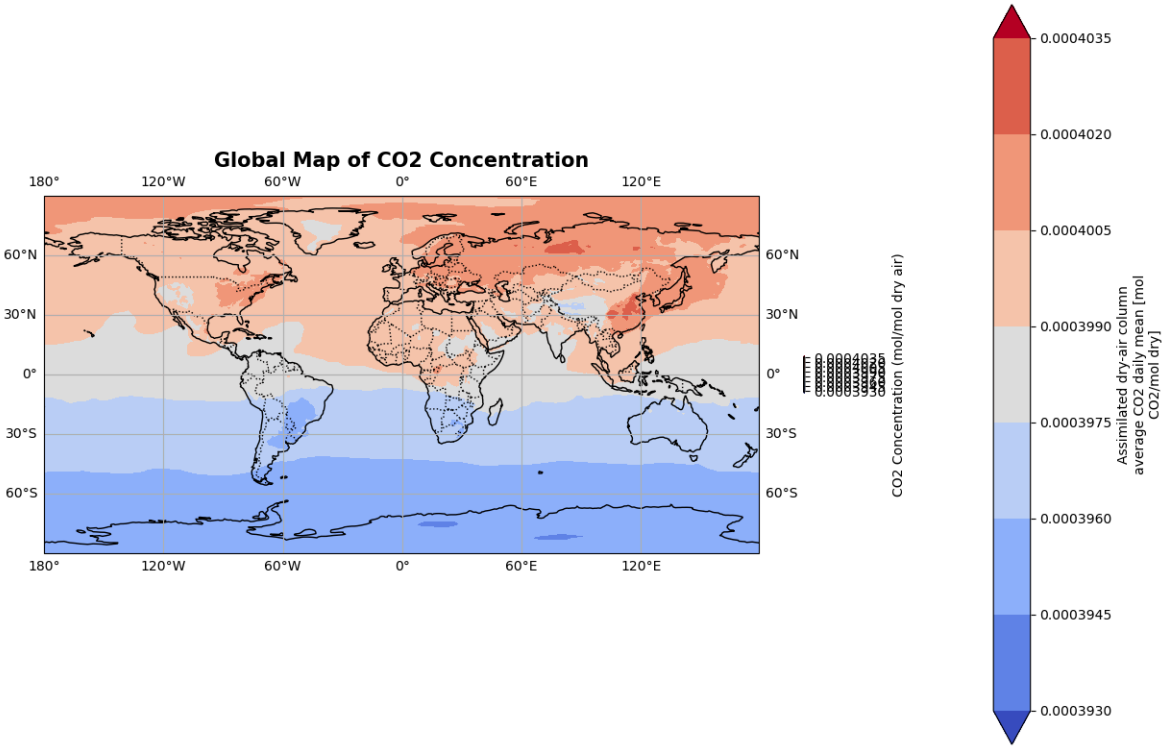
In [3]:
```
#1 In this problem set, we will use this file from the USGS Earthquakes Database
import pandas as pd
import matplotlib.pyplot as plt
import cartopy.crs as ccrs
import cartopy.feature as cfeature

# 读取地震数据
file_path = 'D:/GitKraken/ese5023/assignment/assignment4/usgs_earthquakes.csv'
df = pd.read_csv(file_path)

# 筛选震级在6.6到8.2之间的地震数据
df_filtered = df[(df['mag'] >= 6.6) & (df['mag'] <= 8.2)]

# 创建地图
fig, ax = plt.subplots(figsize=(15, 10), subplot_kw={'projection': ccrs.Robinson

# 设置地图的显示范围，这里以非洲、亚洲和美洲为中心
ax.set_extent([-180, 180, -60, 90], crs=ccrs.PlateCarree())

# 添加国家边界和海岸线
ax.add_feature(cfeature.BORDERS, linestyle=':')
ax.add_feature(cfeature.COASTLINE)

# 添加彩色的海洋和陆地
ax.add_feature(cfeature.OCEAN, facecolor='blue')
ax.add_feature(cfeature.LAND, facecolor='tan')

# 绘制地震点
scatter = ax.scatter(
    df_filtered['longitude'], df_filtered['latitude'],
    c=df_filtered['mag'],  # 颜色由震级决定
    s=(df_filtered['mag']*10),  # 点的大小由震级决定，这里乘以10以便更明显
    cmap='Reds',  # 使用红色系颜色映射
    alpha=0.7,  # 透明度
    edgecolor='black',  # 点的边缘颜色
    transform=ccrs.PlateCarree()  # 坐标转换
)

# 添加颜色条
cbar = plt.colorbar(scatter, ax=ax, orientation='vertical', shrink=0.5, pad=0.05
cbar.set_label('Earthquake Magnitude')

# 显示地图
plt.show()
```

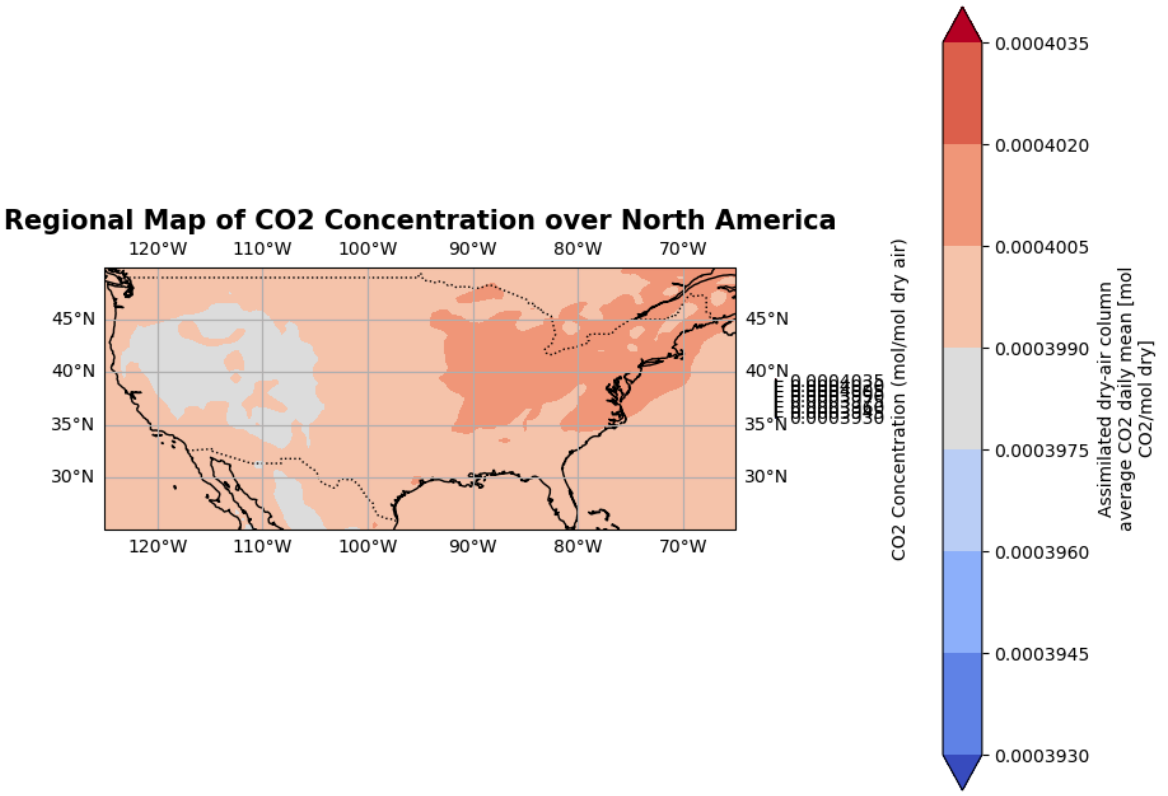


In [5]:
```
#2Explore a netCDF dataset
#2.1  Make a global map of a certain variable. Your figure should contain: a pro
import xarray as xr
import matplotlib.pyplot as plt
import cartopy.crs as ccrs
import cartopy.feature as cfeature

# 加载 NetCDF 文件
file_path = r'D:\GitKraken\ese5023\assignment\assignment4\output_file\oco2_GEOS_
ds = xr.open_dataset(file_path)

# 选择变量，并选择时间的第一个切片
variable = ds['XCO2'].sel(time=ds['time'].values[0])

# 创建地图
fig, ax = plt.subplots(figsize=(15, 10), subplot_kw={'projection': ccrs.PlateCar

# 绘制变量
contourf = variable.plot.contourf(ax=ax, cmap='coolwarm', extend='both', transfo

# 添加特征：海岸线、国家边界、陆地和海洋
ax.coastlines()
ax.add_feature(cfeature.BORDERS, linestyle=':')
ax.add_feature(cfeature.LAND, facecolor='tan')
ax.add_feature(cfeature.OCEAN, facecolor='skyblue')

# 添加网格线
ax.gridlines(draw_labels=True, dms=True, x_inline=False, y_inline=False)

# 添加颜色条
cbar = plt.colorbar(contourf, ax=ax, orientation='vertical', shrink=0.05, aspect
cbar.set_label('CO2 Concentration (mol/mol dry air)')

# 添加标题
ax.set_title('Global Map of CO2 Concentration', fontsize=15, fontweight='bold')

# 添加坐标轴标签
ax.set_xlabel('Longitude', fontsize=12)
ax.set_ylabel('Latitude', fontsize=12)

# 显示地图
plt.show()
```



In [7]:
```
#2.2Make a regional map of the same variable. Your figure should contain: a diff
import xarray as xr
import matplotlib.pyplot as plt
import cartopy.crs as ccrs
import cartopy.feature as cfeature

# 加载 NetCDF 文件
file_path = r'D:\GitKraken\ese5023\assignment\assignment4\output_file\oco2_GEOS_
ds = xr.open_dataset(file_path)

# 选择变量，并选择时间的第一个切片
variable = ds['XCO2'].sel(time=ds['time'].values[0])

# 创建区域地图
fig, ax = plt.subplots(figsize=(10, 8), subplot_kw={'projection': ccrs.PlateCarr

# 设置区域地图的经纬度范围，这里以北美洲为例
ax.set_extent([-125, -65, 25, 50], crs=ccrs.PlateCarree())

# 绘制变量
contourf = variable.plot.contourf(ax=ax, cmap='coolwarm', extend='both', transfo

# 添加特征：海岸线、国家边界、陆地和海洋
ax.coastlines()
ax.add_feature(cfeature.BORDERS, linestyle=':')
ax.add_feature(cfeature.LAND, facecolor='tan')
ax.add_feature(cfeature.OCEAN, facecolor='skyblue')

# 添加网格线
ax.gridlines(draw_labels=True, dms=True, x_inline=False, y_inline=False)

# 添加颜色条
cbar = plt.colorbar(contourf, ax=ax, orientation='vertical', shrink=0.05, aspect
cbar.set_label('CO2 Concentration (mol/mol dry air)')

# 添加标题
```

```
ax.set_title('Regional Map of CO2 Concentration over North America', fontsize=15

# 添加坐标轴标签
ax.set_xlabel('Longitude', fontsize=12)
ax.set_ylabel('Latitude', fontsize=12)

# 添加注释和文本框（如果需要）
# ax.text(-100, 35, 'North America', transform=ccrs.Geodetic(), fontsize=12, bbo

# 显示地图
plt.show()
```



In [ ]: