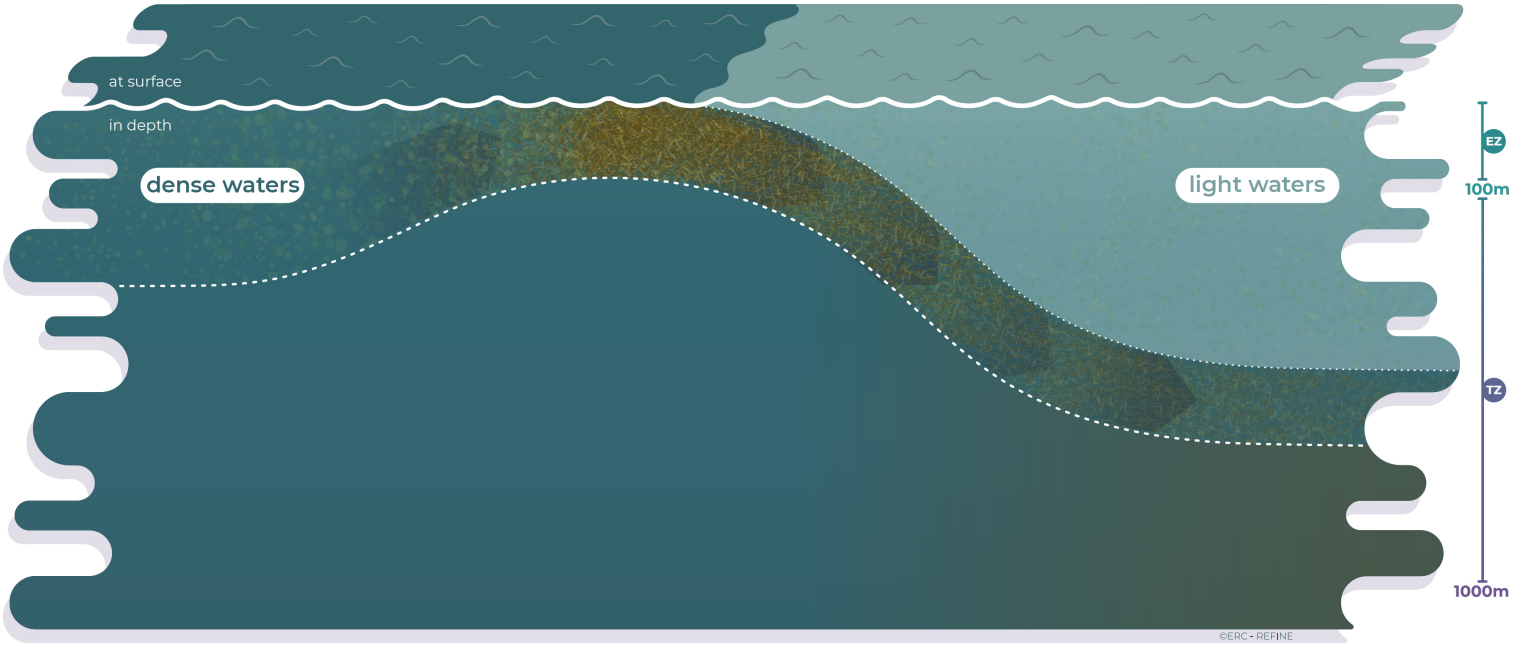
THE EDDY SUBDUCTION PUMP



The Eddy Subduction Pump.

The Eddy Subduction Pump is a physical mechanism injecting surface biogenic material deeper in the water column. This injection mechanism occurs at fronts which result from abutting between dense and less-dense waters. The mechanism is accentuated by atmospheric forcing which inhomogeneously mixes the upper ocean through the actions of winds and the exchange of heat and freshwater with the atmosphere.

The density gradients between waters of different densities trigger variations in water movement over the vertical dimension (so-called cross-front circulation) and occurring over sub-mesoscale spatial scales of 1-10 kilometers. Movements with positive velocities (known as obduction) bring dense waters to the surface; from there they will later flow under less dense waters via water movements with negative velocities (known as subduction). Such subduction can carry surface biogenic content to depths as deep as 500 m.

Very often, subducted waters are also enriched with biogenic material (the situation represented here). This enrichment results from obducted waters originating from a nutrient-rich depth horizon. When these waters reach the illuminated surface layer, environmental conditions hence become favorable for phytoplankton growth and the development of biomass hotspots which will be subsequently carried to depths from which they can also further sink through the Gravitational Pump.