INFLUENCE OF THE FEEDING TEXTURE ON BED ADJUSTMENTS

Carles Ferrer-Boix
Marwan A. Hassan

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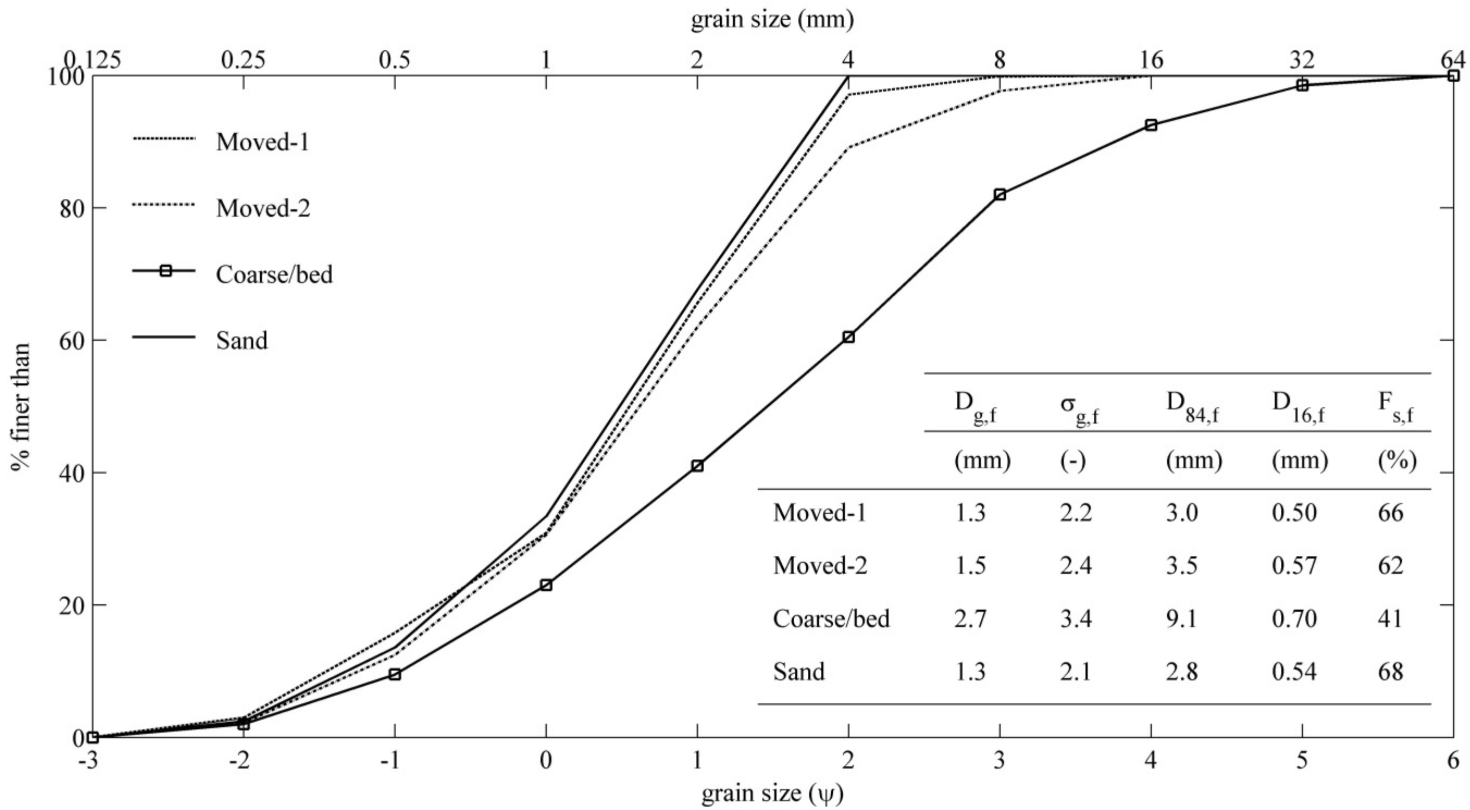
a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

EXPERIMENTAL CAMPAIGN

- 13 feeding experiments (+ 2 runs with no feed)
- Duration = 96 h
- Q_w = 21 l/s and 32 l/s
- $q_{b,f}$ = 0.14 - 0.75 g/m/s
- $S_{b0} \approx 0.008$ m/m
- τ_{b0} = 5.1-6.2 Pa (τ_{b0}^* = 0.12 – 0.14)
- 3 textures

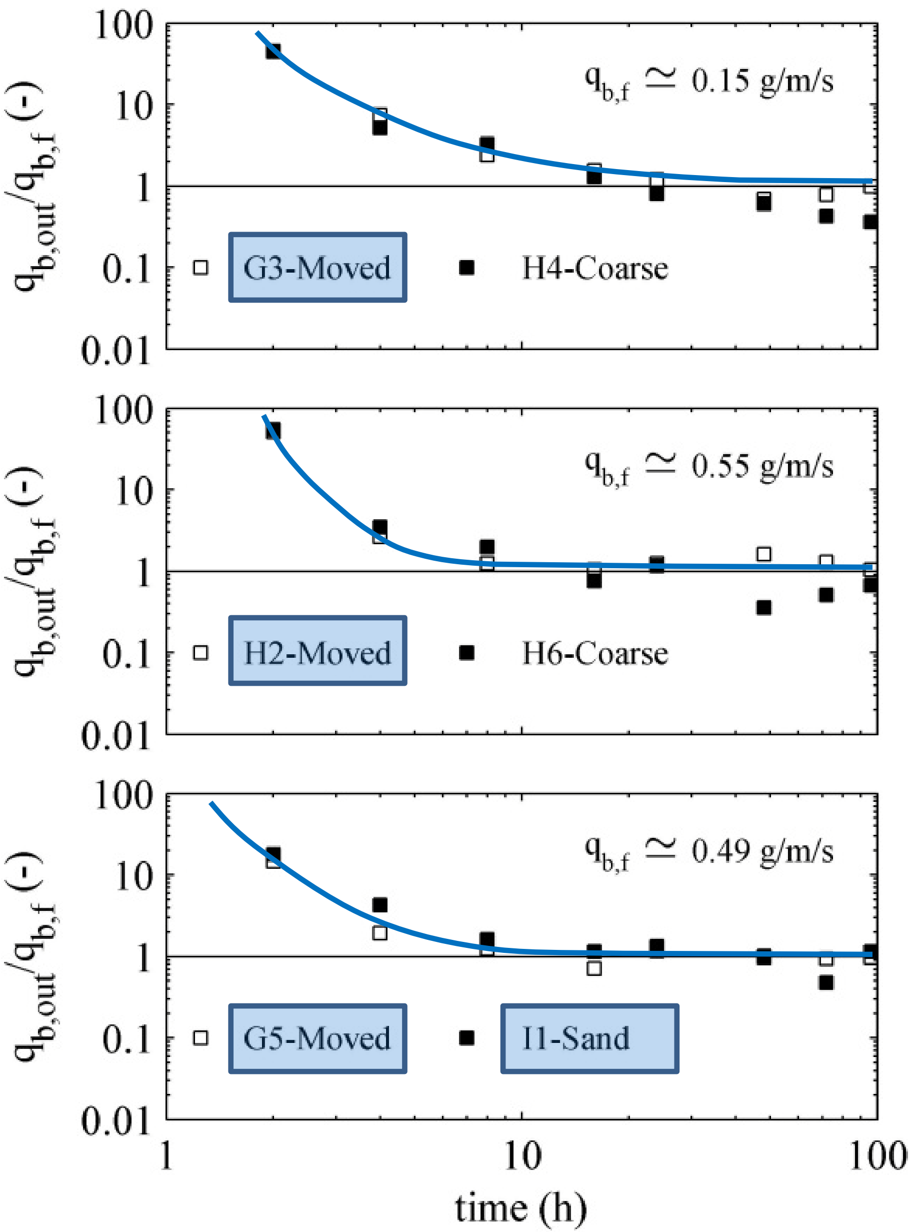
- 9.0 m-long tilting flume
- B = 0.6 m

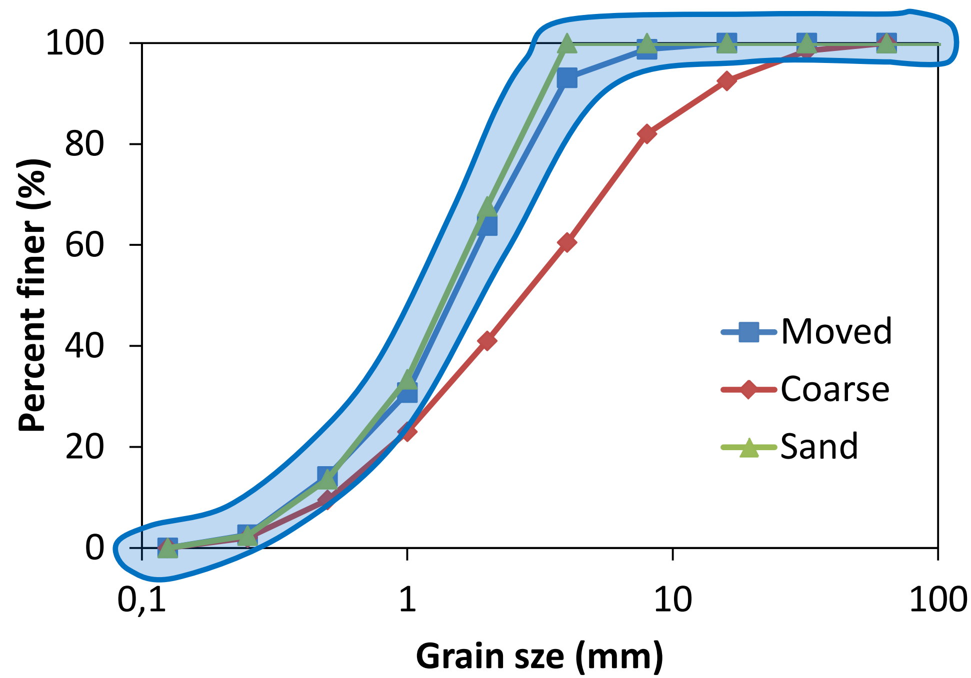
Hydraulic Laboratory of the Geography `Department (Hebrew University)



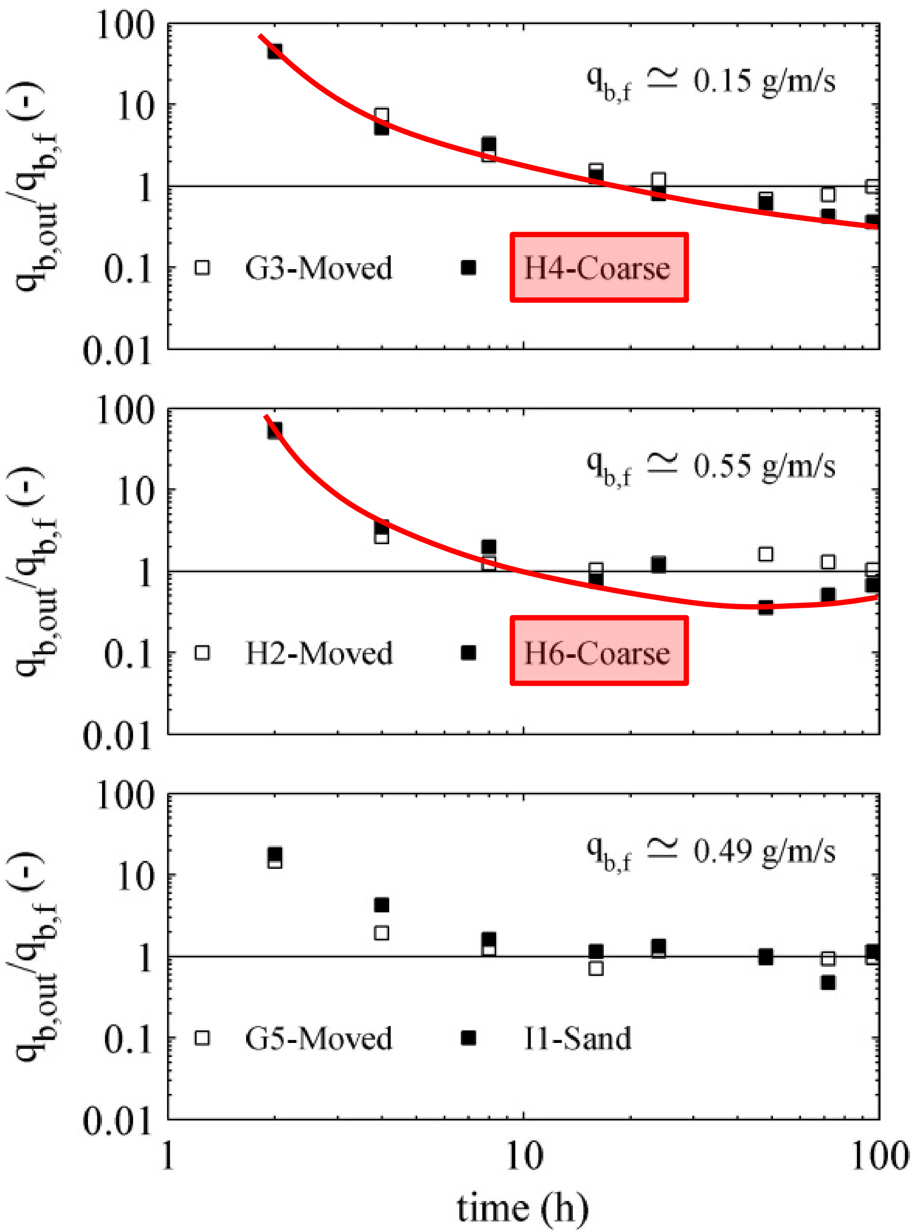
	$D_{g,f}$ (mm)	$\sigma_{g,f}$ (-)	$D_{84,f}$ (mm)	$D_{16,f}$ (mm)	$F_{s,f}$ (%)
Moved-1	1.3	2.2	3.0	0.50	66
Moved-2	1.5	2.4	3.5	0.57	62
Coarse/bed	2.7	3.4	9.1	0.70	41
Sand	1.3	2.1	2.8	0.54	68

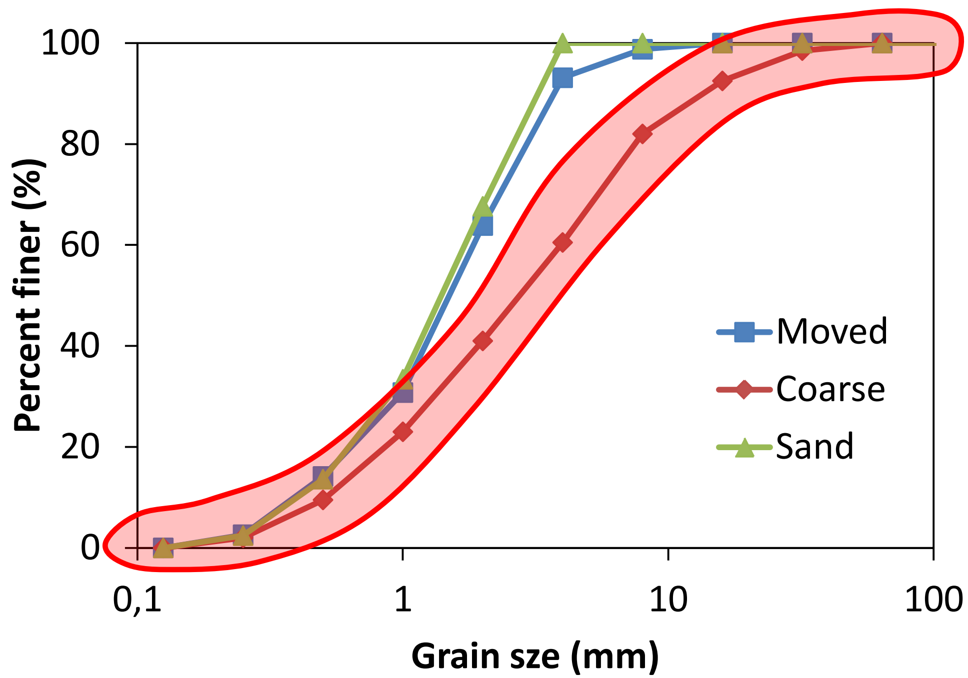
SEDIMENT TRANSPORT RATE





SEDIMENT TRANSPORT RATE



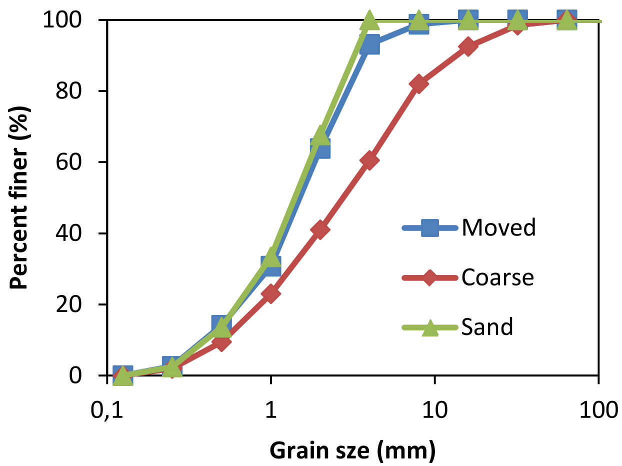


NUMERICAL MODEL.

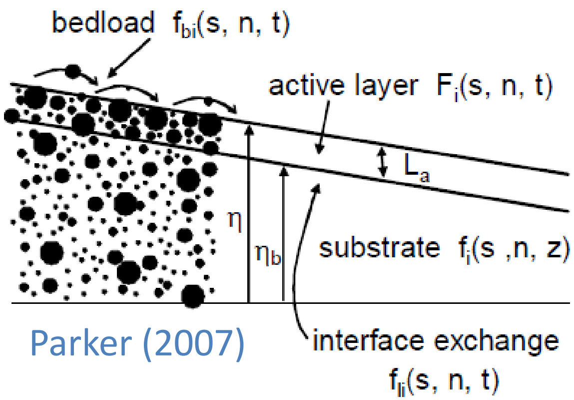
Normal flow approximation

Wilcock-Crowe (2003)

GSD adjustments:

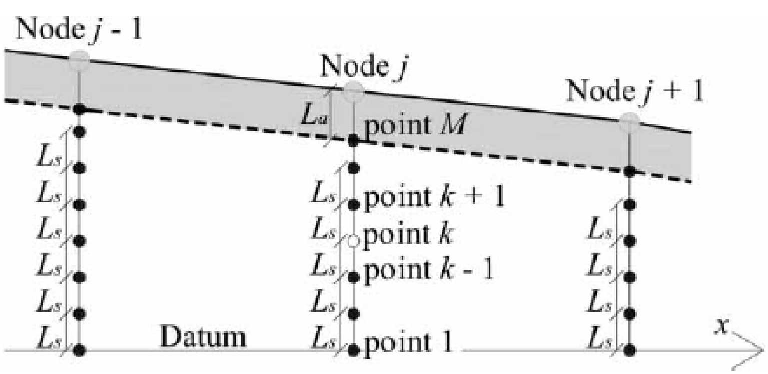


Active layer concept (Hirano, 1971)



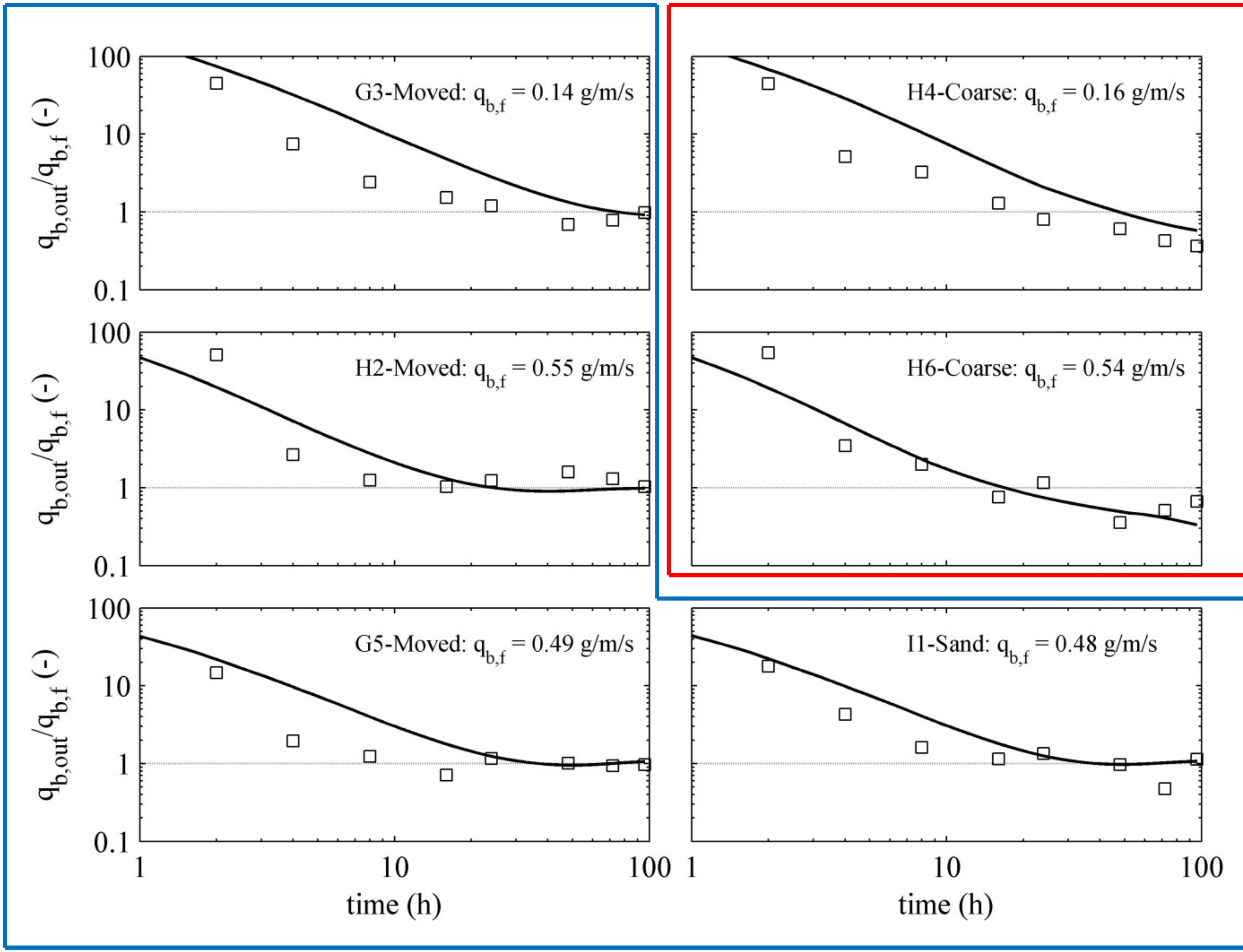
Parker (2007)

Temporal and spatial storage of the vertical STRATIGRAPHY

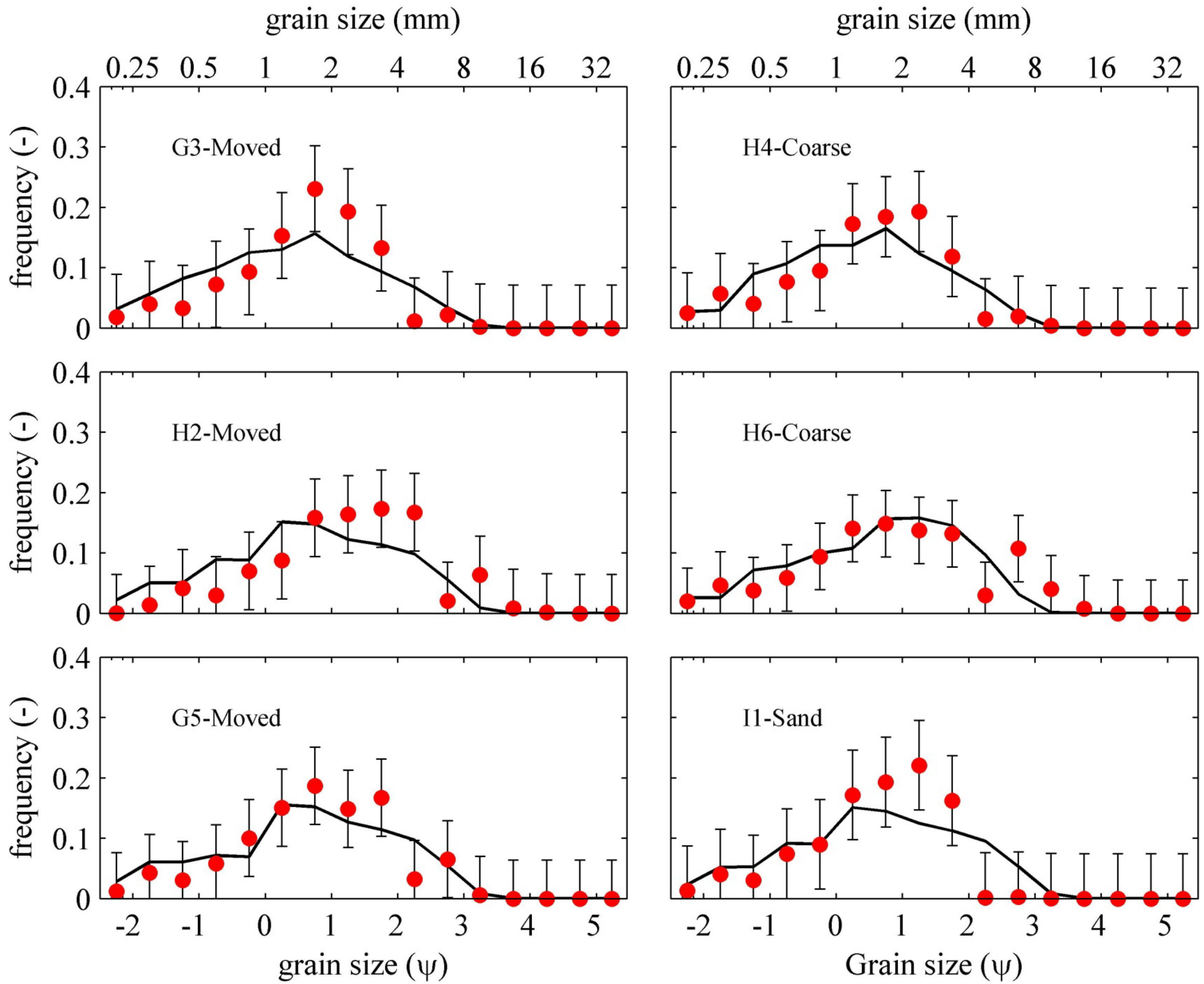


Viparelli et al. (2010)

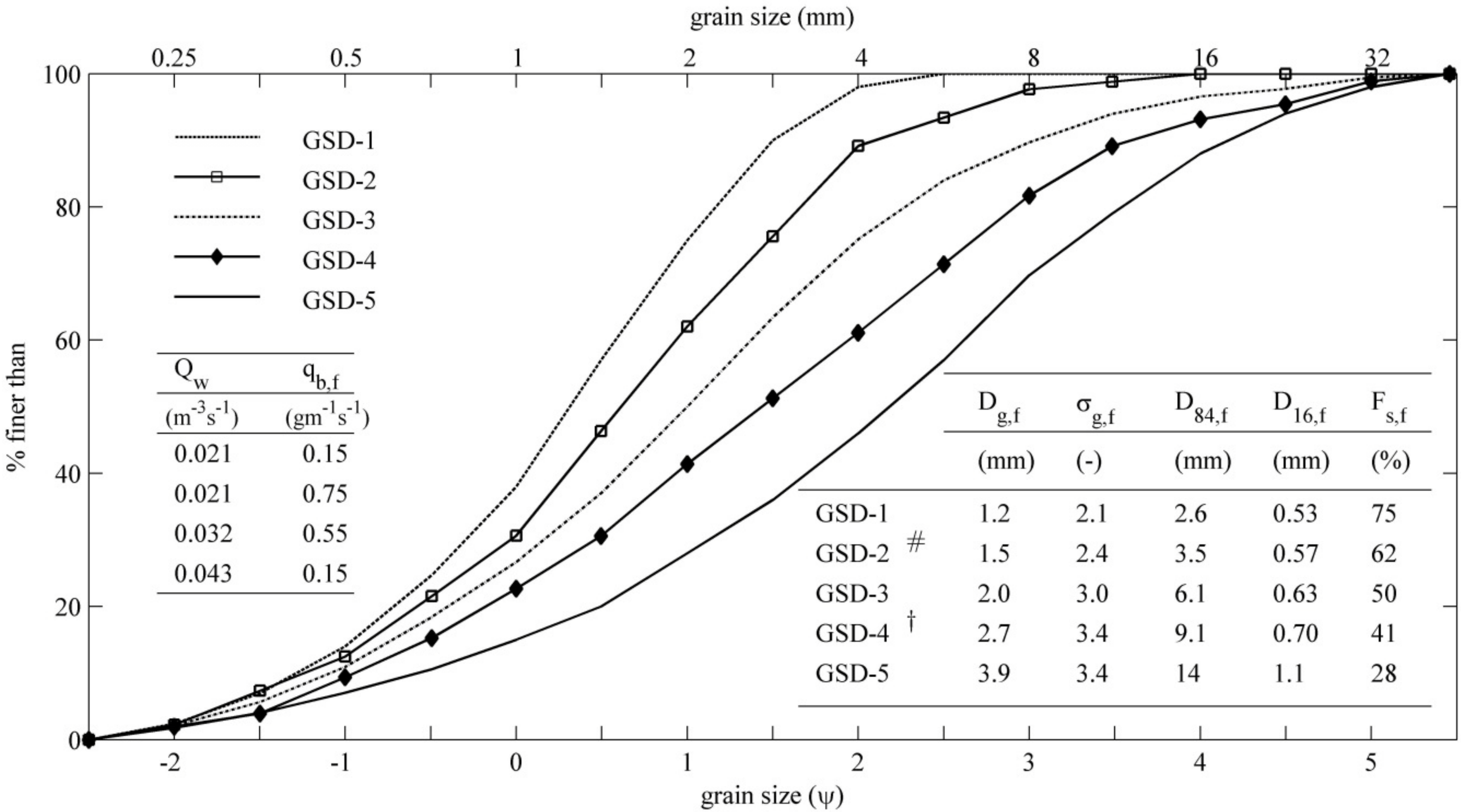
NUMERICAL MODEL. BEDLOAD COMPARISONS



NUMERICAL MODEL. BEDLOAD TEXTURE COMPARISONS



NUMERICAL EXPERIMENTS:



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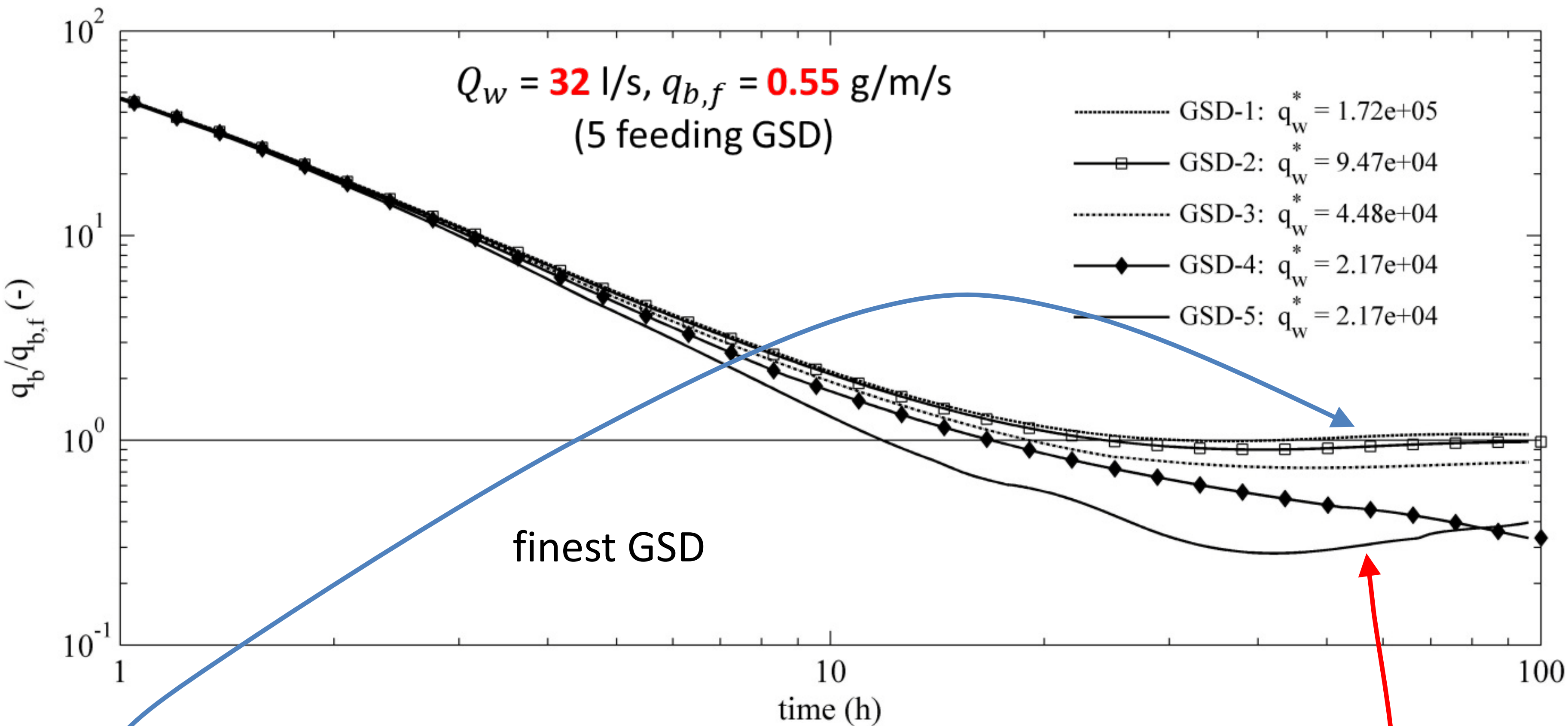
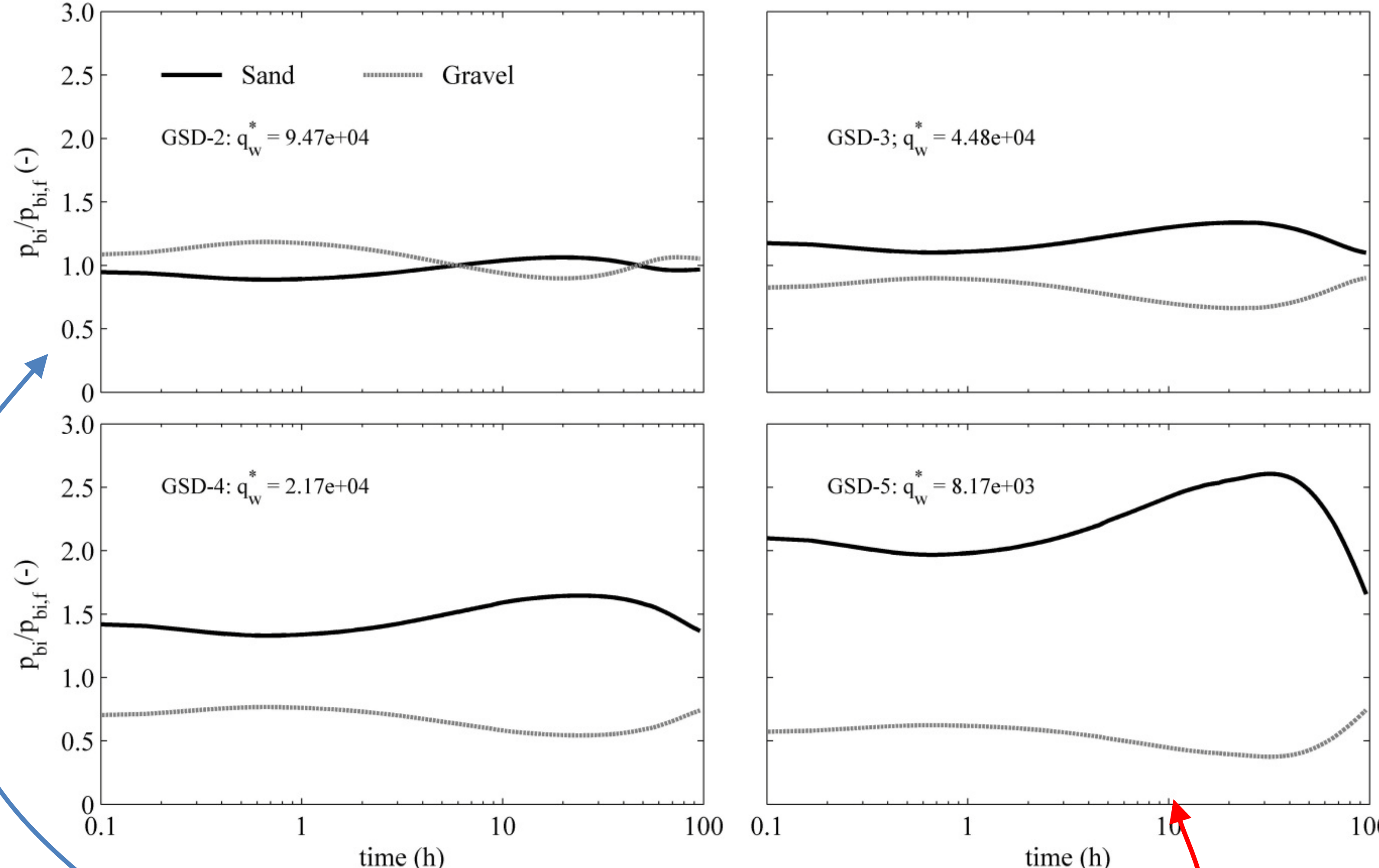


	GSD-1	GSD-2•	GSD-3	GSD-4†	GSD-5
$D_{g,f}$ (mm)	1.2	1.5	2.0	2.7	3.9

coarsest GSD

NUMERICAL EXPERIMENTS:

$$K = \frac{1}{T}\int_0^T \left| \frac{p_{bs}(t)}{p_{fs}} - \frac{p_{bg}(t)}{p_{fg}} \right| dt$$



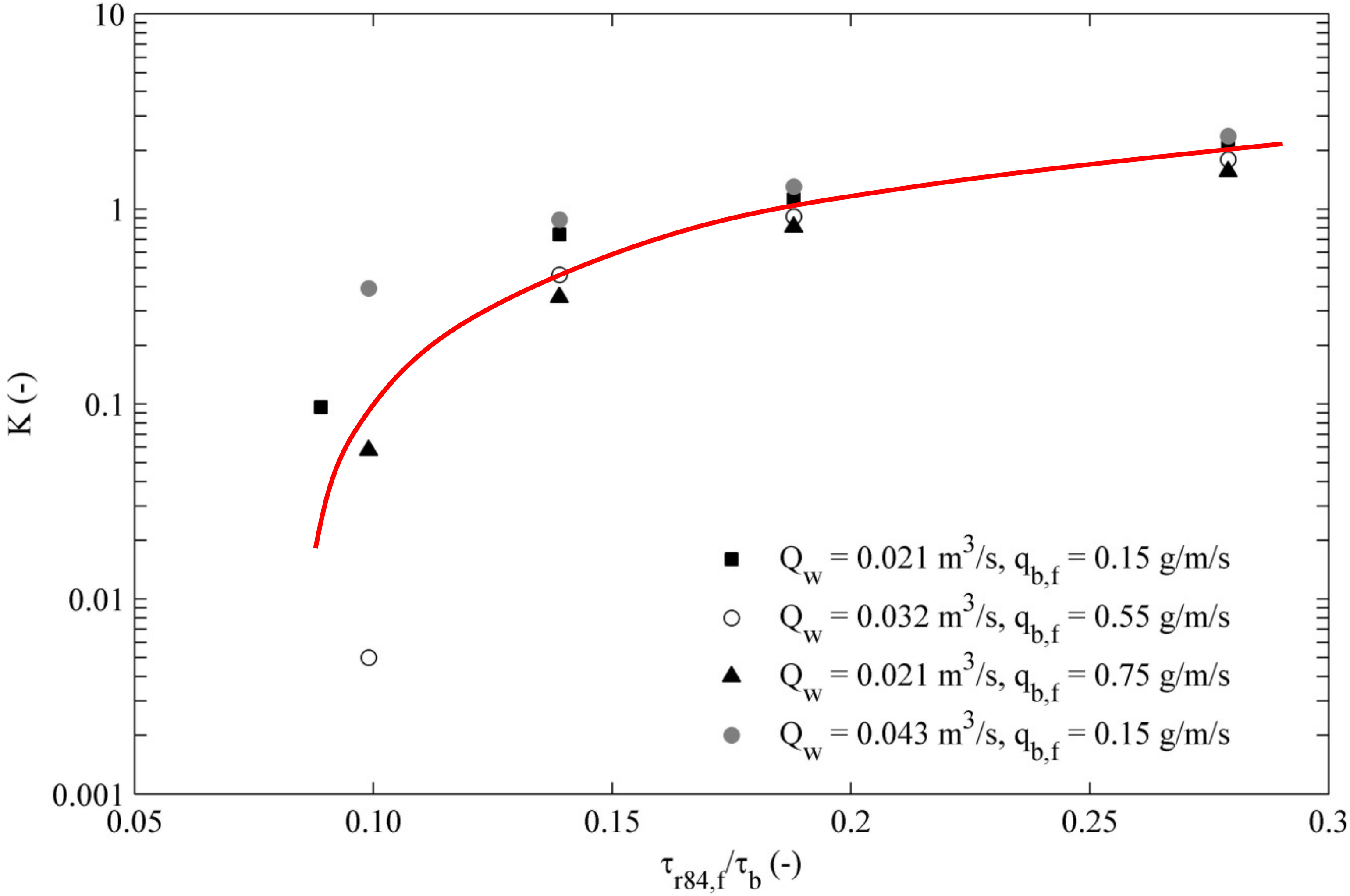
finest GSD

	GSD-1	GSD-2•	GSD-3	GSD-4†	GSD-5
$D_{g,f}$ (mm)	1.2	1.5	2.0	2.7	3.9

coarsest GSD

$$K = \frac{1}{T}\int_0^T \left|\frac{p_{bs}(t)}{p_{fs}} - \frac{p_{bg}(t)}{p_{fg}}\right| dt$$

$$\uparrow \tau_{r84,f} \rightarrow \uparrow K$$

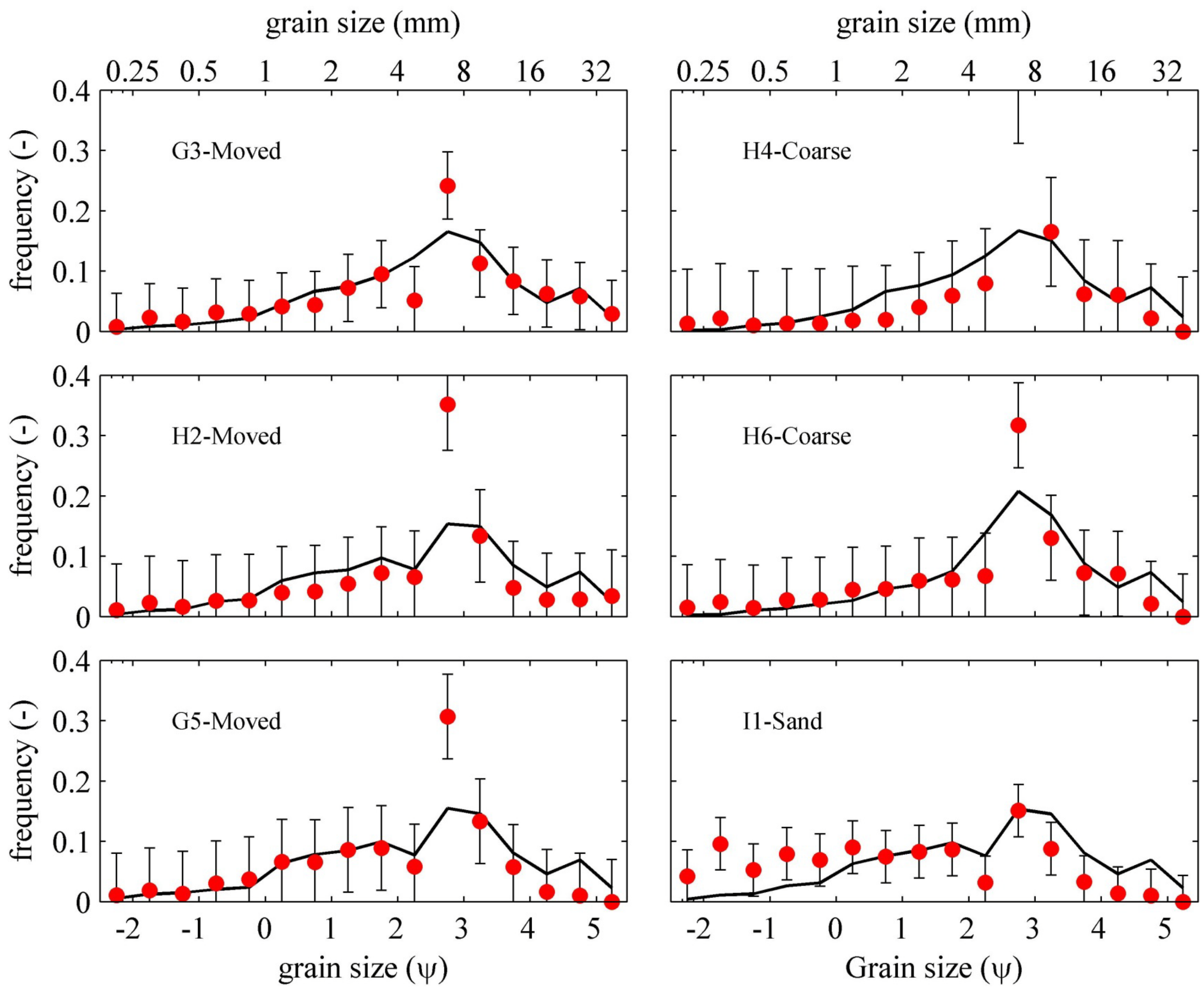


CONCLUSIONS:

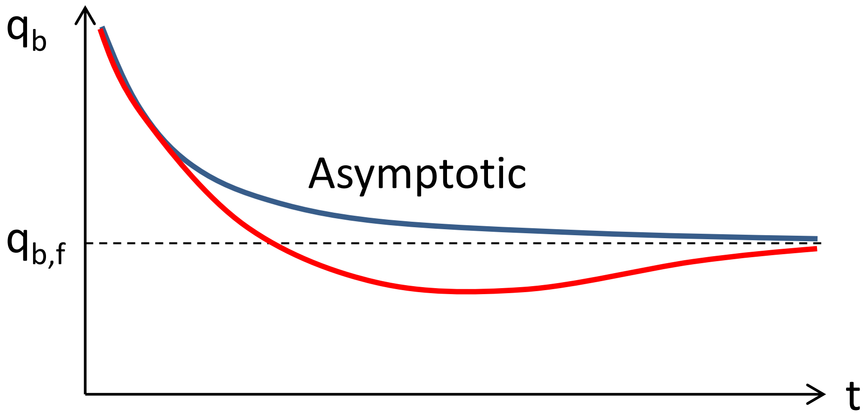
- A set of feed experiments has been carried to study the influence of the feeding GSD in the bed adjustments.
- Different trends on how sediment transport rate approached the feed rate were observed depending on the feeding texture.
- The main features of the experimental results have been reproduced by a simple numerical model.
- Numerical tests demonstrate that the higher the difference in mobility among the different grain sizes of the feed rate, the less asymptotic approach of the tansport feed rate towards the feed rate.

THANK YOU

NUMERICAL MODEL. SURFACE TEXTURE COMPARISONS



SEDIMENT TRANSPORT RATE. WHY?



Hypothesis: differences in mobility of the coarse and fine grain classes for the given flow conditions.

Let us consider that the GSD is composed of only **two** sizes: **sand + gravel**

The **initial high** content of **sand** makes **coarser fractions to be more mobile**:

$\uparrow q_{b,gravel} \rightarrow \uparrow p_{b,gravel}$ $\downarrow p_{b,sand}$ peak in $p_{b,gravel}$ (and a through in $p_{b,sand}$)

As bed **surface coarsens** $\downarrow F_{sand} \rightarrow \downarrow q_{b,gravel}$ through in $p_{b,gravel}$ (and a peak in $p_{b,sand}$)

that propagates along the flume.