Hydrodynamics over an estuarine scour pit

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The hydrodynamics associated with a scour pit, or bathymetric hollow, in an estuary
are explored with observations and numerical model results. Observations over a scour
pit (hollow) in the Chesapeake Bay suggest strongly asymmetric distributions of tidal
flows from flood to ebb. The tidal flow accelerates over the hollow in flood but decel-
erates over it in ebb. In both instances, the flow exhibits marked convergences upon
entering the hollow. A simple conceptual model of the hydrodynamics suggests that a
horizontal density gradient is needed to produce such acceleration over an expanding
cross-section. Numerical solutions over an idealized hollow confirm the suggestion of
the conceptual model. The numerical results also indicate that the flood accelerations
take place at the transition from a frictionally dominated flow to an inertially domi-
nated flow at a critical slope of the hollow. This critical slope is approximately equal
to the bottom drag coefficient.