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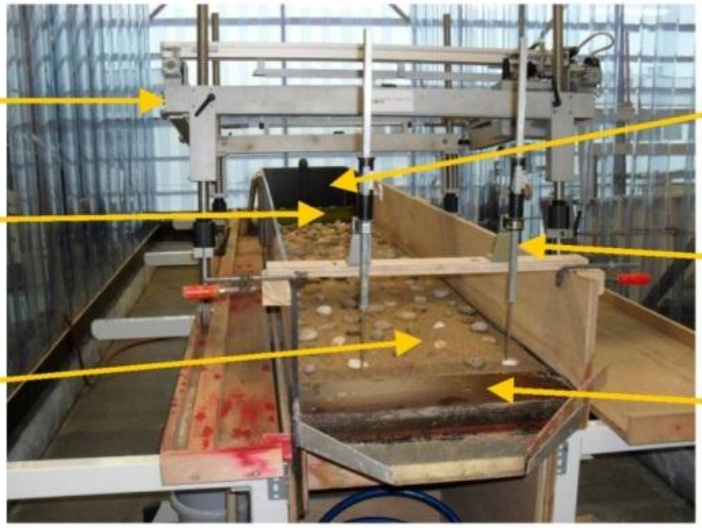
Flume and Rainfall Simulator for Overland Flow Studies

Mazhar Ali[1], Geert Sterk[2] and Manuel Seeger[1]



Technical Specifications

- Flume
  - Length (L) 3.0 m
  - Width (w) 0.5 m
  - Depth (d) 0.04 m
  - Slope 0 to 15°
  - Upper Stopper L = 0.20, w = 0.5, d = 0.04 m
  - Lower Stopper L = 0.15, w = 0.5, d = 0.04 m
- Water Supply
  - Flow Rate Measurements Water-meter
  - Flow Rate 33 to 1033 cm^3/sec
- Flow Velocity
  - Velocity Measurements Dye Tracing Technique
  - Dye Used Lycopene
  - Test Length 1.24 m
- Water Depth
  - Depth Measurements 2 Point Gauges
  - Accuracy 0.1 mm
- Rainfall Simulator
  - Nozzle Lechler 461.008 71 mm/hr
  - Nozzle Lechler 460.788 36 mm/hr
  - Height above Flume Bed 3.0 m
  - Area Covered 2 m^2
- Available Sediment
  - Median Grain Size (D_{50}) 0.233, 0.536, 0.719 and 1.022 mm
- Bed Roughness
  - Roughness Measurements Laser Scanner
  - Accuracy 1mm
  - Scan Area 1 m^2

Applications

The flume and other available equipments can be used for following studies:

- Overland flow studies
- Hillslope studies
- Soil stability studies
- Interception studies
- Calibration of field equipment
- Sediment detachment and transport studies

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Evaluation of Sediment Transport Equations Under Overland Flow Conditions

Mazhar Ali[1] and Geert Sterk[2]

Background

- Empirical and physically-based equations are used in most water erosion models for soil detachment and sediment transport.
- Most equations were derived for streamflow conditions due to non-availability of experimental data for overland flow conditions.
- But hydraulic and sediment transport conditions in streamflow are different from overland flow conditions (depth, velocity, slope, etc), which makes the use of streamflow transport equations questionable.

Methodology

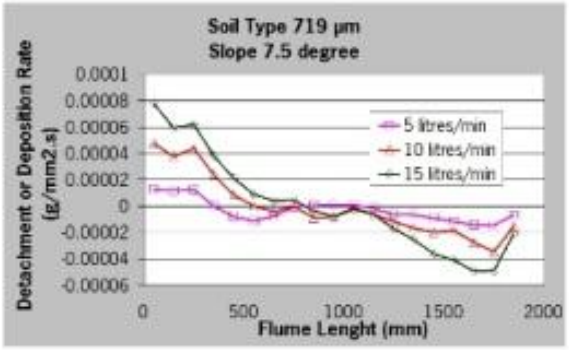
- Seven well-known and widely-used sediment transport equations are critically analyzed and a literature review of previous tests has been made.
- 1214 flume experiments are being carried out to collect the hydraulic and sediment parameters under four different conditions:
  1. Smooth bed
  2. Rough bed
  3. Smooth + Rainfall
  4. Rough + Rainfall

Study Objectives

- To study the effect of bed roughness, rainfall amount and intensity on sediment transport capacity in the laboratory under different flow conditions.
- To evaluate the performance of existing soil transport equations using the laboratory data, and identify the best-performing transport equations.
- To adapt the best performing transport equations by including the effects of bed roughness and rainfall effects.

Preliminary Results

- Interaction of detachment and deposition along flume is dependent on the discharge at same slope.



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