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Installing netCDF4 for utilizing netCDF

```
!pip install netCDF4
```

```
Collecting netCDF4
  Downloading netCDF4-1.7.2-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (1.8 kB)
Collecting cftime (from netCDF4)
  Downloading cftime-1.6.4.post1-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (8.7 kB)
Requirement already satisfied: certifi in /usr/local/lib/python3.10/dist-packages (from netCDF4) (2024.12.14)
Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-packages (from netCDF4) (1.26.4)
Downloading netCDF4-1.7.2-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (9.1 MB)
 9.1/9.1 MB 25.7 MB/s eta 0:00:00
Downloading cftime-1.6.4.post1-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (1.3 MB)
 1.3/1.3 MB 31.1 MB/s eta 0:00:00
Installing collected packages: cftime, netCDF4
Successfully installed cftime-1.6.4.post1 netCDF4-1.7.2
```

Importing Dataset from netCDF4

```
from netCDF4 import Dataset
```

Defining path of original file

```
file_path = '/content/chirps-v2.0.annual.nc' #netCDF file link
nc_file = Dataset(file_path, mode='r')
```

Checking the structure of the file

```
print(nc_file)
```

```
<class 'netCDF4.Dataset'>
root group (NETCDF4 data model, file format HDF5):
  Conventions: CF-1.6
  title: CHIRPS Version 2.0
  history: created by Climate Hazards Group
  version: Version 2.0
  date_created: 2024-01-11
  creator_name: Pete Peterson
  creator_email: pete@geog.ucsb.edu
  institution: Climate Hazards Group. University of California at Santa Barbara
  documentation: http://pubs.usgs.gov/ds/832/
  reference: Funk, C.C., Peterson, P.J., Landsfeld, M.F., Pedreros, D.H., Verdin, J.P., Rowland, J.D., Romero, B.E., Husak, G.J., Mich
  comments: time variable denotes the first day of the given year.
  acknowledgements: The Climate Hazards Group InfraRed Precipitation with Stations development process was carried out through U.S. Ge
  ftp_url: ftp://chg-ftpout.geog.ucsb.edu/pub/org/chg/products/CHIRPS-latest/
  website: http://chg.geog.ucsb.edu/data/chirps/index.html
  faq: http://chg-wiki.geog.ucsb.edu/wiki/CHIRPS\_FAQ
  dimensions(sizes): longitude(7200), latitude(2000), time(43)
  variables(dimensions): float32 latitude(latitude), float32 longitude(longitude), float32 precip(time, latitude, longitude), float32
  groups:
```

Checking dimensions and variables

```
print(nc_file.dimensions.keys())
```

```
dict_keys(['longitude', 'latitude', 'time'])
```

```
print(nc_file.variables.keys())
```

```
dict_keys(['latitude', 'longitude', 'precip', 'time'])
```

Checking weather the coordinates of chittagong is exist or not

```
import numpy as np
latitude = nc_file.variables['latitude'][:]
longitude = nc_file.variables['longitude'][:]

# Define the city's coordinates (Chittagong, Bangladesh)
city_lat = 22.3569
city_lon = 91.7832
lat_exists = np.any(np.isclose(latitude, city_lat, atol=0.1))
lon_exists = np.any(np.isclose(longitude, city_lon, atol=0.1))
if lat_exists and lon_exists:
    print("Chittagong exists in the dataset!")
else:
    print("Chittagong does not exist in the dataset.")
```

→ Chittagong exists in the dataset!

Finding the yearly data from precipitations

```
import numpy as np
precip = nc_file.variables['precip'][:]
time = nc_file.variables['time'][:]
lat_idx = np.argmin(np.abs(latitude - city_lat))
lon_idx = np.argmin(np.abs(longitude - city_lon))
city_precip = precip[:, lat_idx, lon_idx]
print(f"Yearly precipitation for Chittagong (Lat: {latitude[lat_idx]}, Lon: {longitude[lon_idx]}):")
for t, precip_value in enumerate(city_precip):
    print(f"Year {t + 1}: Precipitation = {precip_value} mm/year")
```

→ Yearly precipitation for Chittagong (Lat: 22.375, Lon: 91.77499389648438):

```
Year 1: Precipitation = 2958.538818359375 mm/year
Year 2: Precipitation = 2888.331298828125 mm/year
Year 3: Precipitation = 3454.39208984375 mm/year
Year 4: Precipitation = 3280.471435546875 mm/year
Year 5: Precipitation = 2819.4814453125 mm/year
Year 6: Precipitation = 2842.270263671875 mm/year
Year 7: Precipitation = 3061.319580078125 mm/year
Year 8: Precipitation = 3311.30517578125 mm/year
Year 9: Precipitation = 2458.58544921875 mm/year
Year 10: Precipitation = 2671.96484375 mm/year
Year 11: Precipitation = 2568.026123046875 mm/year
Year 12: Precipitation = 2557.381103515625 mm/year
Year 13: Precipitation = 3134.93212890625 mm/year
Year 14: Precipitation = 2632.046875 mm/year
Year 15: Precipitation = 3193.55810546875 mm/year
Year 16: Precipitation = 2786.989013671875 mm/year
Year 17: Precipitation = 3355.35400390625 mm/year
Year 18: Precipitation = 2791.165283203125 mm/year
Year 19: Precipitation = 3198.627685546875 mm/year
Year 20: Precipitation = 3098.869873046875 mm/year
Year 21: Precipitation = 3015.61279296875 mm/year
Year 22: Precipitation = 2977.432861328125 mm/year
Year 23: Precipitation = 2769.923583984375 mm/year
Year 24: Precipitation = 2916.143310546875 mm/year
Year 25: Precipitation = 2416.97705078125 mm/year
Year 26: Precipitation = 2498.96240234375 mm/year
Year 27: Precipitation = 3426.43505859375 mm/year
Year 28: Precipitation = 2725.568603515625 mm/year
Year 29: Precipitation = 2984.60693359375 mm/year
Year 30: Precipitation = 2744.294677734375 mm/year
Year 31: Precipitation = 3447.59326171875 mm/year
Year 32: Precipitation = 2885.849609375 mm/year
Year 33: Precipitation = 2516.45703125 mm/year
Year 34: Precipitation = 2889.591796875 mm/year
Year 35: Precipitation = 3638.416748046875 mm/year
Year 36: Precipitation = 3065.7724609375 mm/year
Year 37: Precipitation = 4202.92333984375 mm/year
Year 38: Precipitation = 2634.197998046875 mm/year
Year 39: Precipitation = 3208.260986328125 mm/year
Year 40: Precipitation = 3311.71337890625 mm/year
Year 41: Precipitation = 3082.400390625 mm/year
Year 42: Precipitation = 2358.8037109375 mm/year
Year 43: Precipitation = 3100.751708984375 mm/year
```

Adjusting with calender time

```

from datetime import datetime, timedelta
time_units = nc_file.variables['time'].units
print(f"Time units: {time_units}")
base_date = datetime.strptime(time_units.split('since')[1].strip(), "%Y-%m-%d %H:%M:%S")
dates = [base_date + timedelta(days=int(t)) for t in time]
print(f"Yearly precipitation for Chittagong:")
for date, precip_value in zip(dates, city_precip):
    print(f"Year {date.year} : Precipitation = {precip_value} mm/year")

```

```

↗ Time units: days since 1980-1-1 0:0:0
Yearly precipitation for Chittagong:
Year 1981 : Precipitation = 2958.538818359375 mm/year
Year 1982 : Precipitation = 2888.331298828125 mm/year
Year 1983 : Precipitation = 3454.39208984375 mm/year
Year 1984 : Precipitation = 3280.471435546875 mm/year
Year 1985 : Precipitation = 2819.4814453125 mm/year
Year 1986 : Precipitation = 2842.270263671875 mm/year
Year 1987 : Precipitation = 3061.319580078125 mm/year
Year 1988 : Precipitation = 3311.30517578125 mm/year
Year 1989 : Precipitation = 2458.58544921875 mm/year
Year 1990 : Precipitation = 2671.96484375 mm/year
Year 1991 : Precipitation = 2568.026123046875 mm/year
Year 1992 : Precipitation = 2557.381103515625 mm/year
Year 1993 : Precipitation = 3134.93212890625 mm/year
Year 1994 : Precipitation = 2632.046875 mm/year
Year 1995 : Precipitation = 3193.55810546875 mm/year
Year 1996 : Precipitation = 2786.989013671875 mm/year
Year 1997 : Precipitation = 3355.35400390625 mm/year
Year 1998 : Precipitation = 2791.165283203125 mm/year
Year 1999 : Precipitation = 3198.627685546875 mm/year
Year 2000 : Precipitation = 3098.869873046875 mm/year
Year 2001 : Precipitation = 3015.61279296875 mm/year
Year 2002 : Precipitation = 2977.432861328125 mm/year
Year 2003 : Precipitation = 2769.923583984375 mm/year
Year 2004 : Precipitation = 2916.143310546875 mm/year
Year 2005 : Precipitation = 2416.97705078125 mm/year
Year 2006 : Precipitation = 2498.96240234375 mm/year
Year 2007 : Precipitation = 3426.43505859375 mm/year
Year 2008 : Precipitation = 2725.568603515625 mm/year
Year 2009 : Precipitation = 2984.60693359375 mm/year
Year 2010 : Precipitation = 2744.294677734375 mm/year
Year 2011 : Precipitation = 3447.59326171875 mm/year
Year 2012 : Precipitation = 2885.849609375 mm/year
Year 2013 : Precipitation = 2516.45703125 mm/year
Year 2014 : Precipitation = 2889.591796875 mm/year
Year 2015 : Precipitation = 3638.416748046875 mm/year
Year 2016 : Precipitation = 3065.7724609375 mm/year
Year 2017 : Precipitation = 4202.92333984375 mm/year
Year 2018 : Precipitation = 2634.197998046875 mm/year
Year 2019 : Precipitation = 3208.260986328125 mm/year
Year 2020 : Precipitation = 3311.71337890625 mm/year
Year 2021 : Precipitation = 3082.400390625 mm/year
Year 2022 : Precipitation = 2358.8037109375 mm/year
Year 2023 : Precipitation = 3100.751708984375 mm/year

```

Converting the year data of Chittagong city to CSV file and visualizing data

```

import pandas as pd
import matplotlib.pyplot as plt

data = []
for t in range(len(time)):
    year = (base_date + timedelta(days=int(time[t]))).year
    chittagong_precip = precip[t, lat_idx, lon_idx]
    data.append([year, chittagong_precip])
df_yearly = pd.DataFrame(data, columns=['Year', 'Precipitation (mm/year)'])
yearly_precip = df_yearly.groupby('Year')['Precipitation (mm/year)'].sum().reset_index()
yearly_precip.to_csv('chittagong_yearly_precipitation.csv', index=False)
print(yearly_precip)
plt.figure(figsize=(15, 8))
yearly_precip.plot(kind='bar', x='Year', y='Precipitation (mm/year)', color='skyblue')
plt.title('Total Yearly Precipitation for Chittagong')
plt.xlabel('Year')
plt.ylabel('Total Precipitation (mm/year)')
plt.xticks(rotation=45)

```

```
plt.tight_layout()
plt.show()
```

	Year	Precipitation (mm/year)
0	1981	2958.538818
1	1982	2888.331299
2	1983	3454.392090
3	1984	3280.471436
4	1985	2819.481445
5	1986	2842.270264
6	1987	3061.319580
7	1988	3311.305176
8	1989	2458.585449
9	1990	2671.964844
10	1991	2568.026123
11	1992	2557.381104
12	1993	3134.932129
13	1994	2632.046875
14	1995	3193.558105
15	1996	2786.989014
16	1997	3355.354004
17	1998	2791.165283
18	1999	3198.627686
19	2000	3098.869873
20	2001	3015.612793
21	2002	2977.432861
22	2003	2769.923584
23	2004	2916.143311
24	2005	2416.977051
25	2006	2498.962402
26	2007	3426.435059
27	2008	2725.568604
28	2009	2984.606934
29	2010	2744.294678
30	2011	3447.593262
31	2012	2885.849609
32	2013	2516.457031
33	2014	2889.591797
34	2015	3638.416748
35	2016	3065.772461
36	2017	4202.923340
37	2018	2634.197998
38	2019	3208.260986
39	2020	3311.713379
40	2021	3082.400391
41	2022	2358.803711
42	2023	3100.751709

<Figure size 1500x800 with 0 Axes>



