## Abstract View

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# Shock Waves in Currents and Outflows

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ABSTRACT

Shock waves are discontinuities (in the physical properties of a fluid) which behave in an organized manner. The possibility that such waves may occur in oceanic boundary currents is examined with a nonlinear two-layer analytical model. Attention is focused on separated boundary currents (i.e., light currents whose lower interface strikes the free surface or heavy currents whose upper interface intersects the floor) with zero potential vorticity. The shocks result from an increase in the upstream transport; they correspond to abrupt and violent changes in depth and velocity accompanied by a local energy loss. Nonlinear solutions for steadily translating shocks are constructed analytically by connecting the upstream and downstream fields without solving for the complicated region in the immediate vicinity of the shock.

It is found that, while stationary shocks are impossible, steadily propagating shocks can always occur. There are no special requirements on the boundary currents in question and the only necessary condition for steadily advancing shocks to occur is that the upstream depth is increased. Once formed the shocks propagate downstream at a speed greater than that of a Kelvin wave associated with the increased up-stream flow.

Possible application of this theory to the Mediterranean outflow is discussed. For this purpose, the results of the two-layer model are extended to a three-layer model corresponding to a wedge-like boundary current “sandwiched” between two infinitely deep layers. With the aid of this model it is suggested that the abrupt changes in temperature and depth observed in the Mediterranean outflow are a result of a shock wave advancing downstream. The observed changes in this region are so abrupt and violent that no other known kind of wave ran explain them.

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