In [5]:

```
# Import the necessary modules
import requests
import arcpy
import zipfile
import imageio
import os
```

In [2]:

```
# Set the data URL
data = 'http://services.nacse.org/prism/data/public/normals/4km/ppt/'
```

In [3]:

```
# Use loop to download data and extraxt them to original data folder
for month in range(1,13):
    url = data + str(month)
    print(url)
    r = requests.get(url, allow_redirects=True)
    open(f'{str(month)}.zip', 'wb').write(r.content)
    with zipfile.ZipFile(open(f'C:/Users/user/{str(month)}.zip', 'rb')) as f:
        f.extractall('D:/2021-spring/ArcGIS/Lab2/Cube/original')
```

```
http://services.nacse.org/prism/data/public/normals/4km/ppt/1 (http://servic
es.nacse.org/prism/data/public/normals/4km/ppt/1)
http://services.nacse.org/prism/data/public/normals/4km/ppt/2 (http://servic
es.nacse.org/prism/data/public/normals/4km/ppt/2)
http://services.nacse.org/prism/data/public/normals/4km/ppt/3 (http://servic
es.nacse.org/prism/data/public/normals/4km/ppt/3)
http://services.nacse.org/prism/data/public/normals/4km/ppt/4 (http://servic
es.nacse.org/prism/data/public/normals/4km/ppt/4)
http://services.nacse.org/prism/data/public/normals/4km/ppt/5 (http://servic
es.nacse.org/prism/data/public/normals/4km/ppt/5)
http://services.nacse.org/prism/data/public/normals/4km/ppt/6 (http://servic
es.nacse.org/prism/data/public/normals/4km/ppt/6)
http://services.nacse.org/prism/data/public/normals/4km/ppt/7 (http://servic
es.nacse.org/prism/data/public/normals/4km/ppt/7)
http://services.nacse.org/prism/data/public/normals/4km/ppt/8 (http://servic
es.nacse.org/prism/data/public/normals/4km/ppt/8)
http://services.nacse.org/prism/data/public/normals/4km/ppt/9 (http://servic
es.nacse.org/prism/data/public/normals/4km/ppt/9)
http://services.nacse.org/prism/data/public/normals/4km/ppt/10 (http://servi
ces.nacse.org/prism/data/public/normals/4km/ppt/10)
http://services.nacse.org/prism/data/public/normals/4km/ppt/11 (http://servi
ces.nacse.org/prism/data/public/normals/4km/ppt/11)
http://services.nacse.org/prism/data/public/normals/4km/ppt/12 (http://servi
ces.nacse.org/prism/data/public/normals/4km/ppt/12)
```

In [3]:

```
# Set the work environment
arcpy.env.workspace = r'D:\2021-spring\ArcGIS\Lab2\Cube'
```

In [17]:

```
# Set the parameter for creating mosaic dataset
in_workspace = r'D:\2021-spring\ArcGIS\Lab2\Cube\Cube.gdb'
mosaicdataset = 'lab2cube1'
coordinate_system = arcpy.SpatialReference("c:/coordsystems/NAD 1983.prj")
```

In [18]:

```
# Create Mosaic Dataset
arcpy.management.CreateMosaicDataset(in_workspace, mosaicdataset, coordinate_system, None,
```

Out[18]:

Output

D:\2021-spring\ArcGIS\Lab2\Cube\Cube.gdb\lab2cube1

Messages

Start Time: 2021年3月1日 下午 03:45:54

Succeeded at 2021年3月1日 下午 03:45:55 (Elapsed Time: 0.98 seconds)

In [7]:

```
# Convert .bil data into TIFF
arcpy.env.workspace = r'D:\2021-spring\ArcGIS\Lab2\Cube\original'
outgdb = r'D:\2021-spring\ArcGIS\Lab2\Cube\Cube.gdb'
for bil in arcpy.ListRasters():
    arcpy.conversion.RasterToOtherFormat(bil, outgdb, "TIFF")
    print(bil)
```

```
PRISM_ppt_30yr_normal_4kmM2_01_bil.bil
PRISM_ppt_30yr_normal_4kmM2_02_bil.bil
PRISM_ppt_30yr_normal_4kmM2_03_bil.bil
PRISM_ppt_30yr_normal_4kmM2_04_bil.bil
PRISM_ppt_30yr_normal_4kmM2_05_bil.bil
PRISM_ppt_30yr_normal_4kmM2_06_bil.bil
PRISM_ppt_30yr_normal_4kmM2_07_bil.bil
PRISM_ppt_30yr_normal_4kmM2_08_bil.bil
PRISM_ppt_30yr_normal_4kmM2_09_bil.bil
PRISM_ppt_30yr_normal_4kmM2_10_bil.bil
PRISM_ppt_30yr_normal_4kmM2_11_bil.bil
PRISM_ppt_30yr_normal_4kmM2_12_bil.bil
```

In [19]:

```
# Add the TIFF files into mosaic dataset
arcpy.env.workspace = r'D:\2021-spring\ArcGIS\Lab2\Cube\Cube.gdb'
for tiff in arcpy.ListRasters():
    arcpy.management.AddRastersToMosaicDataset(mosaicdataset, "Raster Dataset", tiff)
    print(tiff)
```

```
PRISM_ppt_30yr_normal_4kmM2_01_bil
PRISM_ppt_30yr_normal_4kmM2_02_bil
PRISM_ppt_30yr_normal_4kmM2_03_bil
PRISM_ppt_30yr_normal_4kmM2_04_bil
PRISM_ppt_30yr_normal_4kmM2_05_bil
PRISM_ppt_30yr_normal_4kmM2_06_bil
PRISM_ppt_30yr_normal_4kmM2_07_bil
PRISM_ppt_30yr_normal_4kmM2_08_bil
PRISM_ppt_30yr_normal_4kmM2_09_bil
PRISM_ppt_30yr_normal_4kmM2_10_bil
PRISM_ppt_30yr_normal_4kmM2_12_bil
```

In [21]:

```
# Create a Variable field in the Footprints table of mosaic dataset
arcpy.management.CalculateField(mosaicdataset, "variable", '"prism"', "PYTHON3", '', "TEXT"
```

Out[21]:

Output

D:\2021-spring\ArcGIS\Lab2\Cube\Cube.gdb\lab2cube1

Messages

Start Time: 2021年3月1日 下午 03:47:44

Adding variable to AMD_lab2cube1_CAT...

Succeeded at 2021年3月1日 下午 03:47:48 (Elapsed Time: 3.54 seconds)

In [22]:

```
# Create a Timestamp field in the Footprints table of mosaic dataset
arcpy.management.CalculateField(mosaicdataset, "Time", "DateAdd(Date(1998,0,1), $feature.OB
```

Out[22]:

Output

D:\2021-spring\ArcGIS\Lab2\Cube\Cube.gdb\lab2cube1

Messages

Start Time: 2021年3月1日 下午 03:47:55

Adding Time to AMD_lab2cube1_CAT...

Succeeded at 2021年3月1日 下午 03:47:59 (Elapsed Time: 3.51 seconds)

In [11]:

```
# Execute the build mutidimensional info tool to format the two fields above correctly
arcpy.md.BuildMultidimensionalInfo(mosaicdataset, "variable", "Time # #", None)
```

Out[11]:

Output
D:\2021-spring\ArcGIS\Lab2\Cube\Cube.gdb\lab2cube

Messages
Start Time: 2021年3月1日 下午 03:18:30
Succeeded at 2021年3月1日 下午 03:18:32 (Elapsed Time: 2.04 seconds)

In [13]:

```
# Make Multidimensional Raster Layer
arcpy.md.MakeMultidimensionalRasterLayer(mosaicdataset, "lab2cube_MultidimLayer", "prism",
```

Out[13]:

Output
a Layer object

Messages
Start Time: 2021年3月1日 下午 03:18:55
Succeeded at 2021年3月1日 下午 03:19:00 (Elapsed Time: 5.24 seconds)

In [14]:

```
# Create Space Time Cube and save it into disk
arcpy.stpm.CreateSpaceTimeCubeMDRasterLayer("lab2cube_MultidimLayer", "lab2cube.nc", "ZEROS
```

Out[14]:

Output

D:\2021-spring\ArcGIS\Lab2\Cube\lab2cube.nc

Messages

Start Time: 2021年3月1日 下午 03:19:21
WARNING 110290: This tool requires projected data to accurately measure distances. The Input Multidimensional Raster Layer will be projected to the WGS 1984 World Equidistant Cylindrical projection (WKID 4087).
WARNING 110013: The default Time Step Interval is 1 year.
WARNING 110067: Your spatial reference is not compatible with CF Conventions. You may experience difficulties using the resulting space-time cube with other NetCDF tools and software.

---------- Space Time Cube Characteristics ----------
Input feature time extent 1998-01-01 06:00:00
to 2008-01-01 06:00:00

Number of time steps 11
Time step interval 1 year
Time step alignment End

First time step temporal bias 100.00%
First time step interval after
1997-01-01 06:00:00
to on or before
1998-01-01 06:00:00

Last time step temporal bias 0.00%
Last time step interval after
2007-01-01 06:00:00
to on or before
2008-01-01 06:00:00

Cube extent across space (coordinates in meters)
Min X -13894063.9446
Min Y 2708361.9668
Max X -7451448.4150
Max Y 5478283.7456

Locations 481631
Total observations 5297941

------- Overall Data Trend - PRISM_NONE_ZEROS --------
Trend direction Not Significant
Trend statistic 0.0000

Trend p-value 1.0000

Succeeded at 2021年3月1日 下午 03:28:26 (Elapsed Time: 9 minutes 4 seconds)

In [21]:

```
# Download all the images from ArcPro layouts
aprx = arcpy.mp.ArcGISProject(r'D:\2021-spring\ArcGIS\Lab2\Cube\Cube.aprx')
for layout in range(11,22):
    png = aprx.listLayouts(layout)[0]
    png.exportToGIF(f'D:/2021-spring/ArcGIS/Lab2/Cube/Output/{layout}.gif')
```

In [29]:

```
# Get all the dirctories of images
location = r'D:\2021-spring\ArcGIS\Lab2\Cube\Output'
pics = []
for file in os.listdir(location):
    pics.append(f"{location}\\{file}")
```

In [31]:

```
# Combine all the images and save it as a GIF
gifs = []
for pic in pics:
    gifs.append(imageio.imread(pic))
imageio.mimwrite(r'D:\2021-spring\ArcGIS\Lab2\Cube\Output\GIF.gif', gifs, fps=5)
```