Exercises

12.1 Using (12.43), (12.36), and (12.37), evaluate the quasi-geostrophic potential vorticity in terms of Z using *dimensional* variables. Identify the Rossby radius. What does it tell you about the horizontal range of influence of point sources of vorticity? (See Pedlosky, 1979, pp. 101–5.) How does this account for the maximum Rossby wave frequency you obtained in Problem 11.3?

12.2 Use (12.57) to derive the vertical structure equation for a linearized internal Rossby wave on a basic zonal flow $u_0(z^*)$. Show that when $u_0 =$ constant we regain the results of Chapter 11.

12.3 Show that for flow rotating about a point $\vec{x} = 0$ with constant angular momentum/unit mass (i.e., $u_\phi = c/r$), vorticity is zero everywhere except at $\vec{x} = 0$. Explain this result in terms of the discussion in Section 12.1.