of interest and the slope of the land. For confined aquifers, the effect of sea level rise is to cause a feedback which tends to offset the rise. The increased head due to the rise at the point of discharge causes a decrease in the piezometric gradient, a reduction in the discharge rate and a resultant transient that, for the same recharge rate, causes an increase in the inland head. The net effect is to reestablish the same discharge rate and same relative (to sea level) piezometric head as before sea level rise.

8.3 PHYSICAL PRINCIPLES AND SOLUTIONS TO IDEALIZED PROBLEMS

8.3.1 General

A simple hydrostatic analysis of the balance between a freshwater aquifier meeting a saline water body yields the Ghyben-Herzberg principle

$$z = \frac{\rho_f}{\rho_s - \rho_f} h \tag{8.1}$$

as illustrated in Fig. 8.2. The above relation applies for a distinct fresh-saltwater interface. However, field measurements have proven definitively that the transition between salt and fresh water is quite gradual with mixing occurring over this transition zone, see Fig. 8.3. The principal cause of the gradual transition, which can be interpreted as dispersion, is the movement of this interface back and forth due to the relatively short period astronomical tide components and also the longer term oscillations due to seasonal variations in replenishment by rainfall and still the more infrequent droughts. During the saltwater advancement and retreat, some salt water is left in the interstices. This is the so-called convective mode. The mixing with the retained fresh water occurs by more slowly occurring molecular diffusion. Experiments have been conducted which demonstrate that the dispersion due to ocean tides can be expressed as

$$D = 4MA/t_o \tag{8.2}$$

where M is a parameter with dimensions of length and A and t_o are the horizontal amplitude of tidal motion and period, respectively. Laboratory studies have been shown that the parameter, M, increases with the uniformity of the stratum and can range from 0.063 cm to possibly as high as 2.8 cm for very uniform sand. Methods employing numerical models combined with Taylor's hypothesis relating the dispersion coefficient tensor, the pore water velocity