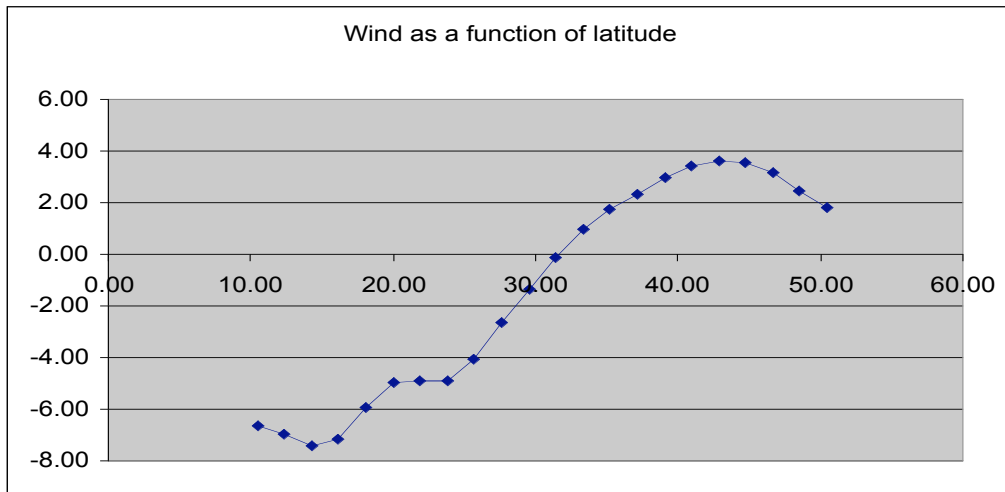


**Ocean 420 Physical Processes in the Ocean**  
**Project 3: Ekman Transport**  
**Answers**

**2. Ekman transport.**

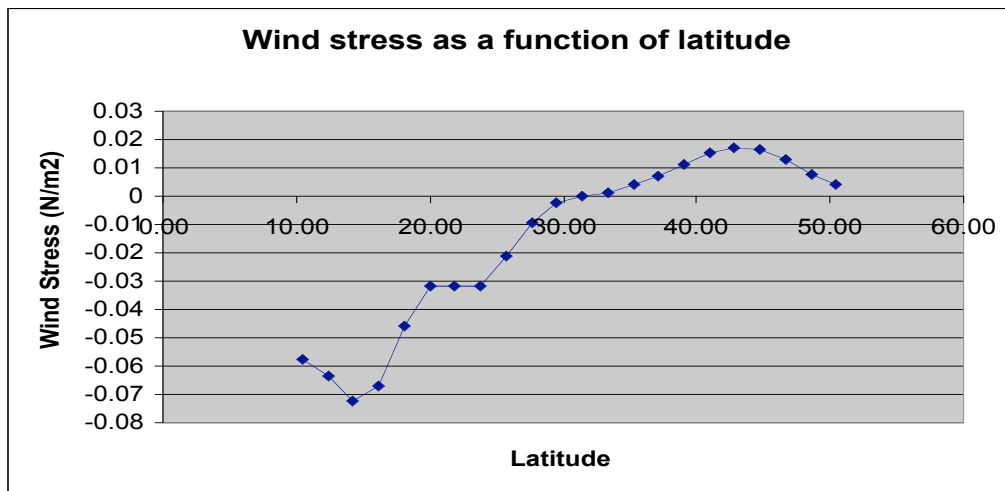
Download wind data for the Pacific from the web page. In the plots you create below, only show results for 10N to 50N. The file is wind.dat and it contains the zonal (east-west) wind in m/s as a function of latitude. Turn in the plots and be sure to say what the units are for each quantity.

- a) Plot the wind as a function of latitude.



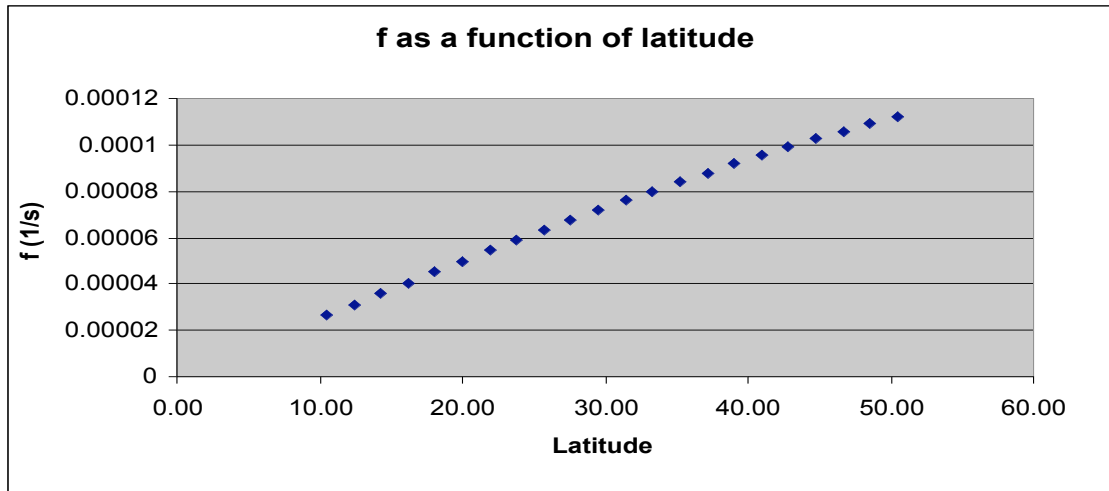
- b) Plot the stress as a function of latitude. You may use a drag coefficient of  $1 \times 10^{-3}$  and an air density of  $1.3 \text{ kg/m}^3$ .

$$\tau_{wind} = \rho_a C_D W |W|$$



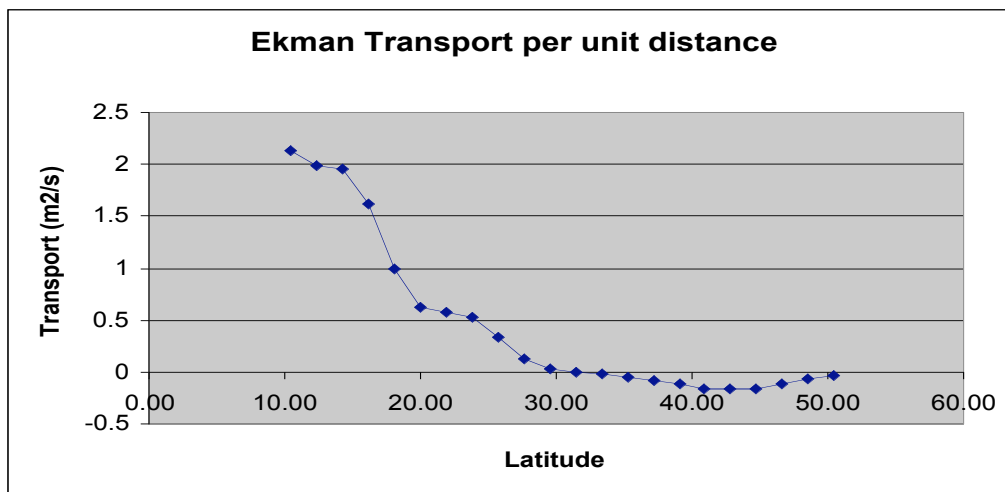
- c) Calculate  $f$  as a function of latitude and plot it (be sure to calculate it using the correct units, degrees or radians, for the latitude).

$$f = 2\Omega \sin \theta \quad \text{Note: Excel expects angles in sin and cos functions to be in radians.}$$



- d) Calculate the Ekman volume transport per unit distance as a function of latitude and plot it.

$$V_{yE} = -\frac{\tau_W^x}{f\rho}$$



- e) For a basin 100 degrees wide for all latitudes, what would the total Ekman volume transport be at each latitude?

$$V_{total} = V_{yE} \cdot 100 \cdot 111000 \cdot \cos \theta$$

Latitude (degrees)	Total Ekman transport (m <sup>3</sup> /s)
10.48	23172725.33
12.38	21584565.73
14.29	21079362.3
16.19	17185788.16
18.09	10485263.94
20.00	6502910.154
21.90	5850801.826
23.81	5341775.713
25.71	3285000.769
27.62	1300629.979
29.52	312764.7167
31.43	3250.802009
33.33	-137076.5388
35.24	-413885.8683
37.14	-696870.4954
39.05	-1043799.31
40.95	-1310600.229
42.86	-1363616.342
44.76	-1246477.327
46.67	-924575.8395
48.57	-520895.7401
50.48	-268665.0563

- f) Using this formula, calculate the vertical velocity at the base of the Ekman layer and plot it.

$$\frac{\partial V}{\partial y} = w_{bottom}$$

$$w_{bottom} = \frac{\partial V}{\partial y} = \frac{V_2 - V_1}{\Delta y \cdot 111000m} \text{ with } \Delta y \text{ in degrees.}$$

