### River Engineering and Stream Restoration IIa- Watersheds

## Pierre Y. Julien

Hong Kong - December 2004

# **Objectives**

Brief overview of River Engineering and Stream Restoration with focus on :

- 1. Watershed Processes;
- 2. Sediment Yield;
- 3. Watershed Modeling.





# **Objectives**

- 1. Extend the applicability of the Model CASC2D-SED for simulating fate and transport of sediment and metals in surface waters
- 2. Field applications at the EPA Superfund site at California Gulch

CASC2D-SED Modeling 2004

83



CASC2D-SED Modeling 2004







### CASC2D-SED

#### Water

- 1. Rainfall
- 2. Infiltration
- 3. Overland and Channel Flow

#### Sediment

- 1. Upland Erosion and Deposition
- 2. Channel Processes
- 3. Sediment yield

#### Metals

8

- 1. Transport and Fate
- 2. Phase Distribution
- 3. Toxicity Levels

#### CASC2D-SED Modeling 2004




























# CASC2D-SED: Water Components

- Hortonian Runoff (infiltration excess)
- Rainfall: Raingages or Radar Data
- Interception, Surface Depression Storage
- Green/Ampt Infiltration
- 2-D Diffusive Wave Overland Flow Routing
- + 1-D Diffusive Wave Channel Routing

83

CASC2D-SED Modeling 2004

Model Output:	Cont <30 Cont <30 Cont <30 Cont <300 Cont
Infiltration	
Runoff	C 0.0001 C 1 C 0.0001 C 3 C 0.001 C 10 C
С.	t = 1 min.





















Sediment	<pre>&lt; 0.00001 &lt; 0.03 &lt; 0.00003 &lt; 0.1 &lt; 0.00001 &lt; 1 &lt; 0.0003 &lt; 0.0003 &lt; 0.001</pre>	Sand Flux (m3/s)
Modeling	₩< 0.003 ₩< 0.01	
		Silt Flux (m3/s)
		Clay Flux (m3/s)
8	c · 1	t = 700 m













































## Cumulative Criterion Unit (CCU)

$$CCU = \sum_{i=1}^{N_{metals}} \frac{mi}{Ci}$$

 $\begin{array}{l} \mbox{Where:} \\ \mbox{mi} = \mbox{measured concentration of the } i^{th} \mbox{ metal} \\ \mbox{Ci} = \mbox{ toxic concentration for the } i^{th} \mbox{ metal} \\ \end{array}$ 

CASC2D-SED Modeling 2004

83

12





















## Conclusions

- 1. Tremendous developments in computer modeling of fate and transport of sediment and metals in surface waters.
- 2. Direct applications at the EPA Superfund site at California Gulch.

CASC2D-SED Modeling 2004

8

## CASC2D-SED Web Page

• At Colorado State University • Under direction of Dr. Pierre Julien

### pierre@engr.colostate.edu

Current manual, source code, example, MPEG movies

http://www.engr.colostate.edu/%7epierre/ce\_old/ projects/casc2d-Rosalia/index.htm

CASC2D-SED Modeling 2004

Æ









