SEA AND LAND BREEZES

The seafarer frequently encounters local wind conditions in coastal waters resulting from heating and cooling of adjacent land and sea surfaces. Such conditions also occur over comparatively large areas of water inland (e.g. The Great Lakes).

During the day, the land surface temperature increases more rapidly than that of the sea surface (Chapter 3). Air temperature above the land is therefore higher, and the vertical motion of the air through convection modifies the pressure gradient in the horizontal plane (1–2) (Fig. 7.10). As the pressure above the land (1) becomes greater than that over the sea in this plane, so the air moves towards lower pressure (2). The surface air pressure on land (4) then decreases, and air moves from the sea (3) to land (4). Thus during the day a *sea breeze* blows onshore, which may be felt for some distance inland, and an offshore wind blows at some 1000 metres above the sea. The sea breeze gradually increases in speed as the land surface temperature increases, and reaches a maximum by mid-afternoon. When the sky is clear a large amount of solar radiation reaches the surface and the wind speed will be at its maximum (mid-latitudes—Force 3; low latitudes—Force 5).

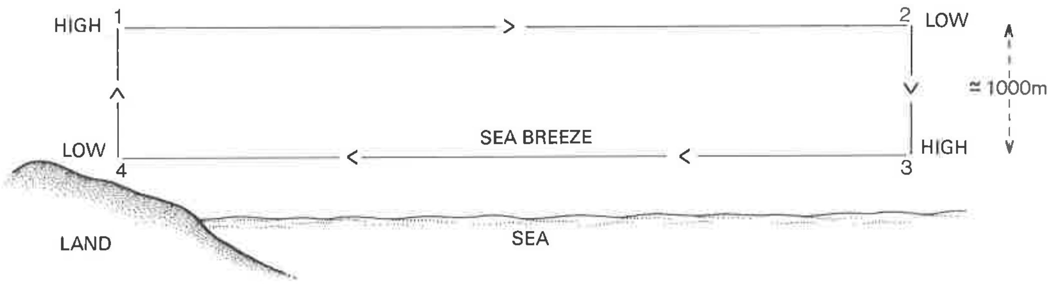

Fig. 7.10 Sea breeze.

The sea breeze has a considerable influence on weather conditions at the coast and for some distance inland. As the sea breeze is relatively cool, coastal zones experience lower air temperatures compared with those inland. The relative humidity value at the coast is higher than inland, and increases during the afternoon when the breeze reaches its maximum speed. This condition contrasts with diurnal variation of relative humidity noted in Chapter 4. The leading onshore edge of the sea breeze is often marked by a line of cumuliform (convective) cloud, which may result in precipitation, particularly in tropical areas.

By contrast the *land breeze* which develops during the night is slight, reaching Force 1–2. With clear skies the radiative cooling of the land surface is at a maximum, but the sea surface temperature decreases slowly (Chapter 3). Above the land the air cools, becomes denser (5), and flows downslope towards the sea (6), hence creating the land breeze (Fig. 7.11). The air, heated by the warmer sea surface, ascends (7) and then moves towards the shore (8). Land breezes are normally evident by midnight local time, but on occasions may not develop until the early hours of the morning. It should be noted that the small temperature difference at night between land and sea surfaces, and the topography of the land, both influence the speed of the land breeze. In tropical areas the convective process (6 → 7) is marked by the development of cumuliform cloud over the sea.

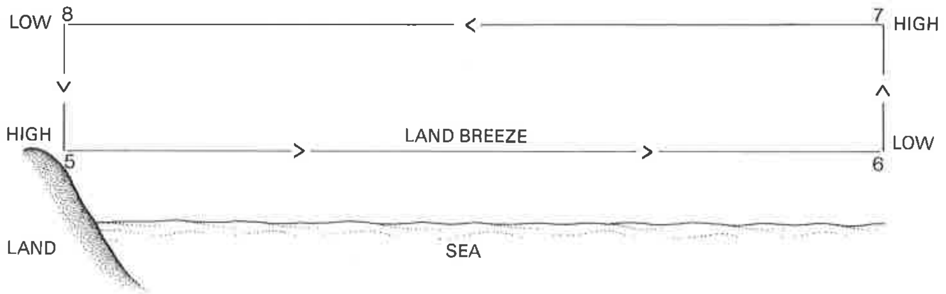

Fig. 7.11 Land breeze.

It is worth noting that both land and sea breezes are caused by local pressure gradients and flow down the gradient. In mid-latitudes the wind may eventually orientate itself parallel to the coastline, reflecting the influence of the Coriolis force on a well developed local system.