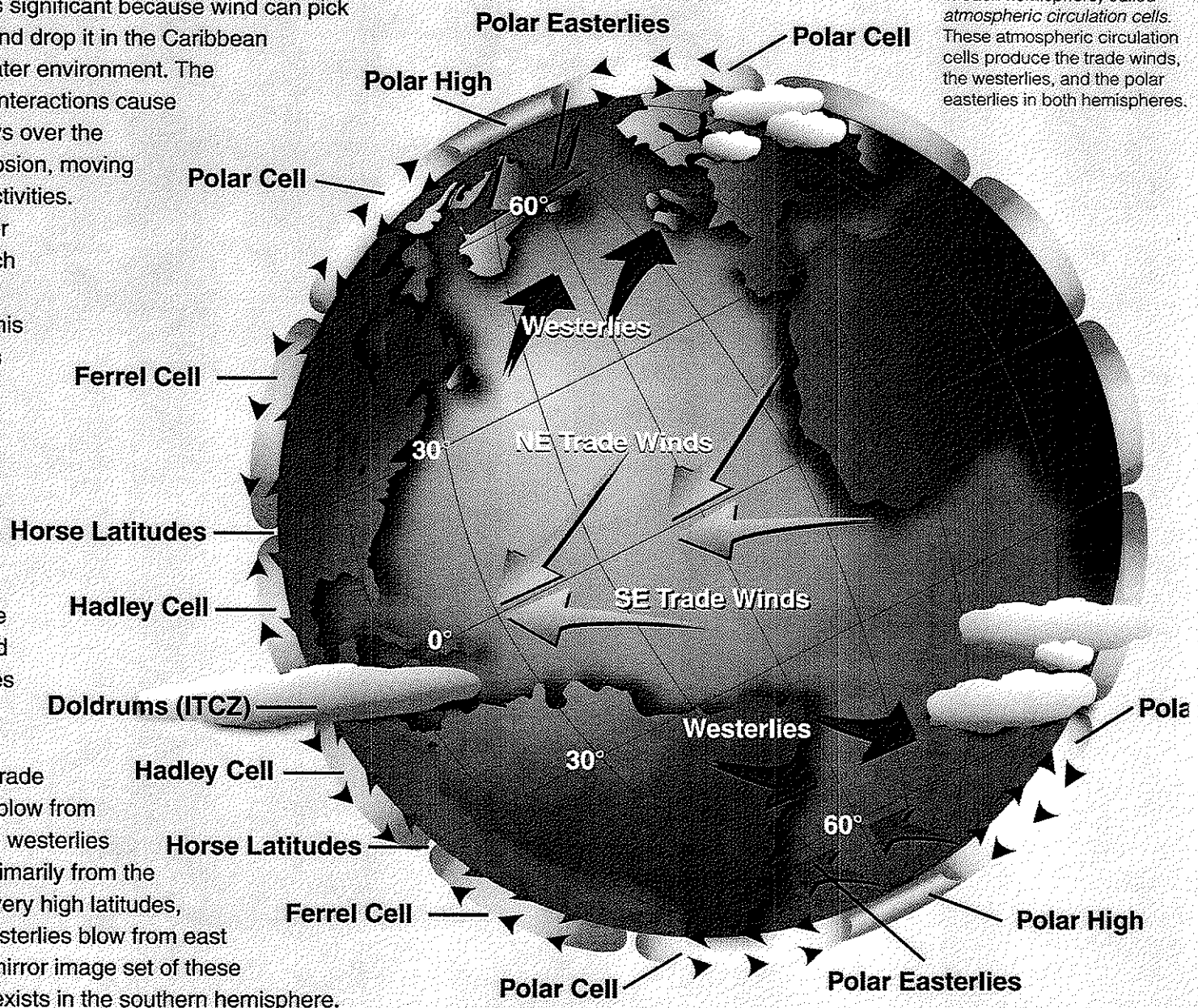
The Ups and Downs of the Seas

Today's scientists realize that the air, land and sea constantly exchange material and energy. This is significant because wind can pick up dry Sahara desert soil and drop it in the Caribbean Sea, changing the underwater environment. The dynamics of these energy interactions cause water to move in many ways over the earth's surface, causing erosion, moving soil and affecting human activities.

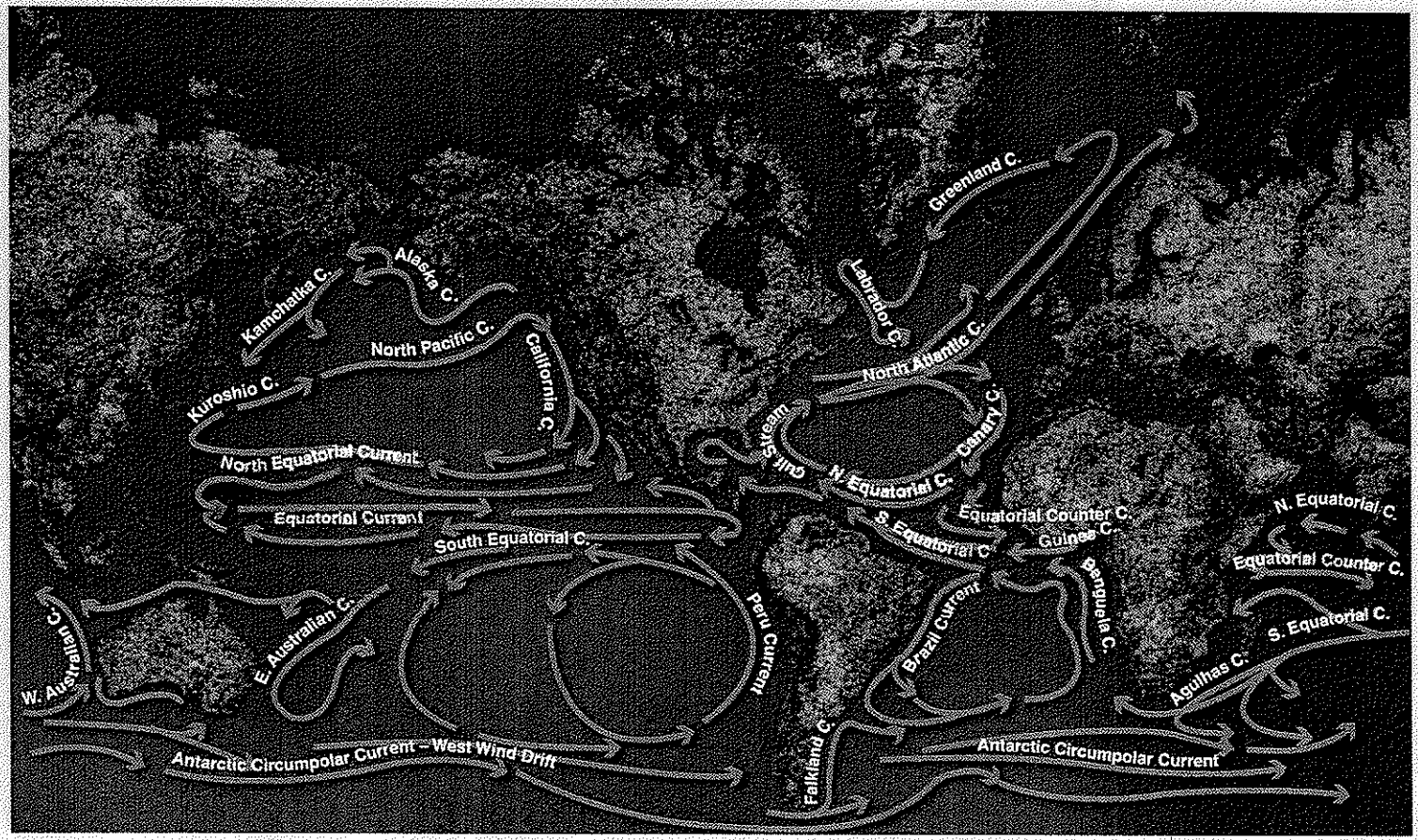
A primary cause of water motion is wind energy, which transfers to the water as it blows across its surface. This results in two primary types of water motion: currents and waves, both of which can result from forces other than wind as well.

SURFACE CURRENTS

When winds blow over large areas with reasonable consistency of direction and strength, significant volumes of water move horizontally across the oceans. In the northern Hemisphere, the trade winds (near latitude 15°N) blow from northeast to southwest; the westerlies in the mid-latitudes blow primarily from the southwest. At very high latitudes, the polar easterlies blow from east to west. A mirror image set of these wind belts exists in the southern hemisphere.



Global wind patterns are divided into six regions (three in each hemisphere) called *atmospheric circulation cells*. These atmospheric circulation cells produce the trade winds, the westerlies, and the polar easterlies in both hemispheres.



The major currents of the world's oceans.

The energy from these wind systems drives the major surface ocean currents. Some of these currents transport more than 100 times the volume of water carried by all of the earth's rivers combined. As with a wind-driven wave, surface current speed diminishes rapidly with depth, becoming negligible at depths around 190 metres/600 feet.

The earth's rotation also affects the major ocean currents. This is termed the *Coriolis effect*, and explains why objects in the northern hemisphere deflect to the right of the direction of the force acting on them (in this case, the wind is the force and the object is the water's surface). The opposite is true in the southern hemisphere. There, objects deflect to the left of the direction of force. The result is that water tends to pile up in the middle of the ocean basins as the major ocean currents travel along their edges according to the Coriolis effect. These

Coriolis Effect