Wind Forcing of Geostrophic Currents

Some of the strongest and most variable winds in the world blow over the Antarctic Circumpolar Current. How does the current respond to fluctuations in wind forcing? In simple theory we might expect the following balance:

$$\frac{\partial U}{\partial t} \propto \left[\frac{\overline{\tau^x}}{H\rho_o} \right] - bU \tag{1}$$

where U represents the vertically and along-stream averaged velocity, τ^x is the zonal wind, and b is a linear drag. The bU term might be thought of as a cheap parameterization of more complicated nonlinear processes.

1. What sort of relationship do you expect between U and τ^x? Fourier transform (1) to derive a relationship in frequency space.

2. Using bottom pressure data from Drake Passage and wind data from NCEP, compute the coherence between ACC transport and wind forcing. What is the phase relationshp between U and τ^x?

3. What are the uncertainties in your calculation?

4. How might you refine your results to take advantage of the vector components in the wind data? What would you do if you had current meter observations available in place of bottom pressure?