

METR 5303 Computer Problem #1

Assigned Tuesday, September 3, Due Thursday, Sept. 19, 2019

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	500mb ht (m)	500mb wind(deg./kts)
72637	42.96700	83.73300	5480.000	255.0000 40.00000

2. Consider a polar stereographic map projection with true latitude $\phi_0 = 60^\circ$, and true longitude $\lambda = 110^\circ$. Choose the origin of the coordinate system to be at the North Pole. Use the mean earth radius of 6371 km. See web link at the end for info on map projections.
 - a) Calculate x and y for each station on this map (in km).
 - b) For each station, calculate distance to all other stations on the map (in km) and determine distance to closest station.
 - c) Calculate the average distance to closest station for this array of stations.
 - e) Calculate the u and v wind components (with respect to the earth) for each station. Convert knots to meters per second using $1 \text{ knot} = 0.5144444 \text{ m s}^{-1}$.
3. Consider a 28×22 rectangular grid of points on the above polar stereographic map where $\Delta x = \Delta y = 190 \text{ km}$, $x_0 = -3,690 \text{ km}$ and $y_0 = -3350 \text{ km}$, where x_0, y_0 represent the northwest corner of your map (Recall origin of coordinate system is the North Pole)
 - a) For each grid point, calculate the distance to the nearest rawinsonde station (in km).
 - 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 $d = 0 \text{ km}$ and make each category equal to 30 km. Answer is the center value of the appropriate category.)

See next page for input/output information, and more detailed instructions.

Weisstein, E. W.: Stereographic Projection. [Available online at <http://mathworld.wolfram.com/StereographicProjection.html>.]

Instructions for 5303 Computer Assignment #1

It is assumed that you have a SoM computing account (If not, see Shawn Riley). You can also use other computing resource, with needed compiler for a computing language of your choices (e.g., Fortran, Matlab, python, C).

1. Download the data file containing 99 rawinsonde station reports into your directory from the class website. The data file is called obj01.dat. Place it inside your work directory.
2. Read the data into your program (a Fortran example is given below, but you should be able to convert to the language of your choice):

```
PARAMETER (K=99)
DIMENSION ID_STN(K), XLAT(K), XLON(K), Z(K), DIR(K), SPD(K)

OPEN (UNIT=1, FILE='obj01.dat', STATUS=OLD)
DO I =1, K
READ (1, *) ID_STN(I), XLAT(I), XLON(I), Z(I), DIR(I), SPD(I)
ENDDO
.
(your code)
```

The 6 variables denote station ID, latitude, longitude, 500mb height (m), wind direction (degrees, the direction from which wind blows, 0° is from north, 90° is from the east, 180° is from south, math angle = 270 – wind direction angle) and speed (knots). They are in floating point format, except for the station ID which is in integer 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 km)
 - c. Y coordinate of kth station (in km)
 - d. Station ID closest to kth station
 - e. Distance to closest station (in km)
 - f. u-component (m s^{-1})
 - g. v-component (m s^{-1})

Also, print out the average distance to closest station in km (on map) and km (on the earth surface, taking into account of map factor).

4. Output for Question 3:
 - a. A (28 x 22) 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).