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Effect of Roughness Geometry on Turbidity Currents Head Characteristics

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Abstract

Turbidity currents are flows driven by density differences caused by suspended fine solid material. The head is the leading edge of turbidity currents. In this paper, the influence of roughness geometry on the head concentration, velocity and height are studied experimentally. Experiments were performed using six rough beds as well as a smooth bed. The roughness elements were in cylindrical and conic shapes. It was found that the head is influenced by height and project area of roughness elements. In a given shape of roughness elements, as the height of roughness elements is increased, the head velocity and concentration declines while the head height increases. In a particular height of roughness elements, the head velocity and concentration decreases and head height rises when the project area of roughness elements increases.

Key Words: Turbidity current, Head, Rough bed, Roughness geometry

1. Introduction

Density currents are produced where gravity acts upon a density difference between one fluid and another and thus such currents also bear the name of gravity currents (Bombardelli et al., 2009). The density difference can be caused by suspended materials, temperature gradients, dissolved contents or a combination of them. These currents are also called turbidity currents when the main driving mechanism is obtained from suspended sediments. The most common type of density currents is an underflow that is produced when a flow is introduced into an ambient fluid of a less density.

Density currents occur in both natural and man-made situations. In estuaries, turbidity or salt water intrusions can travel long distances upstream along rivers. Large-scale atmospheric movements, thunderstorms outflows, sea-breeze fronts and snow avalanches are natural examples of such currents (Kneller and Buckee, 2000). Common industrial examples of