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Experiments on the formation of erosional streamlined islands

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The similarity between morphological features formed by channelized flows on Mars - presumably water - and extreme terrestrial floods has been long argued. In particular, streamlined islands found in Martian outflow channels, in the Channeled Scablands of eastern Washington, USA, or on the newly surveyed floor of the English Channel, are intriguing and yet ubiquitous landforms that have been commonly associated with the action of high energy flows. Although argued to be the result of largest terrestrial or Martian floods, little is known about the particular flow processes under which streamlined islands form. We performed a series of experiments aimed at understanding the origin and first-order processes involved in the formation of features such as streamlined islands and other landforms associated with extreme flooding. The experiments included a series of runs with constant or pulse-type of discharge flowing on an originally flat, wide, tilted deposit composed by two layers, intending to represent a surficial, resistant sediment. We used silt with a certain degree of cohesiveness overlying a more erodible, non-cohesive layer of anthracite. The ratio between flow width and flow depth was always higher than 100. For either of the cases analyzed (constant or pulsed water discharge), we observed the spontaneous formation of randomly-distributed small-scale scours eroded on the surface layer. These then evolved into rapidly upstream-migrating horse-shoe falls and associated downstream channelized flows. Interestingly, the interaction of these upstream-moving features and their downstream channels led to the formation of a series of forms including potholes, cataracts, higher order channels, and erosional streamlined features that closely resemble the streamlined islands and other landforms observed in the Channeled Scablands or on the Martian surface.