
Stratified flow near a topographic control

Kraig Winters*¹

¹Scripps Institution of Oceanography (SIO) – United States

Abstract

For strongly stratified flows over tall obstacles, i.e. when the topographic Fr is small, long internal waves are able to propagate upstream from the obstacle. The upstream influence of these waves leads to blocking and the formation of an upstream jet. The jet becomes hydraulically controlled at the crest of the obstacle and takes the form of an accelerated downslope flow in the lee. In the first half of the talk, an optimal solution for continuously-stratified, topographically controlled flow is derived analytically. This laminar, nonlinear solution describes the upstream flow profile and its transition to a supercritical downslope flow. In the second half of the talk, the fate of the downslope flow, in particular its separation from the obstacle and its turbulent transition back to a subcritical state are examined. For the same flow conditions upstream and at the crest, the intensity of the turbulence in the lee is shown to depend sensitively on the downstream, subcritical boundary conditions, imposed by specifying the height of a second, downstream obstacle. The blocking height of the downstream obstacle is communicated upstream by internal waves that ride on a sharp pycnocline and set the point at which the downslope flow separates from the upstream obstacle.

*Speaker