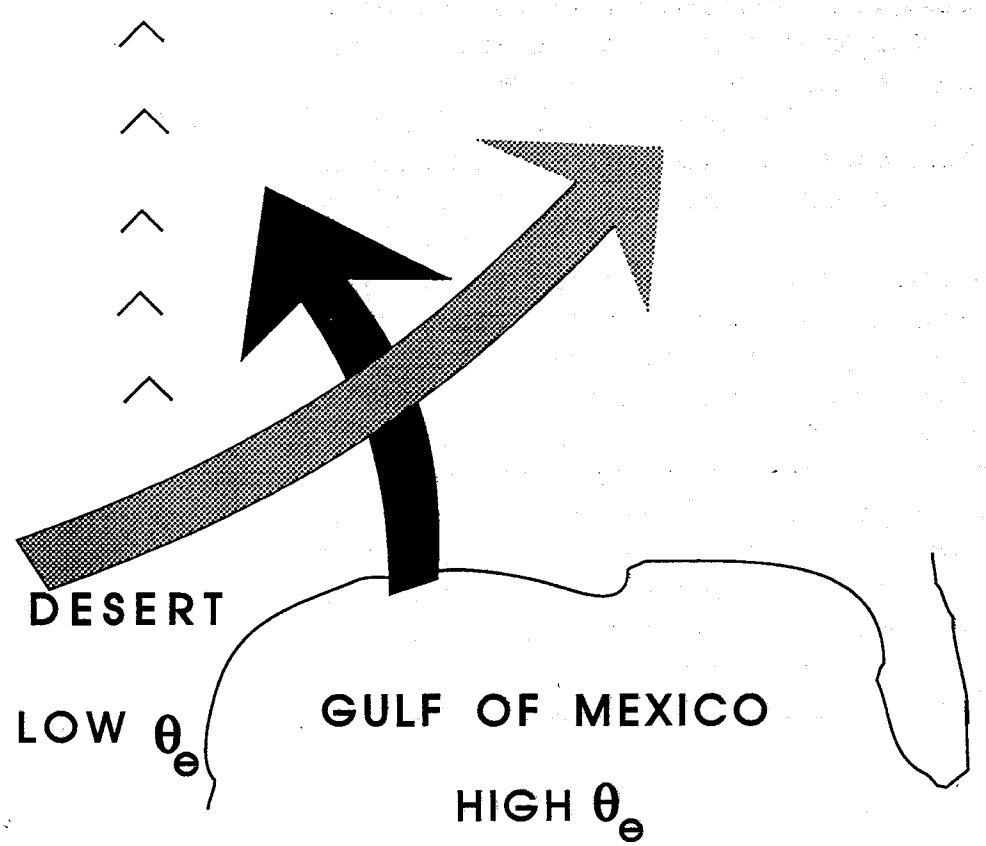

Fig. 9.9 Conditions favorable for development of severe thunderstorms in central United States. Low-level flow of cool, high-θ_e air from the Gulf of Mexico surmounted by midlevel flow of hot, low-θ_e air originating over northern Mexico and southwestern United States.

can be used for evaporation. Hence, very deep, dry adiabatic layers develop over the high deserts; these may occasionally extend up to 500 millibars.

Under particular synoptic weather conditions, the cool, high-θ_e gulf air flows northward and westward underneath desert air, which is flowing northeastward over the plains, as illustrated in Figure 9.9. These two distinct air masses can be seen in the sounding in Oklahoma in Figure 9.8 (also see Exercise 6.1). The cool, high-θ_e gulf air extends upward to about 800 millibars; above this, the very dry, low-θ_e desert air, with nearly dry adiabatic temperature lapse rates up to 500 millibars can be seen. As it is relatively warm, the desert air is separated from the gulf air by a strong temperature inversion near 800 millibars.

Were the vertical column of air whose thermodynamic structure is shown in Figure 9.8 bodily lifted, or the surface air warmed by surface heating, the negative area would diminish and convection would eventually erupt with great force. Alternatively, as shown by Carlson et al. (1983), the gulf air may flow out from under the capping inversion.

The geographical arrangement shown in Figure 9.9 is quite unusual. The only other good example of such an arrangement is the region around northern Australia, where moist air from the Gulf of Carpenteria or the