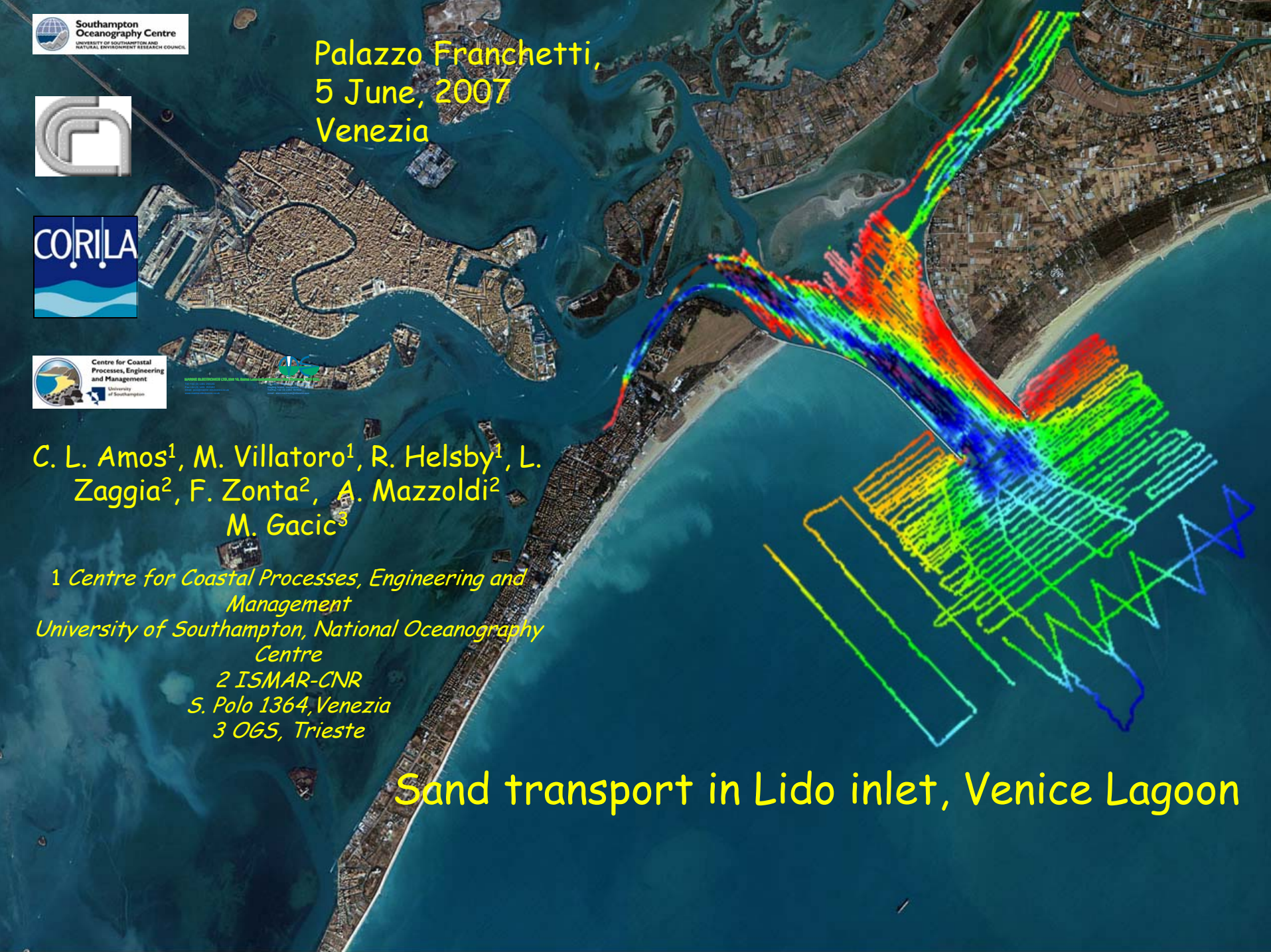

Palazzo Franchetti,
5 June, 2007
Venezia

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Sand transport in Lido inlet, Venice Lagoon

Double agenda: application and scientific research unresolved issues

Habitat destruction

the filtering efficiency (F) of Venice Lagoon

where Q_{loss} is the net export from the inlets
while Q_{total} is the total mass balance
and $Q_{totsl} = Q_{onshore} + Q_{offshore} + Q_{longshore}$

$$F = [1 - \frac{Q_{loss}}{Q_{total}}]$$

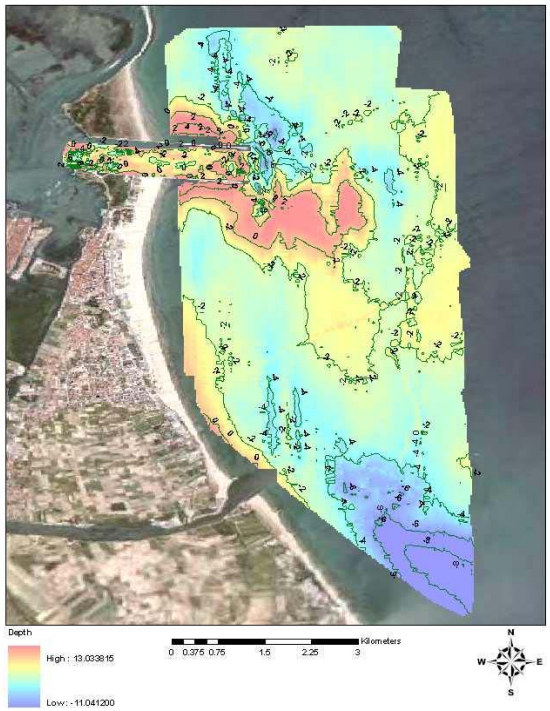
Calibration of backscatter on fixed ADCP's

Upgrade SEDTRANS for fine/v.fine sand

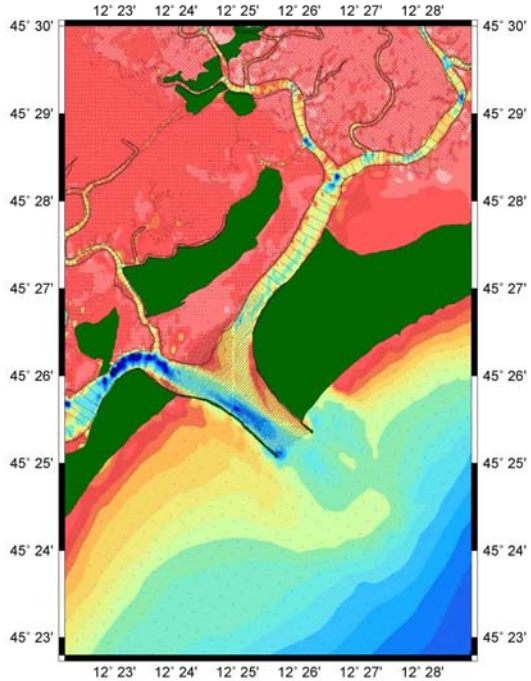
Evolution of sandy ebb tidal deltas - 1930 onwards

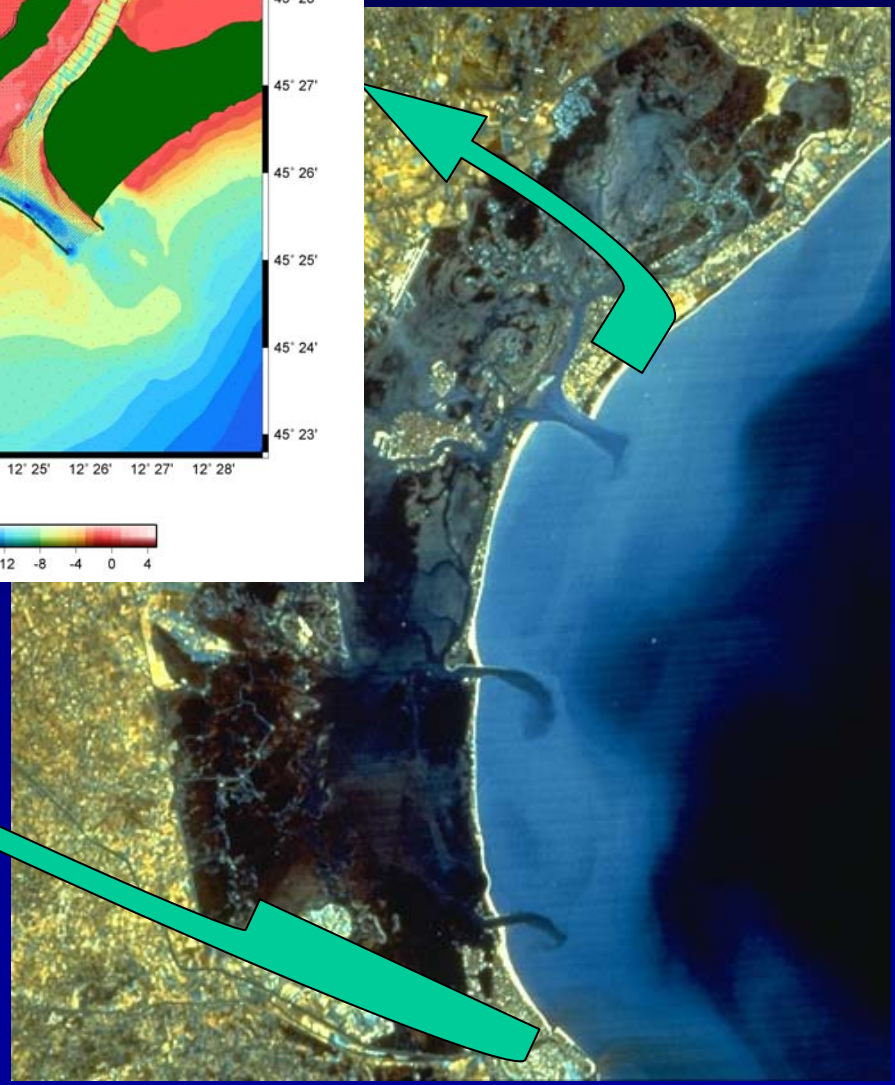
to determine the application of the Rouse exponent (R) to estimations of Q_{susp}

$$R = (\frac{W_s}{\beta \kappa U_*})$$



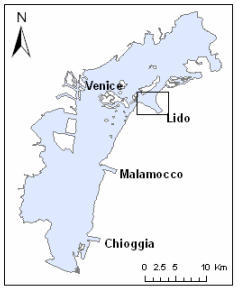
Depth comparison between 1990 and 2005-2006 (Chioggia)

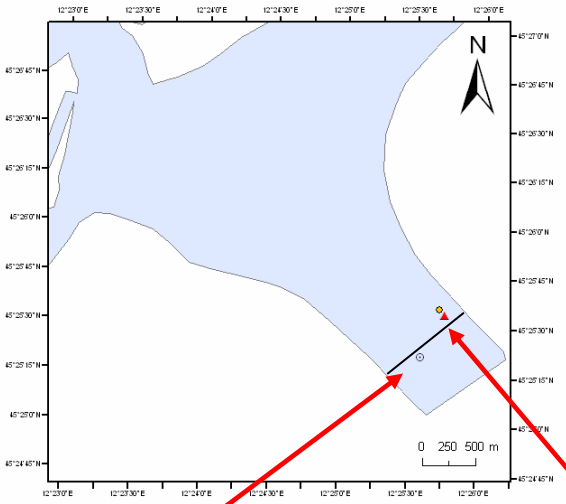


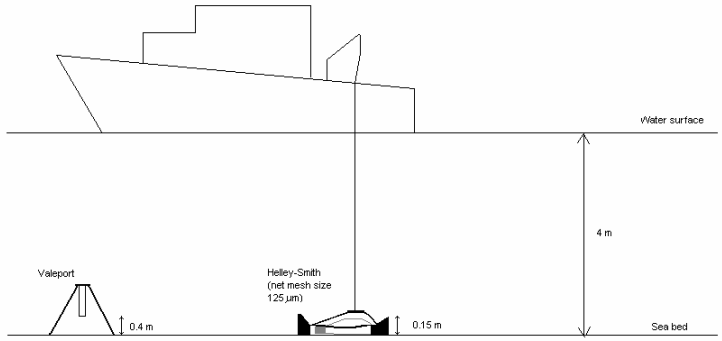


Sand transport surveys 2005 and 2006
2 days in Chioggia, 3 days in Lido

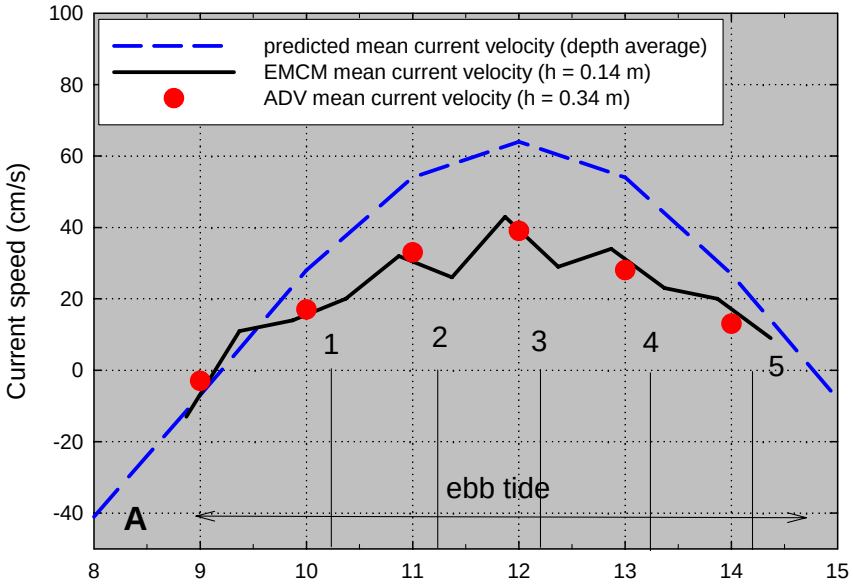
Chioggia inlet morphodynamics and sampling
(survey in July, 2007)


N
Venice
Lido
Malamocco
Chioggia
0 2.5 5 10 Km

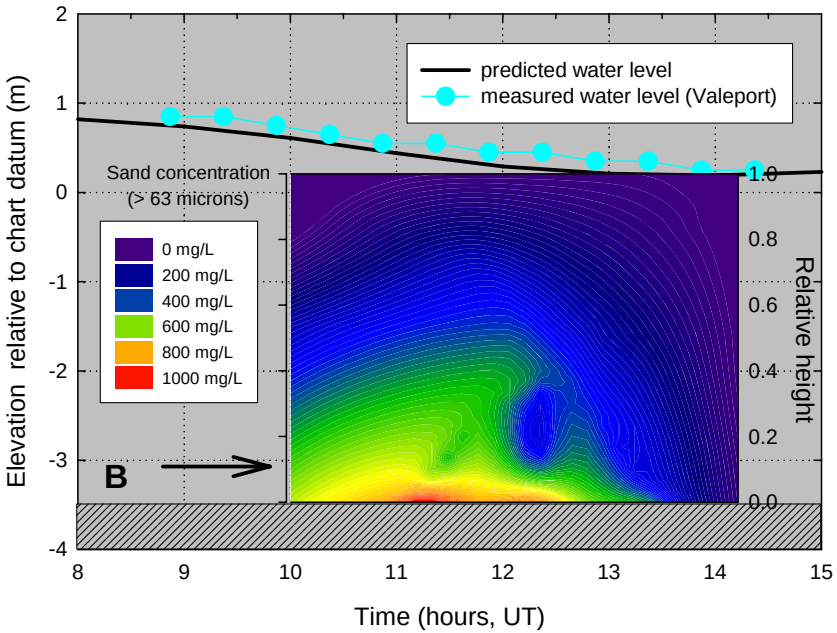

N
0 250 500 m
Legend
Lido Nord
Helley-Smith
Valeport
Fixed ADCP


Water surface
4 m
Valeport
0.4 m
Helley-Smith
(net mesh size
125 µm)
0.15 m
Sea bed

Lido Nord ADV and Valeport measurements - 19 September, 2006



Lido Nord sand trap concentration - 19 September, 2006



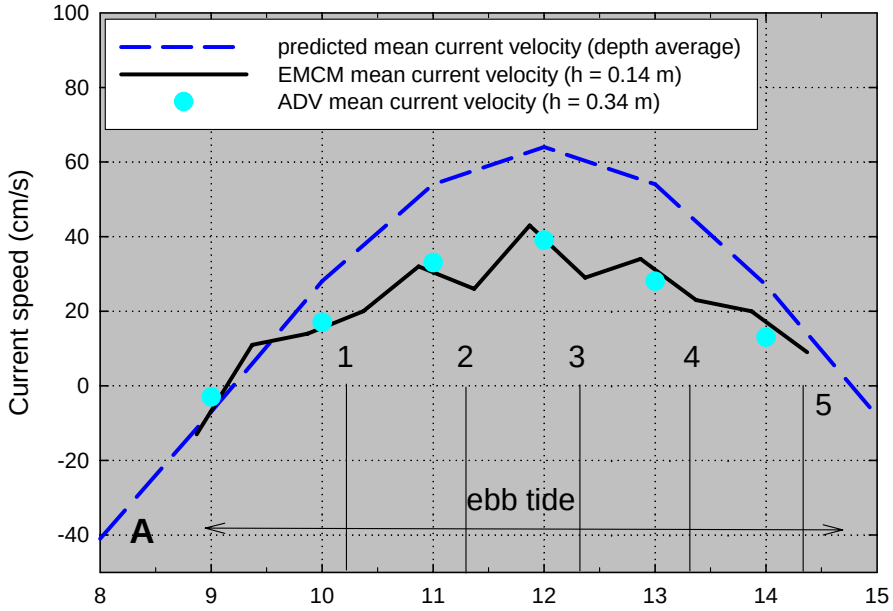
Valeport and ADV yield similar results, and correspond to predictions

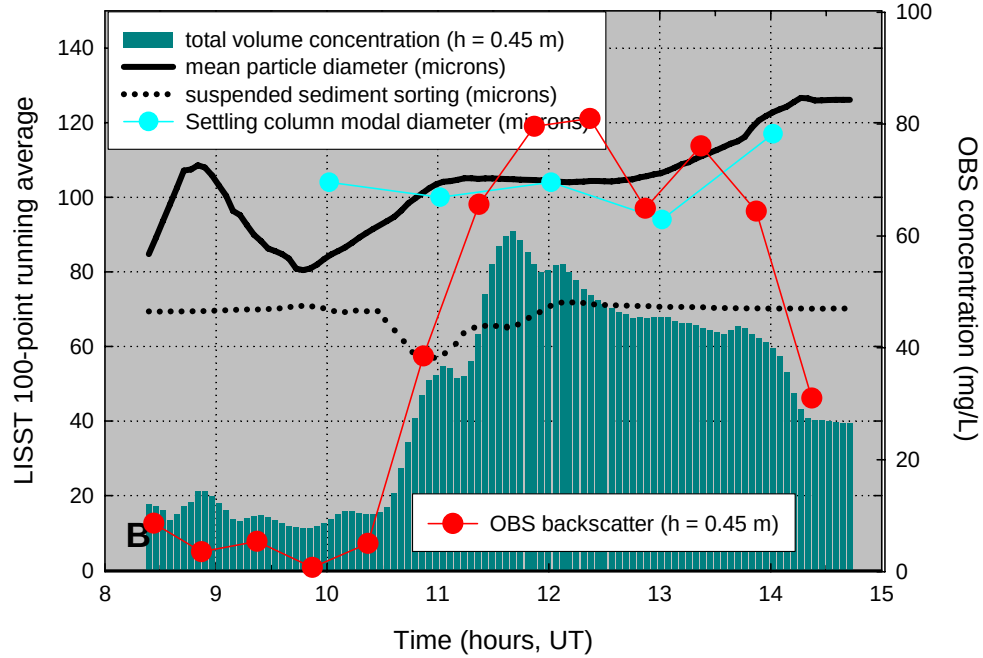
ADV used to determine U* (h = 0.34 m)

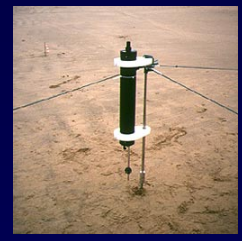
Valeport used to estimate volume of seawater passing through lower sand traps, and OBS used to estimate sediment concentration (h = 0.45 m)

Valeport depth corresponds to predictions

- Helley-Smith sand traps show strong nearbed motion
- Greatest motion during peak ebb flows Strong conc. gradient with height







LISST (h = 0.45 m) records every 1 minute:

- mean grain diameter
- grain size spectrum
- sorting
- volume concentration

Valeport OBS (h = 0.45 m) records every 30 minutes:

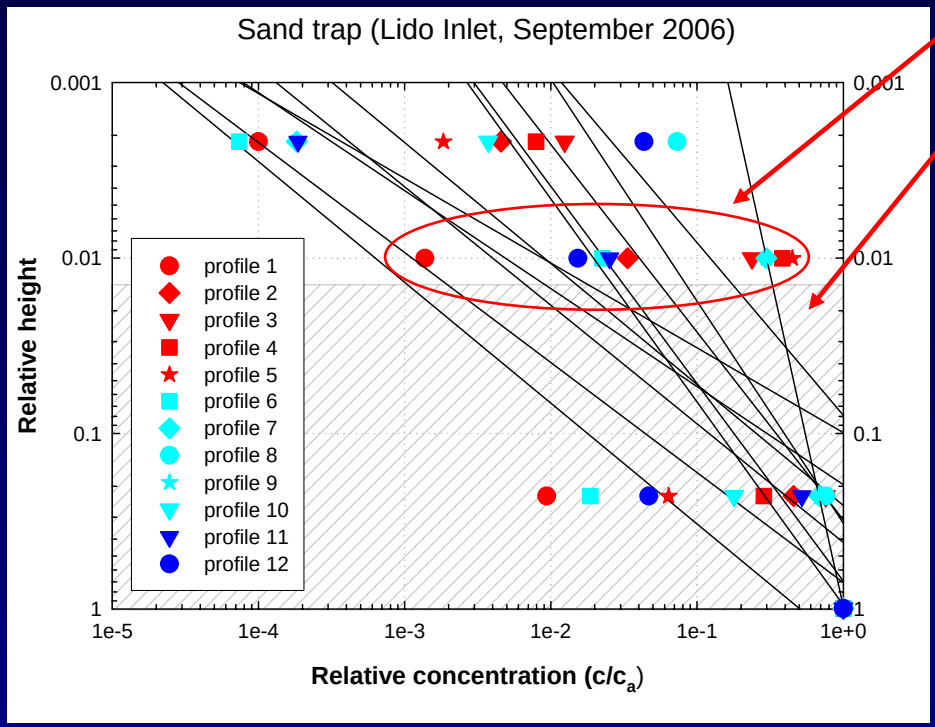
- backscatter

Mean grain diameter minimum over HT

Mean grain diameter increases through ebb tide

Suspension at U = 0.2 m/s evident in LISST and OBS

Peak concentration at peak current



Lido Sud (fixed ADCP site)
Shaded region is the shadow zone of ADCP

PROFILE #	R-squared	1/m	b
1	0.91	1.45	0.2
2	0.98	0.89	-0.16
3	0.82	0.79	-0.49
4	0.65	0.94	-0.51
5	0.47	1.45	-0.59
6	0.77	1.59	-0.15
7	0.66	1.79	-0.71
8	0.26	1.02	-1.1
9	0.99	0.26	-0.01
10	0.26	2.08	-1
11	0.89	1.49	-0.38
12	0.55	0.86	-0.02

$$\log_{10}(z) = m\log(C) + b$$

$$C = (z)^{\frac{1}{m}} 10^{\frac{-b}{m}}$$

Suspension number
Our results 1/m = -0.93

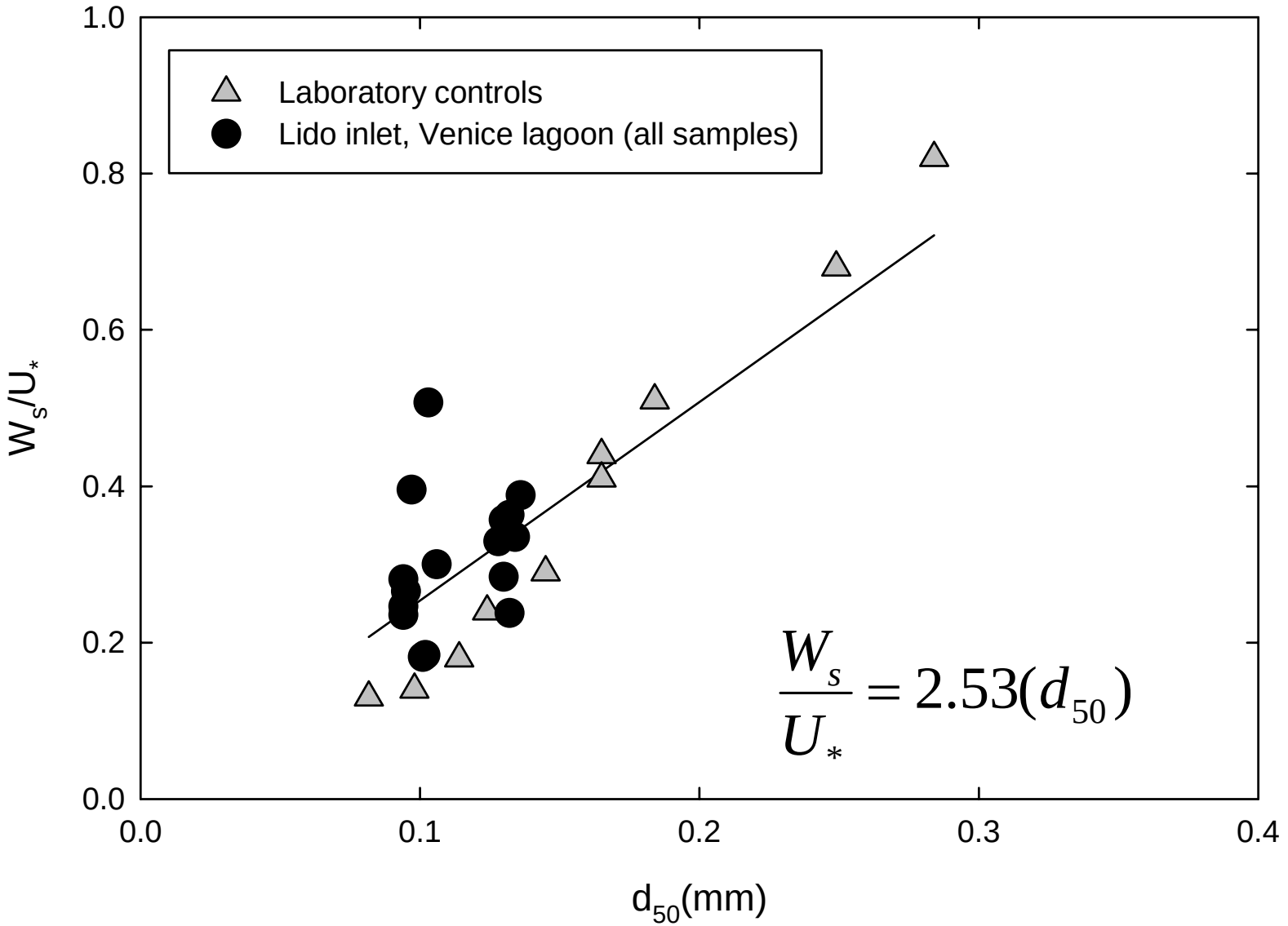
Suspension throughout water column at peak flows

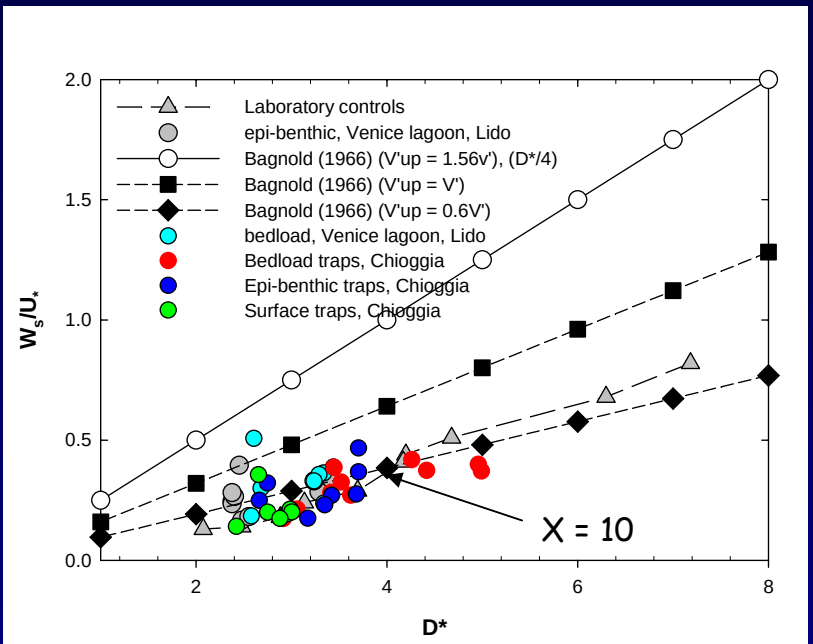
Stratification at Ht and LT

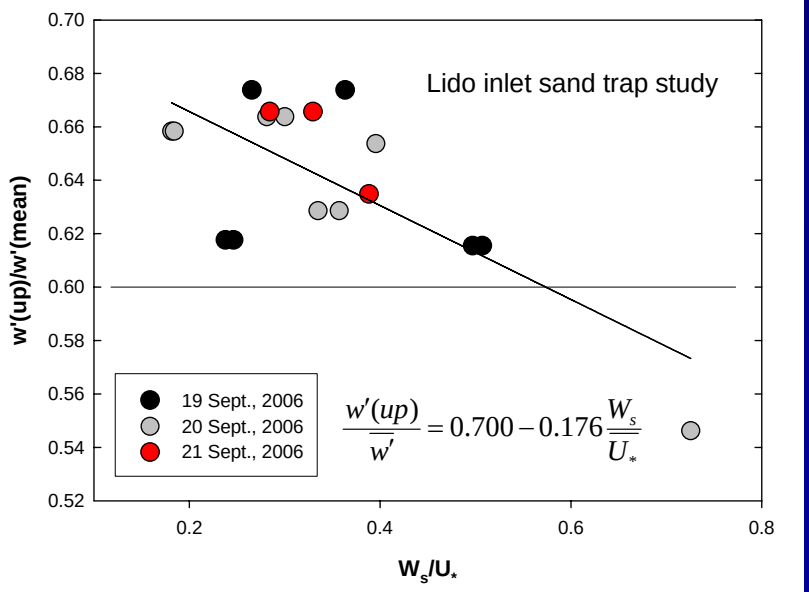
$$\frac{1}{m} = \left(\frac{W_s}{\beta\kappa U_*}\right) \approx 0.93$$

$$\left|\frac{W_s}{U_*}\right| = \beta m \kappa \approx 0.38$$

$$m = 0.5; k = 0.4; \beta = 1$$


Laboratory controls
Lido inlet, Venice lagoon (all samples)
$\frac{W_s}{U_*} = 2.53(d_{50})$
W_s/U_*
d_{50}(mm)
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.1
0.2
0.3
0.4





D* is dimensionless grain diameter
Ws = still water fall velocity
U* = critical friction velocity

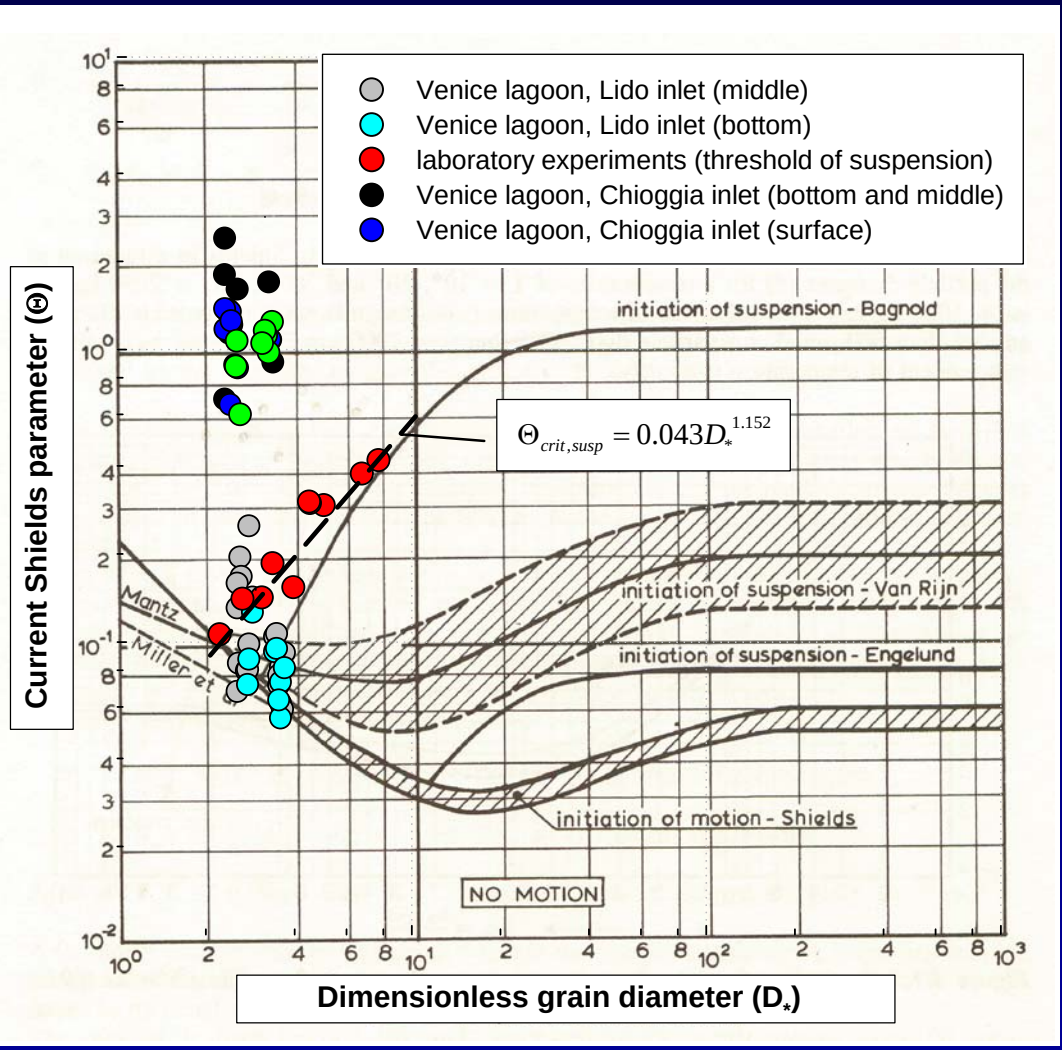
$$D_* = \left| \frac{(\frac{\rho_s - \rho}{\rho})g}{\upsilon^2} \right|^{0.333} d_{50}$$

$$\frac{W_s}{U_*} = \frac{\chi}{D_*}, D_* < 10$$

$$\frac{W_s}{U_*} = const., D_* > 10$$

$$\theta_{crit,susp} = \frac{\chi^2}{D_*^2}\left[\frac{\rho}{\rho_s - \rho}\right]\frac{W_s^2}{gd_{50}}, D_* < 10$$

$$\theta_{crit,susp} = const.\left[\frac{\rho}{\rho_s - \rho}\right]\frac{W_s^2}{gd_{50}}, D_* > 10$$



Ws/U* = 10/D*
Lower than van Rijn (4/D*)

Critical Shields parameter for suspension lower than Bagnold (1966)

Yields good separation between bedload and suspended load samples from Lido inlet.

$$\Theta_{crit,susp} = 0.043 D_*^{1.152}, D_* < 10$$