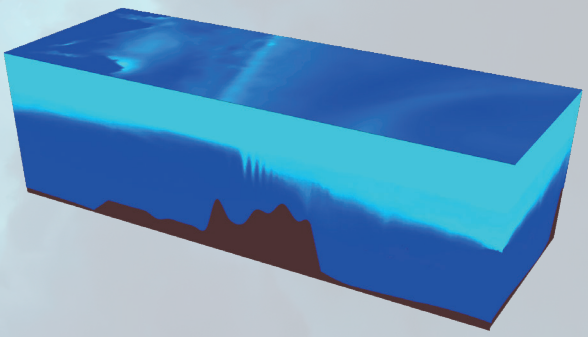
Internal waves

Ocean internal waves are underwater oscillations with an amplitude of 10 to 100 metres, sometimes more. They are triggered by a disturbance of the interface between water layers of different density. Such disturbances may then propagate over great distances, causing these layers to oscillate with respect to their initial equilibrium state. They are observed almost everywhere there is a clear contrast in vertical density, as seen here where the saltier waters of the Mediterranean meet those of the Atlantic in the Gibraltar Strait.

These internal waves are excited by deterministic mechanisms, for example tidal flow over bathymetric obstacles like sea mounts or continental shelves, otherwise known as an internal tide. They may also be excited by more random phenomena like tsunamis or severe ocean storms, and by other complex phenomena that are still poorly understood. Internal waves are considered to be underwater ocean disturbances, and scientists believe they have a significant impact on ocean circulation, currents and exchanges of cold and warm water, and therefore on climate.



Because satellites can only see the upper layers of the oceans, 3D models are needed to simulate how they work. But we know too little about internal waves to build precise models. The surface signal generated by internal waves is too weak in comparison with other signals like sea level anomalies and external tides. The most frequent of these internal waves are internal tides, which occur at horizontal scales of about 20 to 150 km—the same as the signature of mesoscale circulations. Altimetry satellites currently in orbit can't distinguish such phenomena, or at least only partly.
That's why the future SWOT satellite is so important. Its two-dimensional resolution will be a few hundred metres, accurate to within less than 2 centimetres in amplitude. It will therefore be able to see the surface signal of internal waves, especially internal tides, helping scientists to improve 3D models and understand the waves' impact on ocean circulation and climate.