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[Volume 18, Issue 1 \(January 1988\)](#)

Journal of Physical Oceanography

Article: pp. 107–114 | [Abstract](#) | [PDF \(545K\)](#)

Stommel's "Westward Intensification" in a Three-Dimensional Similarity Version

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(Manuscript received January 27, 1987, in final form August 18, 1987)

DOI: 10.1175/1520-0485(1988)018<0107:SIIATD>2.0.CO;2

ABSTRACT

A special three-dimensional solution of similarity type is given for a meridionally closed ocean with dynamic according to Stommel's classical transport model, and with the density determined by three-dimensional advection and vertical diffusion. The boundary current exhibits a rapidly varying scale depth; this depth becomes zero at a critical latitude where the current must separate. The solution requires an upwelling everywhere, to be balanced by abyssal sources of water and a deep circulation, as described by Stommel and Arons. It is proposed that a more general similarity form may be useful in future analytical as well as numerical studies of the ocean circulation.

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