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Waves on density interfaces in stratified water bodies

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ABSTRACT

Where density interfaces exist in natural water bodies as a result of either temperature or salinity differences (or both), such interfaces can support internal wave motions. These motions may be established, for example, as a response to the relaxation of surface wind forcing or to local generation processes. The internal waves may be simple seiching-type modes or they may be dispersive, high-frequency propagating waves that are able to steepen and develop into internal solitary waves (ISWs) and internal surges. Internal wave motions characterise stably-stratified water bodies and they play important roles in their dynamics and energetics. The focus is placed here on internal solitary waves (ISWs), the properties of which are important for the vertical mixing processes that occur in stratified water bodies. Such properties will be discussed and observational evidence of the ubiquity and importance of such waves will be described briefly, particularly with regard to lakes and reservoirs. Laboratory investigations by the author and his colleagues into the behaviour of so-called Mode-1 ISWs will be summarised but the main emphasis will be placed on reporting the results of recent experimental studies of Mode-2 ISWs (sometimes denoted “varicose” or “bulging” ISWs). Laboratory data describing the behaviour and properties of these waves will be compared with the predictions of two recent numerical modelling studies by other groups.