

METR 5303 Computer Problem #1

Assigned Thursday 8, Due Thursday, Sept. 25, 2016

1. You will have access to a data set of 99 rawinsonde station reports for 500 mb.

The format for these data is – with sample values: (see next page for how to read in)

| BLSTN | LAT | LONG | 500 mb ht (m) | 500 mb wind (deg./kts) |
|--------------|------------|-------------|----------------------|-------------------------------|
| 72722 | 46.367 | 75.983 | 5430 | 255 60 |

2. Consider a polar stereographic map projection with $\phi_0 = 60^\circ$, $m = 1/15,000,000$ and $\lambda = 110^\circ$. Choose the origin of the coordinate system to be at the North Pole.
 - a) Calculate x and y for each station on this map (in cm).
 - b) For each station, calculate distance to all other stations (in cm) and determine distance to closest station.
 - c) Calculate the average distance to closest station for this array of stations.
 - d) Convert this average distance to km on the image plane.
 - e) Calculate the u and v wind components (with respect to the earth) for each station. Convert knots to meters per second using $1 \text{ kt} = .5144444 \text{ ms}^{-1}$.
3. Consider a 22 x 28 rectangular grid of points on the above polar stereographic map where $\Delta x = \Delta y = 1.27 \text{ cm}$, $x_0 = 22.86 \text{ cm}$ and $y_0 = -8.89 \text{ cm}$, where x_0, y_0 represent the northwest corner of your map, i.e., the (1, 1) array member. (Recall origin of coordinate system is the North Pole)
 - a) For each grid point, calculate the distance to the nearest rawinsonde station (in cm).
 - b) Calculate the average distance to the closest station for this set of grid points and stations.
 - c) Produce a frequency diagram (histogram) using results from (a) showing frequency (no. of grid points) on the ordinate as a function of distance to the nearest station (abscissa).

What are the maximum, minimum, median and mode of these distances? (For mode, break abscissa up into 20 categories. Start at $d = 0 \text{ cm}$ and make each category equal to 0.20 cm . Answer is the center value of the appropriate category.)

See next page for input/output information.

Instructions for 5303 Computer Assignment #1

It is assumed that you have a SoM computing account (If not, see Shawn Riley). If you plan to use some other computing resource, you will still need a SoM account to download the data. SoM account request forms are found on the SoM website (<http://som.ou.edu/computing/>).

1. Copy the data set of 99 rawinsonde station reports into your directory. This directory can be located on any of the Linux machines in Room 5720 or the Mac machines in 5402. From a terminal window:

- a. `cd ~metr5303/data`
- b. `cp obj01.dat [your directory]`

Or, if you can obtain a copy of this data by downloading from our course website where you download this homework assignment.

2. Read the data into your program (These are Fortran instructions, but you should be able to convert to the language of your choice):

```
PARAMETER (K=99)
DIMENSION STN(K), XLAT(K), XLON(K), Z(K), DIR(K), SPD(K)
OPEN(UNIT=1, FILE='obj01.dat', STATUS=OLD)
READ(1, *) (STN(I), XLAT(I), XLON(I), Z(I), DIR(I),
SPD(I), I=1, K)
.
.
(your code)
```

The 6 variables denote station ID, latitude, longitude, 500mb height (m), wind direction and speed (kts). They are in floating point format.

3. Output for Question 2: Please create a 99x7 matrix where the 7 columns consist of:
 - a. Station ID
 - b. X coordinate of kth station (in cm)
 - c. Y coordinate of kth station (in cm)
 - d. Station ID closest to kth station
 - e. Distance to closest station (in cm)
 - f. u-component (m/s)
 - g. v-component (m/s)

Also, print out the average distance to closest station in cm (on map) and km (on earth).

4. Output for Question 3:

- a. A (22x28) array of nearest rawinsonde distances.
- b. Average, maximum, minimum median and mode of these distances.
- c. Two (20) member arrays of frequencies and cumulative frequencies. Please also plot as a bar graph (histogram) using MS Excel or Matlab or the software of your choice.

Please print out all numbers to four (4) decimal places.

Please label your output clearly and neatly!

5. For assistance with the UNIX/Linux commands, the editor and printing output, see the SoM website (<http://som.ou.edu/computing>). For further assistance, see Shawn Riley (rileysp@ou.edu) (5640 NWC).
6. Access to the SoM lab machines from outside the NWC is available by two methods set up by the NWC Network Operations Center (NOC via OUIT). One means is through a Bastion host. The other is through a SSL client that acts as a VPN (virtual private network).
 - a. SSL
Software: <http://apollo.nwc.ou.edu>
host: apollo.nwc.ou.edu
 - b. Bastion Account
request: <http://som.ou.edu/computing/> (first click on “forms” and then click on “Bastion Host/VPN Access” to request.)
host: starbuck.nwc.ou.edu