Applied Magnetics, Problem set #2.

Definitions: A virtual geomagnetic pole (VGP) is a magnetic pole recorded or calculated for a point in time. Thus, a lava flow burying Missoula today would record a VGP from today's ambient field. Averaging sufficient VGP so that the variance of the average tends to a constant value yields a paleomagnetic pole. The angular variance of that average is an estimate of paleosecular variation.

1. Given five VGP:

| VGP | Latitude | Longitude |
|---|---|---|
| 1 | $75^o$ | $114^o$ West |
| 2 | $75^o$ | $186^o$ West |
| 3 | $75^o$ | $102^o$ East |
| 4 | $75^o$ | $30^o$ East |
| 5 | $75^o$ | $42^o$ West |

Fill out this table:

| Site: Missoula, MT | | |
|---|---|---|
| Latitude: $47^o$ N | | |
| Longitude: $114^o$ W | | |
| VGP: | Expected declination at Missoula | Expected inclination at Missoula |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

Find, using vector averages:

- The average of the expected (D, I) values at Missoula
- The average (latitude, longitude) of the VGP. Show that this is not equal to the arithmetic average of the latitudes and longitudes.
- An estimate of the apparent secular variation given by the distribution of the VGP. A standard estimate of the angular standard deviation of VGP is :

$$\delta_{63} = \text{COS}^{-1}(R/n)$$

where R = length of the resultant vector from summing the VGP positions and n = number of samples (5).

Make enough sketches so that you understand what you are doing in terms of the magnetic elements, spherical coordinates, and lat-long coordinate systems.

2. Suppose a Late Proterozoic paleomagnetic pole for North America is at $19^o$N, $171^o$E; calculate:

Declination expected at Missoula _____
Inclination expected at Missoula _____