Internal waves and sloping boundary mixing in the ocean

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Most of the ocean is stably stratified in density. This stratification supports waves in the interior, also at great depths. Such 'internal' waves are generated via topography. On the other hand, most of ocean's vertical turbulent exchange is thought to be induced from destruction of internal waves, via their breaking. This breaking also occurs at or just above under-water topography or sloping boundaries in the coean. However, above sloping bottoms under rotation other boundary mixing processes may be important as well.

During these lectures concepts of sloping bottom boundaries and internal waves are discussed, highlighted by detailed ocean observations. Step-by-step phases of boundary layer mixing, its (in)efficiency and relevant Earth rotational and internal wave scales are discussed. Naturally, treatment commences with the turbulent boundary layer above flat bottoms, for rotary motions under Ekman dynamics, both in homogeneous and in stratified waters.

Lecture 1:
General introduction to subject: definitions of Internal waves and turbulent boundary layers ; Ekman dynamics above flat bottom: i. Homogeneous case: a. for linear flows, b. for oscillatory flows ; ii. Ekman dynamics for oscillatory motions in stratified waters.

Lecture 2:
Sloping boundary Ekman dynamics: slippery flows; (in)efficiency of mixing, relevant time scales.

Lecture 3:
Internal wave generation, breaking: critical slopes and focal points. The importance of internal waves and boundary mixing for general ocean circulation. Relation to scales of turbulent boundary layer (above a slope).

Lecture 4:
Internal wave interaction: the path from waves to irreversible mixing. Generation of high-frequency "solitary" or bore-like non-linear waves.