EAPS 520 – Assignment #1

Distributed: August 30, 2022
Due: noon, September 6, 2022

Total points: 10 points

(1). Word Cloud of Climate Theory [3 points]

The American Geophysical Union (AGU) is one of the largest nonprofit organization of Earth, atmospheric, ocean, hydrologic, space, and planetary scientists and enthusiasts. Every year, AGU Fall Meeting unites the Earth and space science community to share findings and advance science among experts from around the world through its Fall Meeting. Its scientific programs contain critical information about the cutting-edge scientific focus and progress. These links are for recent five years (2021, 2020, 2019, 2018, 2017). In this exercise, you will use a digital humanity tool - word cloud to get an intuitive sense of the research community's focus in recent years on the theory of climate. There are many free word cloud generator website available – just google "word cloud" and use a service that you are comfortable with. When you submit your answer, please also attach the original texts.

A. From the above links, please search for the keywords "climate" and "theory", and then choose "Session Proposal" under the "Type" category. Please copy and paste three (3) session titles per year, and you will have 15 sessions names. Please use these **session proposal titles** to generate a word cloud.
B. Repeat the above step A, but select "Abstract" under the "Type" category. Please copy and paste five (5) abstracts' titles per year, and you will have 25 sessions names. Please use these **abstract titles** to generate a word cloud.
C. Repeat the above step B, but add a third key words of your choice (please specify your choice). For example, if you are interested in heatwaves, you may search "climate", "theory", and "heatwaves". Please use these **abstract titles** to generate a word cloud.
D. What does the three word cloud images tell you about the research community's focus in recent years?

(2). Now you are added to Purdue Brown supercomputer, and you shall be able to access the Jupyter Notebook and Terminal through Gateway webpage. In this exercise, you will explore Earth climate data through a GUI-based software and through python scripts. [4 points]

A. Open this page, click "Launch" under "Gateway". You can also Virtual Desktop, or use Terminal directly. The point is to use Python script to access Data Depot and conduct simple analysis. For those of you who can access Bell or Scholar, these also work for accessing data stored on Data Depot. Please show a screen snapshot of your approach.
B. Once you login to Brown and open a jyputer notebook or open a terminal window. Please browse the NetCDF files in this folder /depot/eapsdept/data/ERA_Interim, and choose a file ending with "_z.nc" which contains the air temperature data. You will be analyzing this file for following steps. Type "module load nco" to load the software, and type "ncdump -h filename" where filename is your chosen data. Please copy and paste the screen output, and explain the data structure (dimension, axis, data size, variable, etc).

C. Use the below sample python code to read this data, and make a simple plot. Please note that the ? is for you to figure out through the above nco command. Please show a two-dimensional plot of surface air temperature for its first time snapshot.
D. Please calculate a 1D plot showing zonal-mean time-mean surface air temperature profile for your chosen file. Here time-mean is to average all time snapshots of your chosen file, and zonal-mean is to average along the longitude dimension. Please note that you need to pay attention to the vertical dimension and which index to chose to select the surface level (i.e., the lowest level from the ground and this level corresponds to 1000 hPa pressure level). Please show the plot with a caption.
E. Please calculate a 1D plot showing zonal-mean time-mean vertical air temperature profile between 30 N and 60 N for your chosen file. This is similar to the above exercise, but you need to figure out the latitudinal dimension through the above ncdump command, and then do a latitudinal average. Please show the plot with a caption.

```
import numpy as np
from scipy.io import netcdf
import matplotlib.pyplot as plt

# read in the file, and the three dimensional data z is stored in your chosen data
f = netcdf.netcdf_file("/depot/eapsdept/data/ERA_Interim/filename",'r')
z = f.variables['t']
time = f.variables['time'].data
lat = f.variables['latitude'].data
lon = f.variables['longitude'].data
f.close()

# now let us plot the pattern of the first day
plt.figure(1)
plt.contourf(lon,lat,z[?,?,:,:],cmap='RdBu_r');
plt.colorbar()
plt.title('surface air temperature')
plt.xlabel('longitude')
plt.ylabel('latitude')
```

(3) Let's also explore the Mars atmosphere data. [3 points]

Please go to this folder /depot/eapsdept/data/Mars_MACDA which stores the MACDA data. Please read the below resources about the MACDA data.

Montabone, L., Marsh, K., Lewis, S.R., Read, P.L., Smith, M.D., Holmes, J., Spiga, A., Lowe, D. and Pamment, A. (2014), The Mars Analysis Correction Data Assimilation (MACDA) Dataset V1.0. Geosci. Data J., 1: 129-139. link
Link to the data is here.

A. Based on the above information, please write a paragraph to describe the MACDA data.
B. Please chose one file and again use ncdump -h to learn the data structure. Please copy and paste the screen output, and explain the data structure (dimension, axis, data size, variable, etc).
C. Please show a two-dimensional plot of surface air temperature for its first time snapshot.
D. Please calculate a 1D plot showing zonal-mean time-mean surface air temperature profile for your chosen file. Please show the plot with a caption.
E. Please calculate a 1D plot showing zonal-mean time-mean vertical air temperature profile between 30 N and 60 N for your chosen file. Please show the plot with a caption.