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The nature of transition between downslope and lateral splitting flows in low Froude number stratified flows approaching long ridges ARJUN JAGANNATHAN, KRAIG WINTERS, LAURENCE ARMI, Scripps Institution of Oceanography, UC San Diego — We investigate the transition between downslope and laterally splitting flow states for low Froude number stratified flows approaching long but finite ridges. In these flows, upstream influence is established through two distinct and competing mechanisms. The streamwise upstream propagating internal wave modes are responsible for blocking and establishment of an accelerated, hydraulically controlled overflow whereas the oblique modes triggered by the finite extent of the obstacle promote the transition to a horizontal splitting flow. Scaling arguments reveal the time scales of the processes leading to this flow adjustment. We demonstrate through numerical experiments that for sufficiently long ridges, asymmetric downslope flows can persist over time scales that are important from a meteorological perspective. We also examine the case of a ridge with variable height and find that, remarkably, even as the flow over the tall section transitions to a splitting flow, a significantly enhanced downslope flow is established over the shorter section. We show that this flow enhancement can be explained using stratified hydraulic theory and flux conservation principles.

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