

The Ekman spiral, dynamic topography, and geostrophic currents

Dynamic topography of the sea surface results from the net transport of water toward the center of a circle or gyre of currents. The Ekman spiral, our understanding of how winds drive surface currents, dictates that the upper part of the water column moves to the right of the surface water in the Northern Hemisphere and to the left in the Southern Hemisphere. As a result, the clockwise motion of surface currents

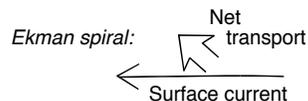
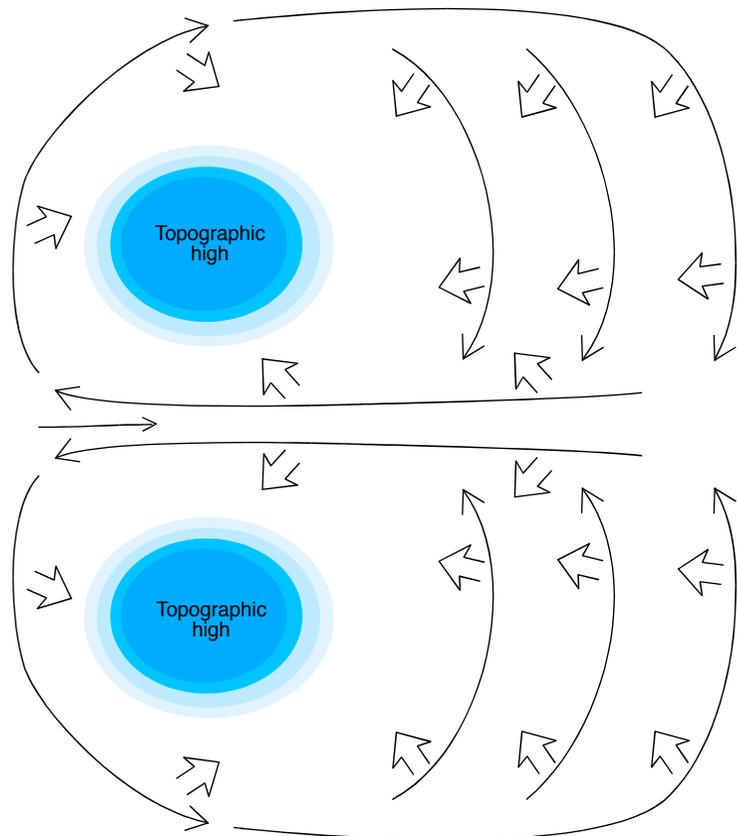
in the Northern Hemisphere pushes water into the western center of the gyre, creating a broad hill of water one to two meters above the rest of the ocean.

Dynamic topography's hill of water is a reservoir of potential energy, because that water will flow downslope toward the side of the hill. However, the Coriolis effect turns

that flow, to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. Thus dynamic topography stores potential energy that would keep the gyres of currents moving, even if the winds stopped. These currents are called "geostrophic currents", and they mean that the ocean gyres are like flywheels that move at relatively constant speed, regardless of local or transient failure of the prevailing winds.

Dynamic topography

A gyre of currents as the cause of a topographic high



Geostrophic current

The topographic high as the cause of a gyre of currents

