SEDIMENT FEEDING EFFECTS ON THE BED MORPHOLOGY IN CHANNEL CONFLUENCES

Sebastián Guillén Ludeña
Mário J. Franca
Anton J. Schleiss
António H. Cardoso

Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

INSTITUTO SUPERIOR TÉCNICO
Universidade Técnica de Lisboa

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Structure

- Introduction
- Background
- Objectives
- Methodology
- Results
- Main conclusions

Introduction

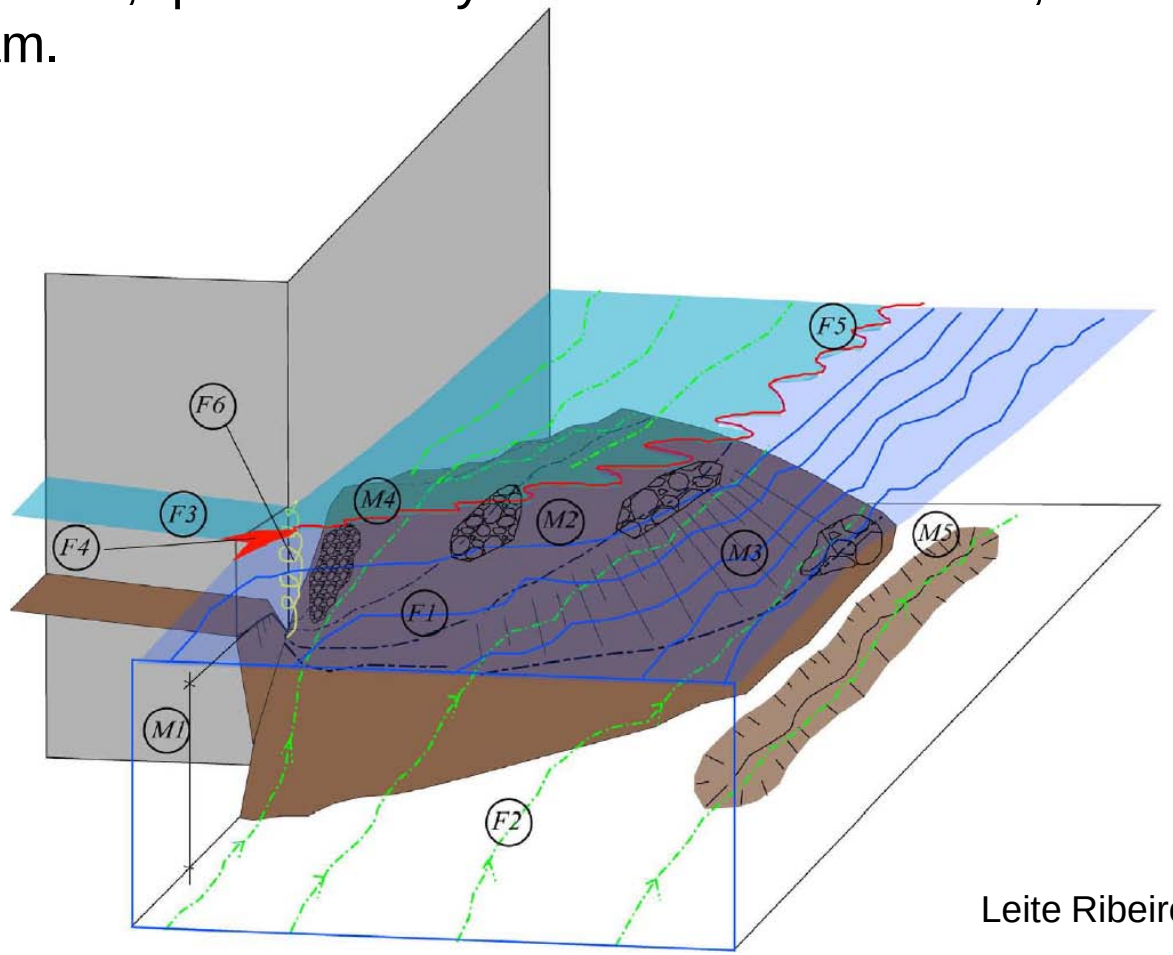
Within the fluvial network, **confluences** are particular areas characterized by **great ecological value**, where flow dynamic and bed morphology are much influenced by **local patterns**.

- **Impoverished ecosystems** due to previous channelization works.
- **Tributaries** environmentally **disconnected** from the main river.
- For future **rehabilitation projects**, it is essential to know in deep the **morphodynamic processes** in these key areas.

Background

Two layer flow structure:

- **Near-surf. flow** is deflected by the tributary flow towards the outer bank.
- **Near-bed flow**, protected by the bed discordance, flows unimpeded downstream.



Leite Ribeiro (JGR, 2012)

Objectives

Within the group of **discordant bed** confluences:

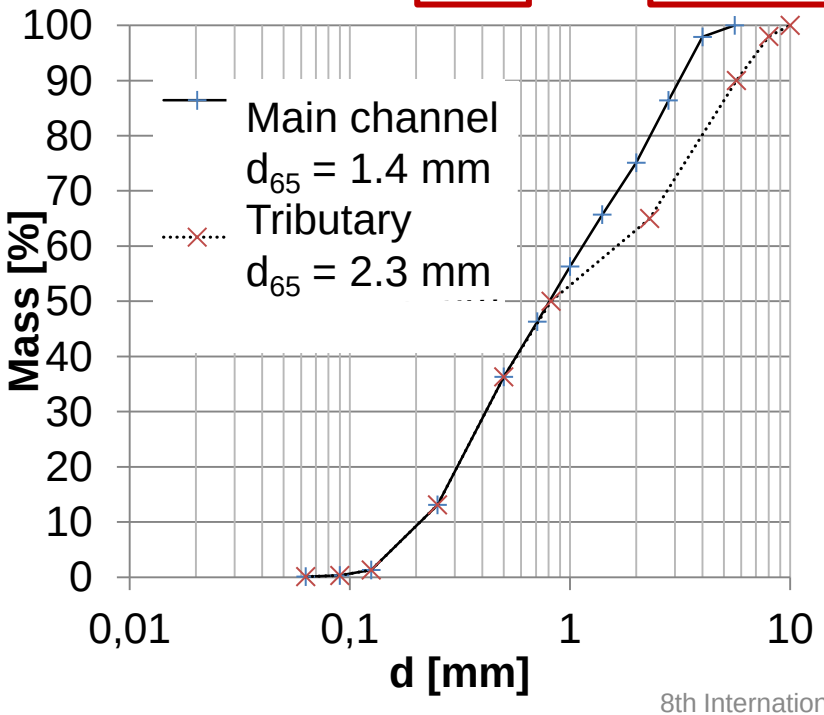
- To study the **effects** of the **sediment feeding** into the main channel on the **bed morphology** under equilibrium conditions.
- To analyze the **influence** of the discharge ratio (**Q_r**) and momentum ratio (**M_r**) on the main **morphological features.**

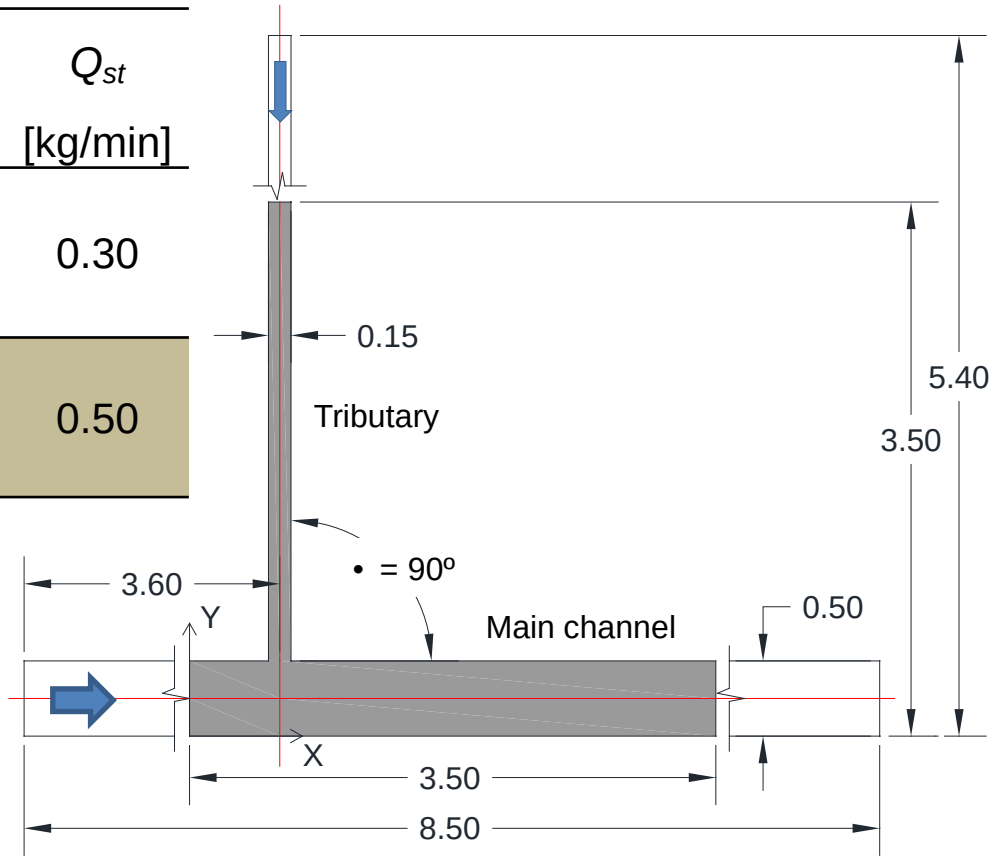
$$Q_r = \frac{Q_{tributary}}{Q_{main}}$$

$$M_r = \frac{M_{tributary}}{M_{main}}$$

Methodology

Discharge scenario	Q_r [-]	Q_{p-c} [l/s]	M_r [-]	Q_{sm} [kg/min]	Q_{st} [kg/min]
Leite Ribeiro (2012)	0.11	20.0	**0.22**	-	0.30
	0.15		**0.31**		
	0.23		**0.46**		
Low	0.11	30.0	**0.16**	**0.30**	0.50
Intermediate	0.15		**0.22**		
High	0.23		**0.36**		

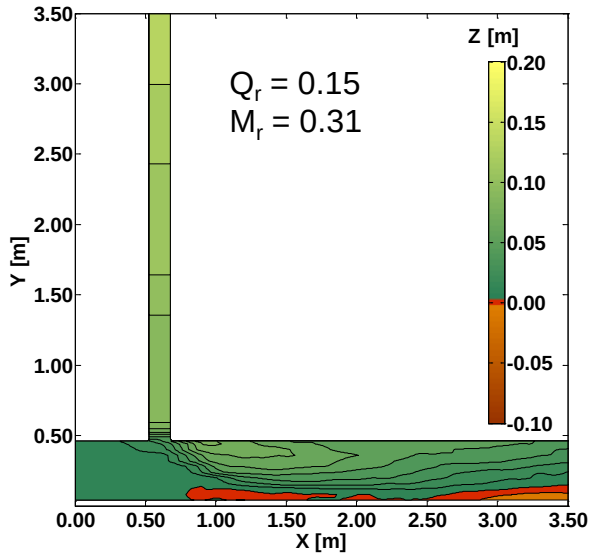


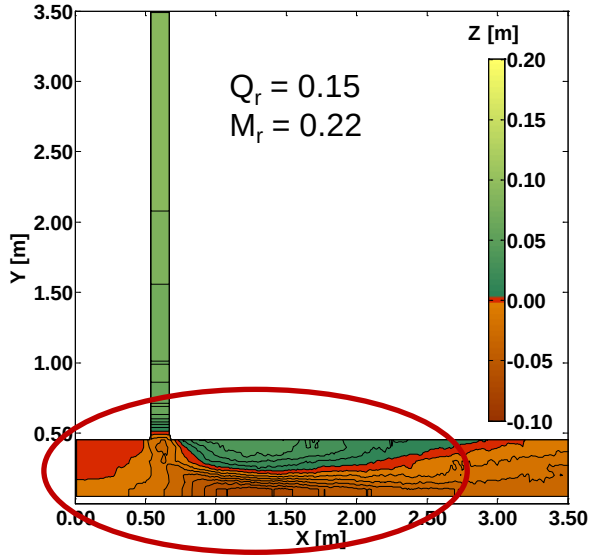


Main differences with Leite Ribeiro tests:

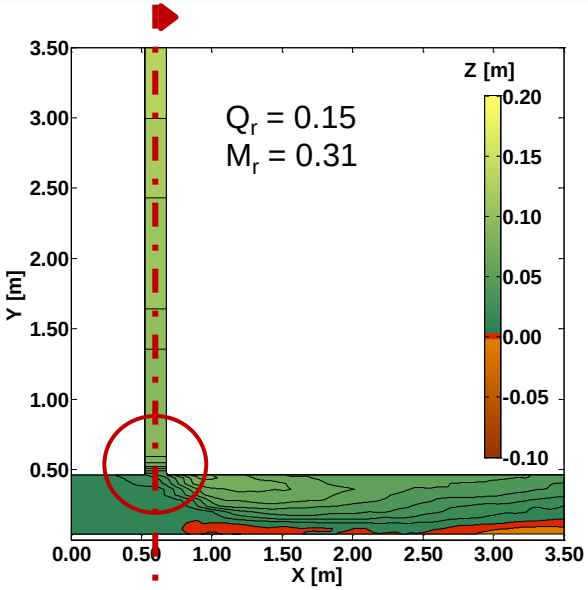
- **Increase** of Q_{p-c} from 20 to 30 l/s
- **Same Q_r** but **lower M_r**
- **Sediment feeding** in both channels

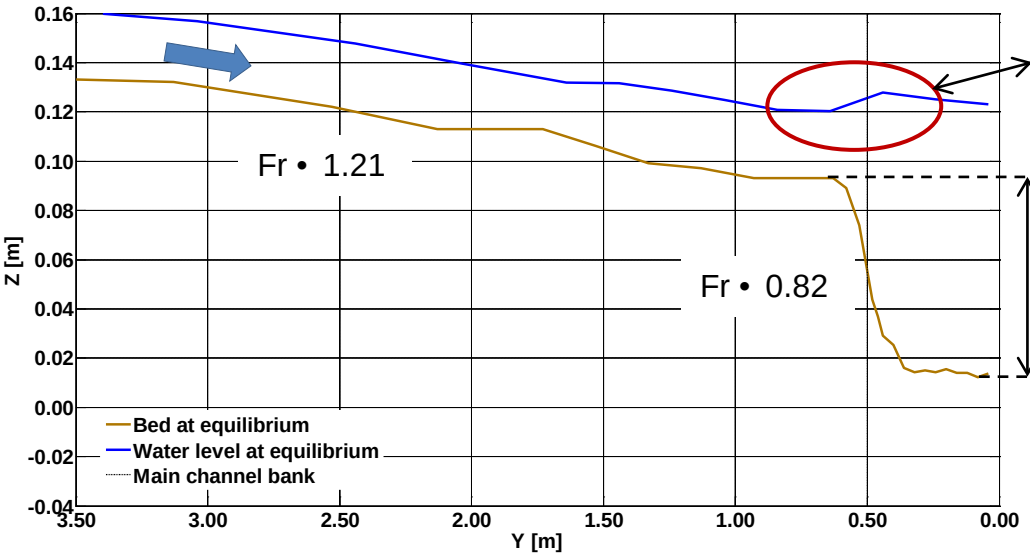
Results. Bed topography

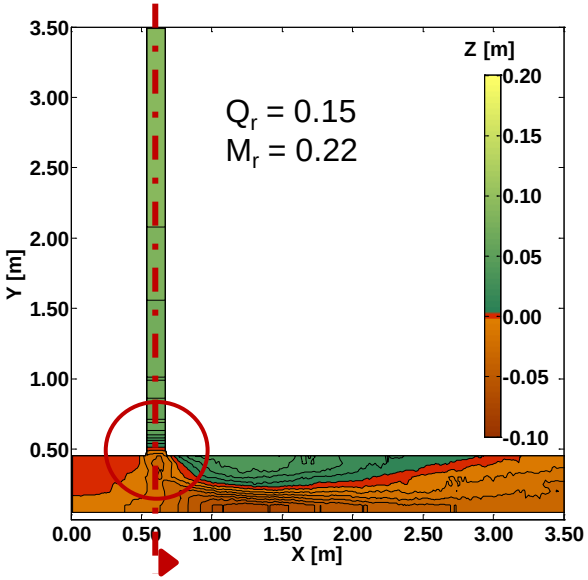


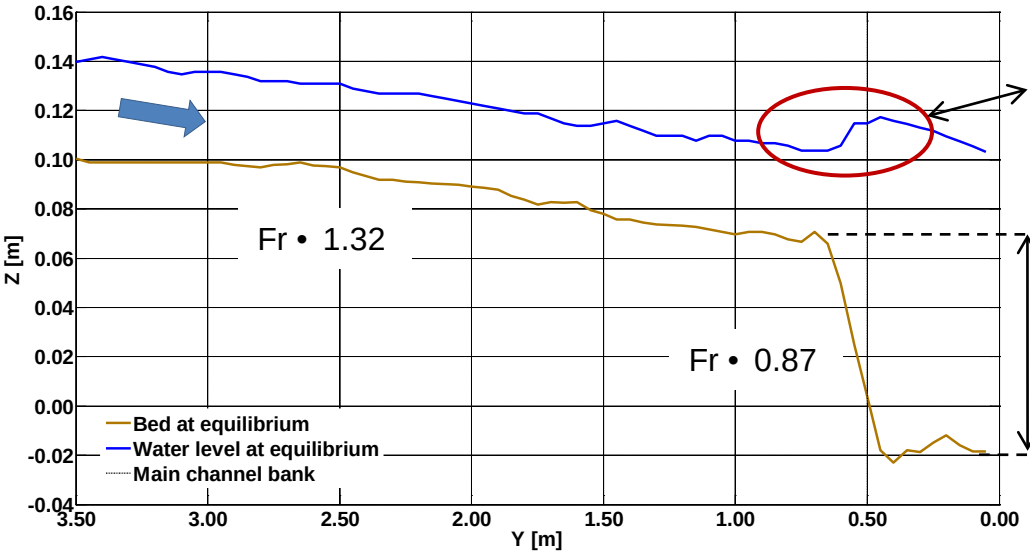


Results. Bed topography

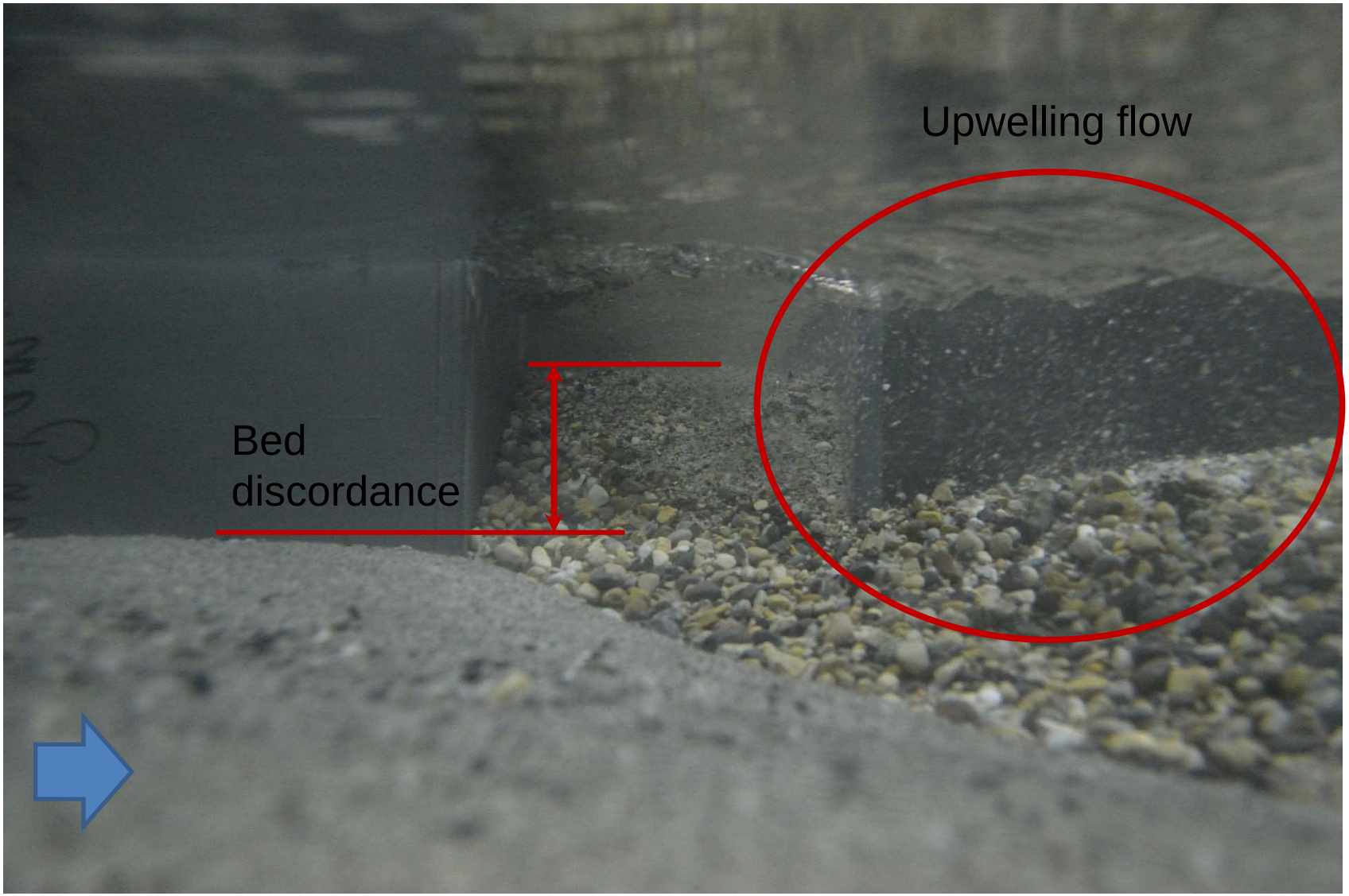






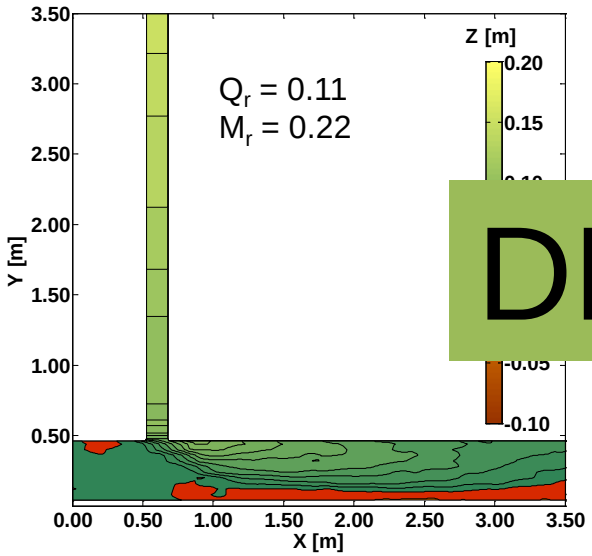


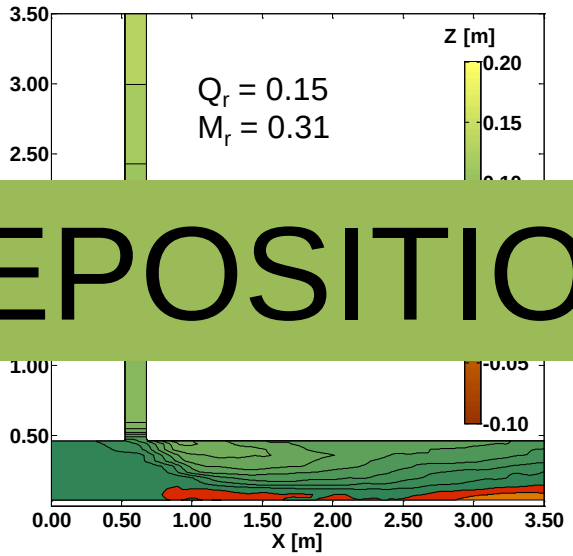
Results. Bed topography

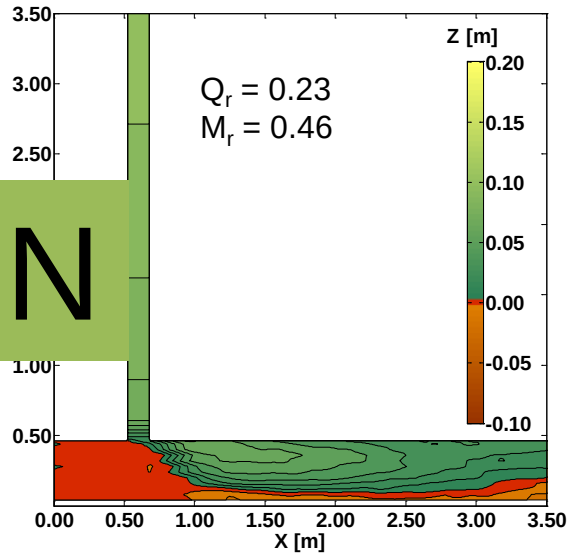


Results. Bed topography

Leite Ribeiro (2012)

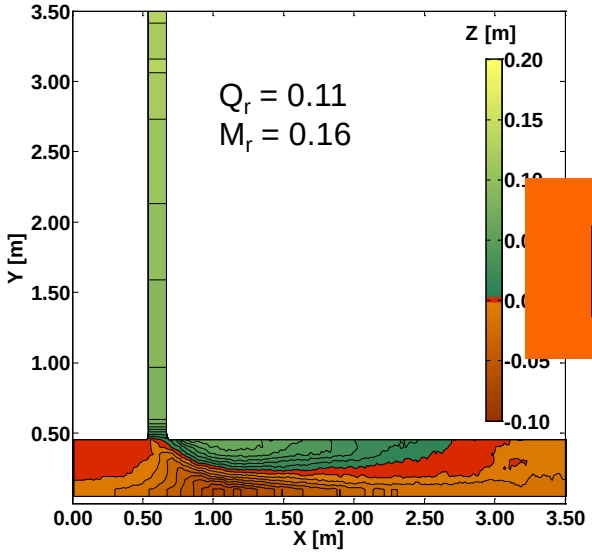


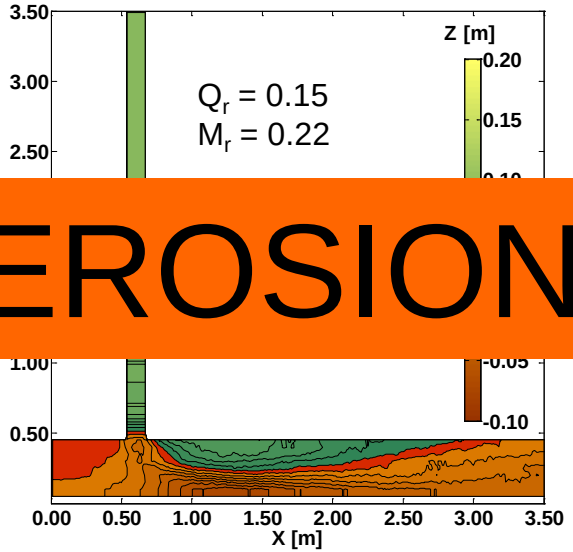


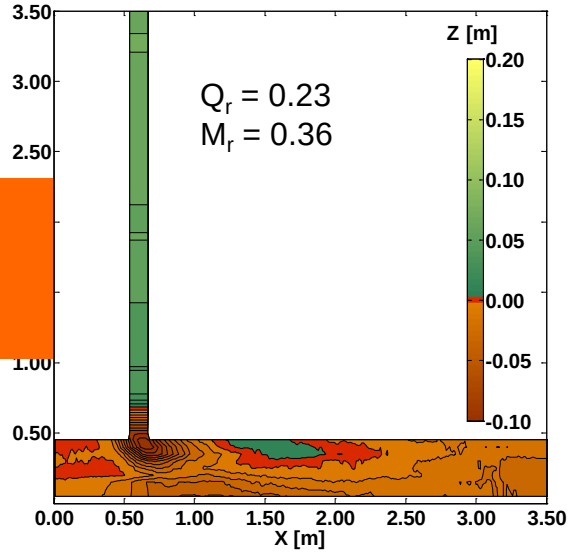


DEPOSITION

New results

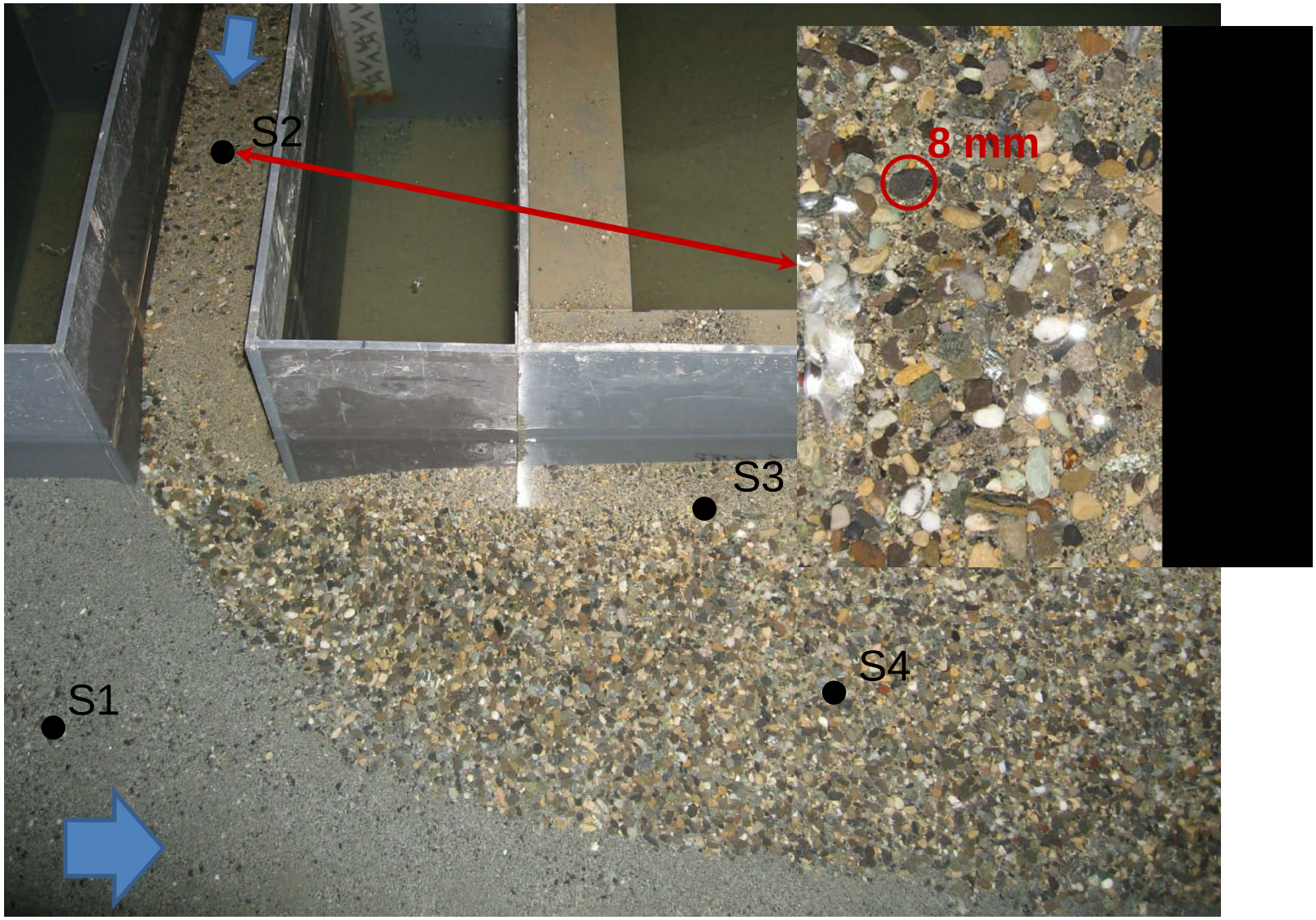




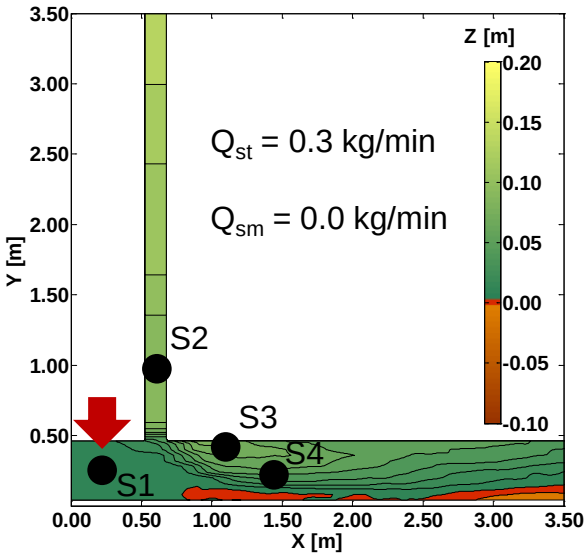


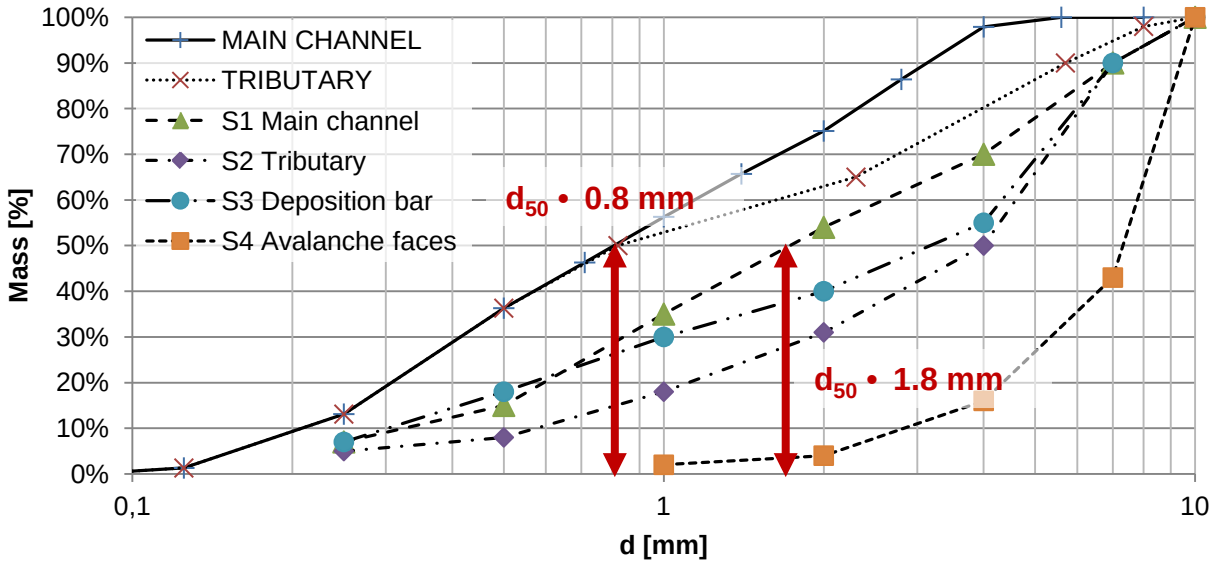
EROSION

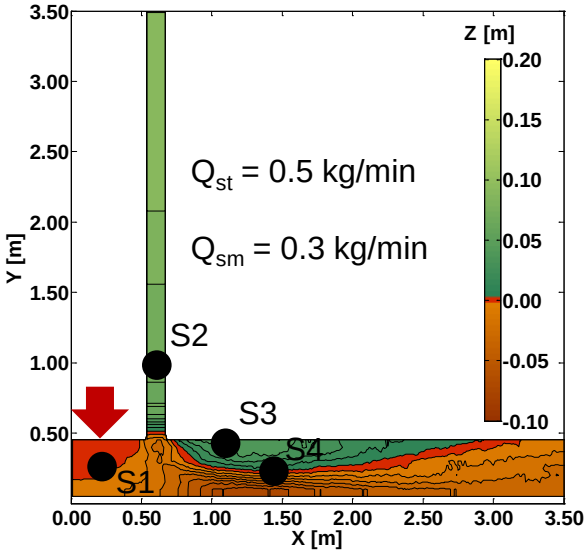
Results. Bed topography

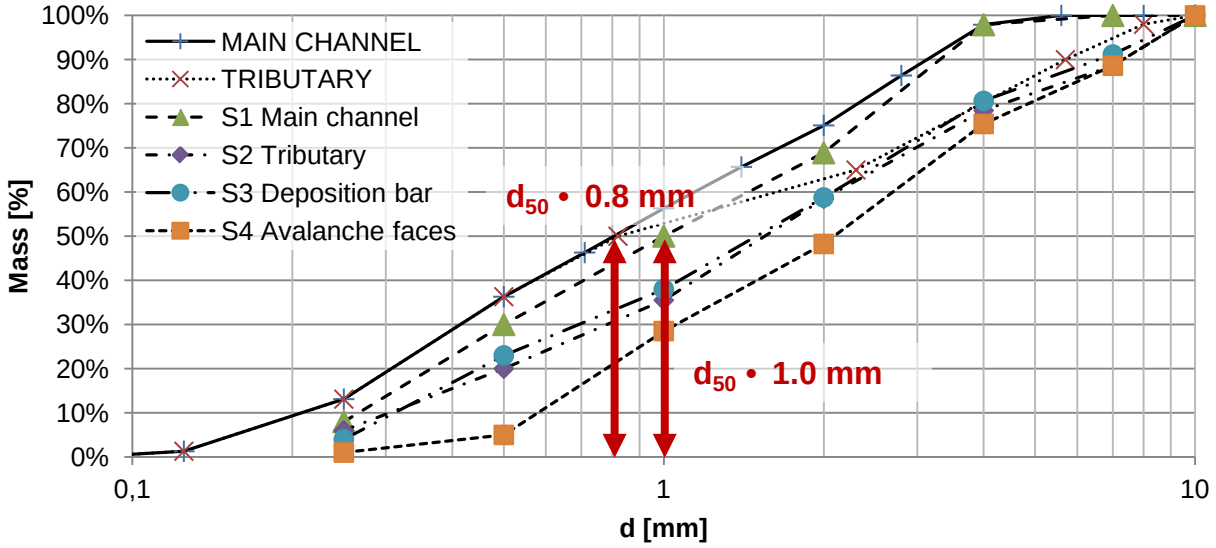


Results. Bed topography









Main conclusions

Why did **not** Leite Ribeiro get **erosion** in the main channel?:

- **The finer particles** of the live-bed **were washed-out** during the test, leading to create an **armor layer** (**increase of d_{50}**).

Why does **erosion** predominate in the new tests?:

- By **feeding sediments**, the **d_{50}** of the live-bed is kept **constant** avoiding armoring effect.
- The **finer particles help,** anyhow, **the movility of the coarser** ones, leading to erosion in the main channel.

- Bed morphology depends on **Q_r** and **M_r**, which is visible on the shape and size of the main morphological features.


THANK YOU
Sebastian.ludena@ist.utl.pt
Sebastian.ludena@epfl.ch