Abstract View

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Hydraulic Control of Sill Flow with Bottom Friction

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ABSTRACT

The hydraulics of strait and sill flow with friction is examined using a reduced gravity model. It is shown that friction moves the critical (or control) point from the sill to a location downstream. If the strait has constant width, the control point lies where the bottom slope is the negative of the drag coefficient C_d. If $-C_d$ exceeds the bottom slope everywhere, the flow cannot be controlled (in the classical sense that energy and flow force are minimized). Friction also decreases the minimum obstacle height required to establish hydraulically controlled flow in the classical laboratory towing experiment. Also, friction greatly encourages the establishment of stationary hydraulic jumps in the lee of the sill and, under certain conditions, gives rise to stationary jumps on the upstream face of the obstacle. Some consequences of these results for deep-ocean overflows are given using the Iceland-Faroe overflow as an example.