Exercises

9.1 Explain why Pekeris' temperature profile 'worked.'

9.2 Show that Equation 9.23 with $J = 0$ and $T_0 =$ constant has a solution which satisfies Equation 9.25 when $h = \gamma H$. This solution is called a 'Lamb wave'. For a planar geometry where $f = 0$ and $v' = 0$ (solution independent of y; *viz.* Equations 9.26 and 9.27) show that the Lamb wave is a horizontally propagating acoustic wave. Discuss how the equations in log –p coordinates, which formally look like the equations for an incompressible fluid, can still have acoustic waves. Hint: The answer lies in the lower boundary condition.

9.3 Consider a thermally forced oscillation (*viz.* Equation 9.23) where the forcing consists of a given energy oscillation over a thin layer of thickness Δz; that is,

$$\rho J \Delta z = Q = \text{constant}.$$

For simplicity, let $T_0 =$ constant and let $\Delta z \ll VWL$. If the forcing is centred at a height z_f, show that the response everywhere increases exponentially with z_f. How is this possible?

9.4 In Equation 9.33, $\sigma = \Omega$ for the diurnal tide and $\sigma = 2\Omega$ for the semidiurnal tide. At the equator $f = 0$ and $k = s/a$ ($a =$ radius of Earth), where $s = 1$ for the diurnal tide and $s = 2$ for the semidiurnal tide. For the positive equivalent depths in Table 9.1 calculate ℓ_n from Equation 9.33 and compare your results with the Hough functions shown in Figures 9.27 and 9.28. For the negative equivalent depth modes take $f = 2\Omega \sin 60°$ and $k = 1/(a \cos \phi) = 1/(a \cos 60°)$ and calculate the ℓ_ns for the negative h_ns given in Table 9.1. Again, compare your results with actual Hough functions. (N.B. These are local approximations, so you should compare your results in the neighbourhood of 0° (or 60°) with the Hough functions in the same neighborhood.)