BEACHMED-e Project, III GESA Meeting

Montpellier, 29 November 2007

ACTIVITY REPORT OF PHASE C
- Partner 4 (DIC-UNIFI) -

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- Activity 4: laboratory tests on gravel beach profiles
- Concluding remarks

1. Accumulated sediments in rivers

OBJECTIVE AND METHODOLOGY

Activity 1

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Conclusion

Selection of a watershed in Tuscany and analysis of accumulated sediments to manage their dredging and re-use

Identification of accumulation areas **(Phase A)**

Identification of sediments **(Phase B)**

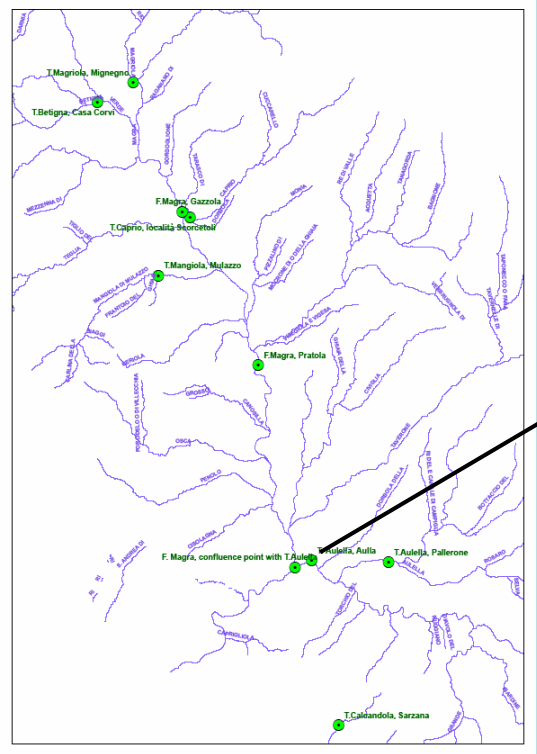
- Local sediment accumulation
- 18 samples at 9 locations
- Sieve analysis
- Grading curves
- All gravel and sand

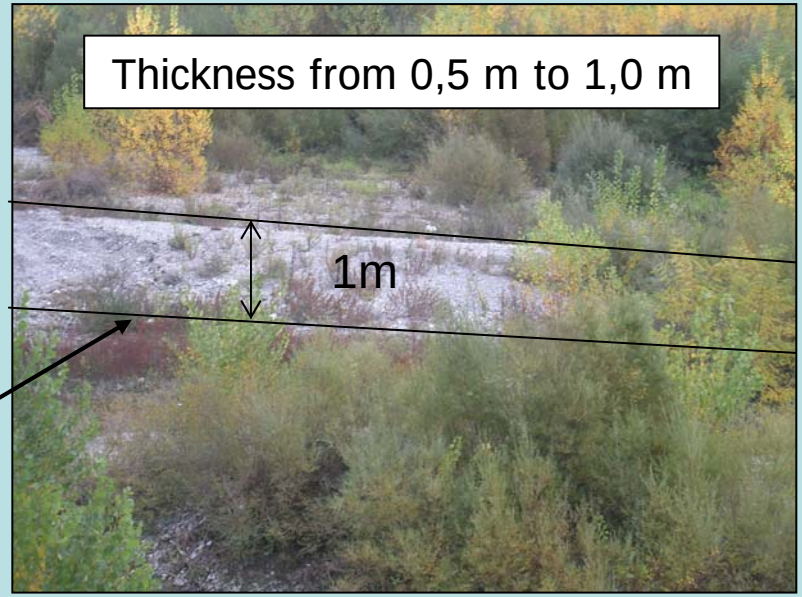
Availability and re-use of sediments **(Phase C)**

- Sediment quantification
- Consequences of dredging
- Re-Use for small nourishments

QUANTIFICATION OF SEDIMENTS AND FINAL ANALYSIS

- Activity 1
- Activity 2
- Activity 3
- Activity 4
- Conclusion





Last analysis:
Impact of dredging

Rinaldi et al. (2007):
"Geomorphological studies of the principal stream beds of the R.Magra watershed, finalized to define guidelines for sediments management and functional mobility band"

Location	Q_s [m^3]
T.Magriola, Mignegno	1500
F.Magra, Gazzola	1000
T.Betigna, Casa Corvi	2000
T.Caprio, Scorcetoli	1800
F.Magra, Lusuolo	5000
T.Aulella, Aulla	500
T.Aulella, Pallerone	2000
F.Magra-T.Aulella	3000
T.Calcandola	1000

2. Sedimentary stock by harbours

Activity 1
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Conclusion

Quantification of sedimentary stocks accumulated by the major Tuscan harbours to assess dredging activities in the area

Collection of bathymetries
(Phase A)

Calculation of volumes
(Phase B)

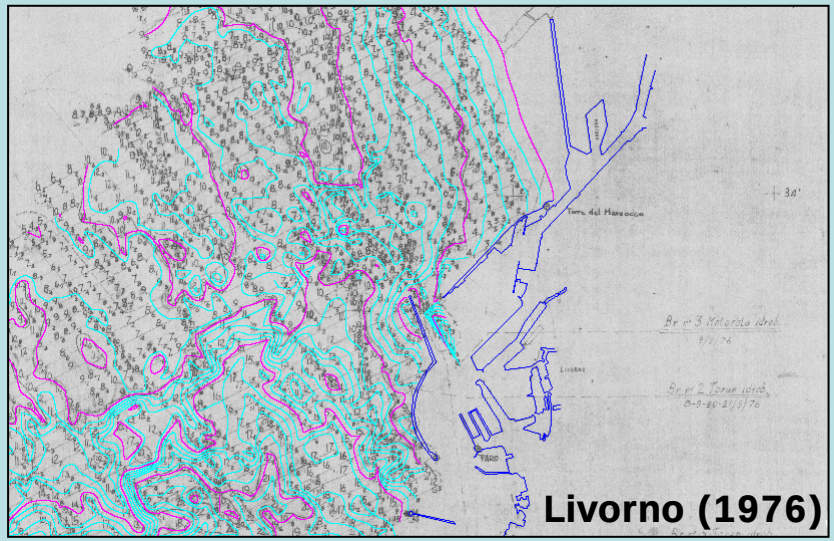
Old maps
and bathymetric surveys

Georeference

Comparable bathymetric domains

Estimate of accumulated volumes

Available future volumes



Consequences of dredging
of estimated volumes
(Phase C, Activity 3)

FINAL RESULTS: HARBOUR OF VIAREGGIO

Activity 1

Activity 2

Activity 3

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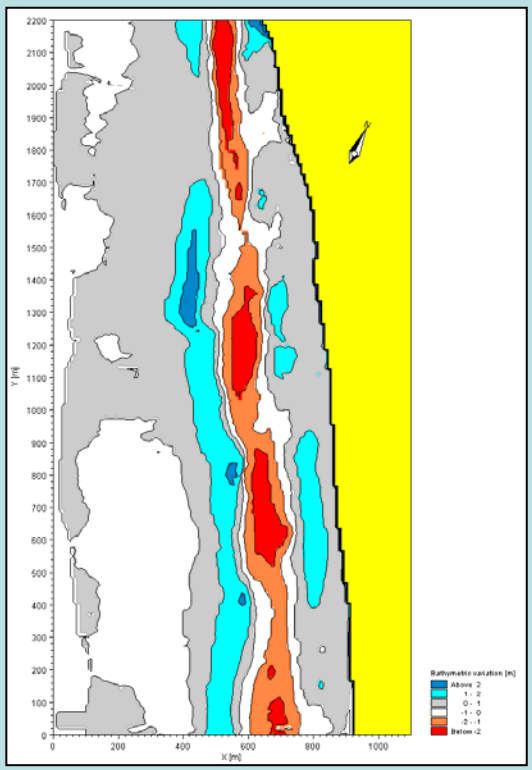
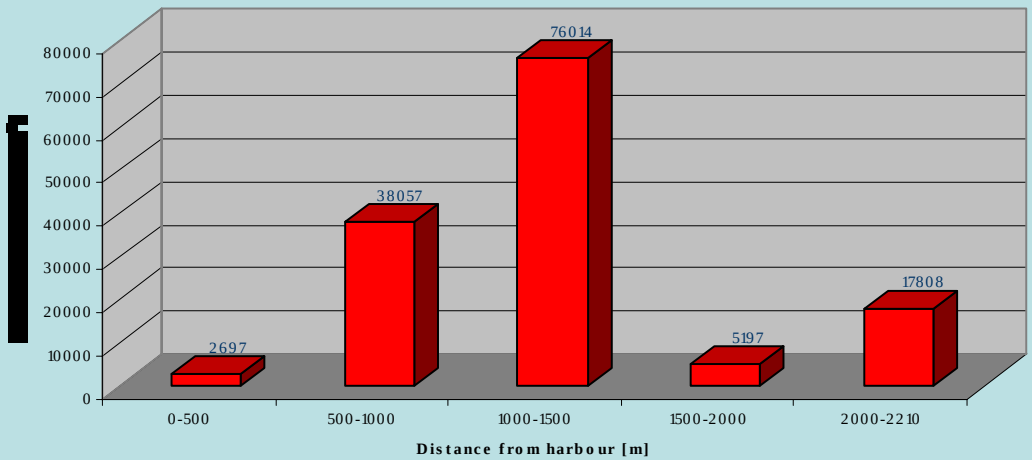
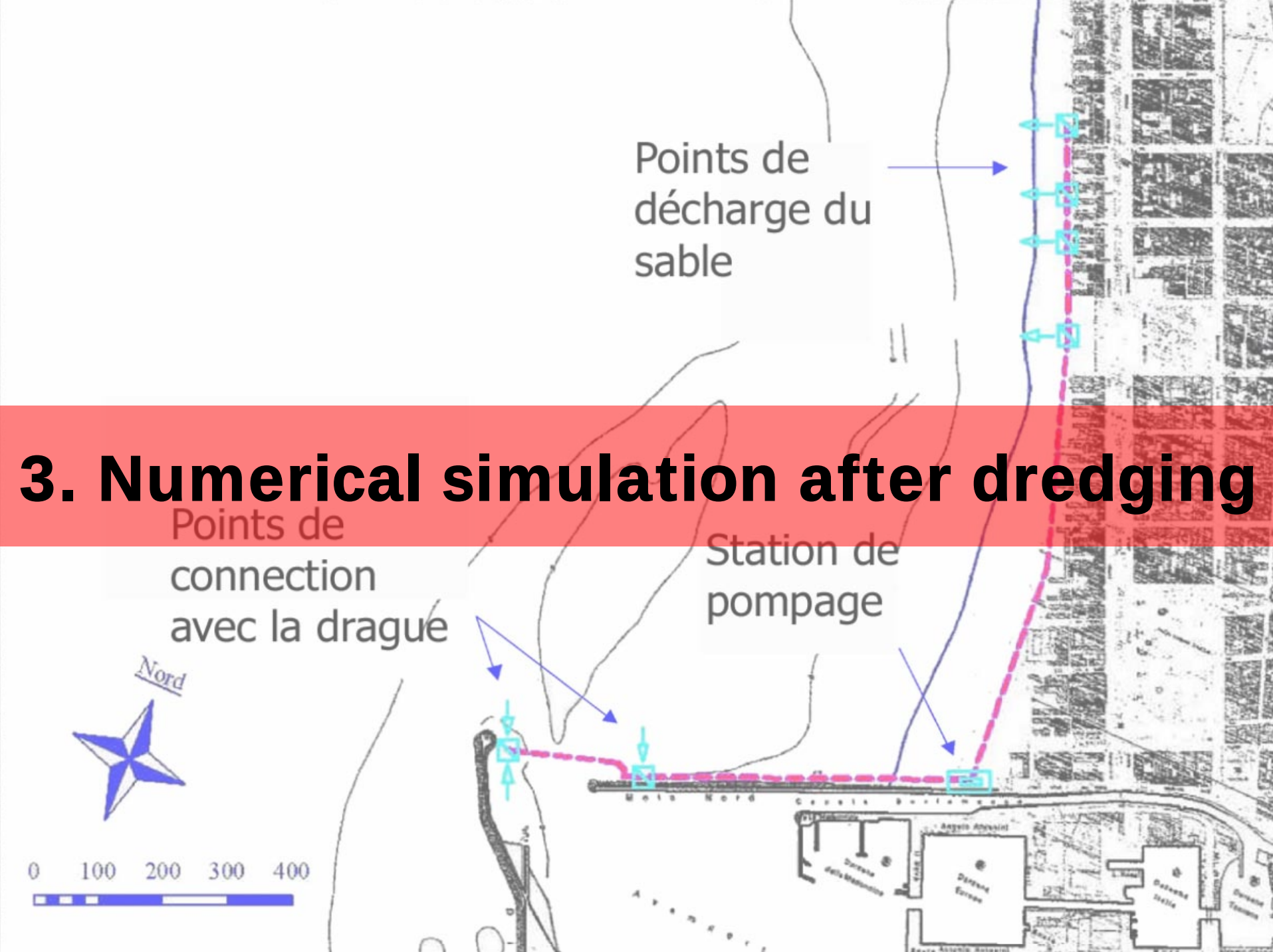
Conclusion

Among the Tuscan harbors, only Viareggio shows in recent times a non-negligible and still growing sedimentary stock

1997-2005







3. Numerical simulation after dredging

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Conclusion

Starting from the results of activity 2 (accumulated sediments), application of a morphodynamic model to optimize dredging quantities

Viareggio

Domain of analysis in activity 2

Application of the CEDAS model (GENESIS)

Dredging 1 (-5.5 m) = -338443 m^3

Dredging 2 (-5 m) = -123900 m^3

Dredging 3 (-4 m) = -100584 m^3

Dredging breakwater (-2) = -60196 m^3

SET-UP OF NUMERICAL SIMULATION

Activity 1

Activity 2

Activity 3

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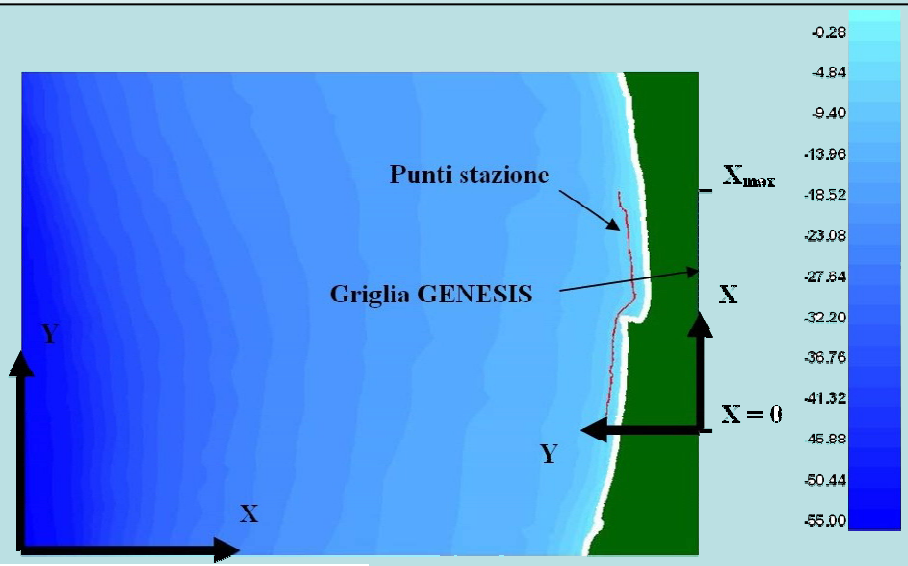
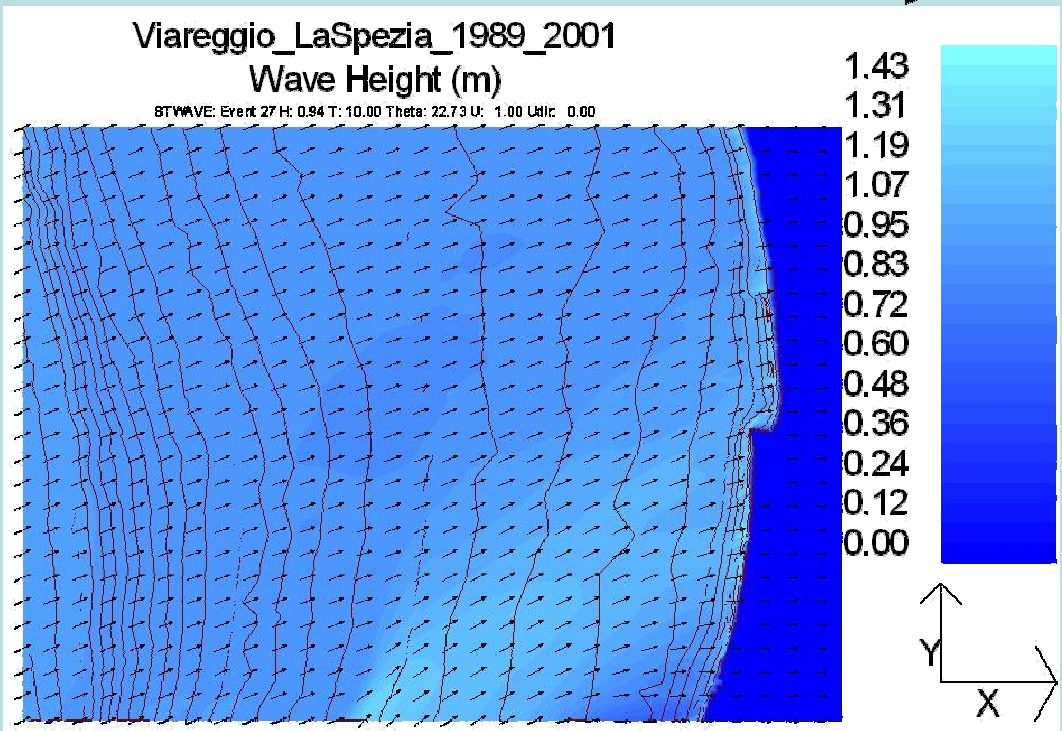
Conclusion

Bathymetry and simulation domain GENESIS over 10 km



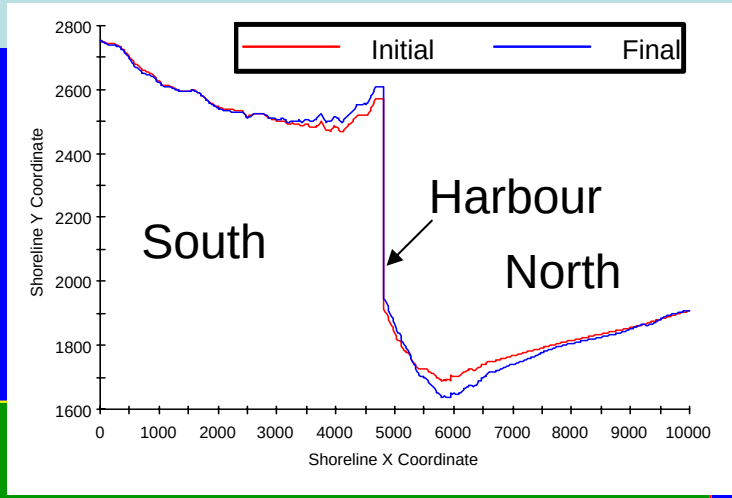


Spectral wave propagation (STWave model)

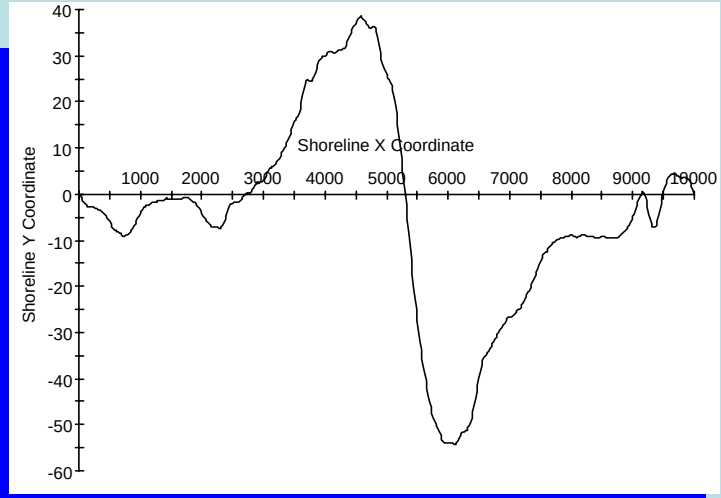
MAIN RESULTS AND CONCLUSION OF THE ACTIVITY

- Activity 1
- Activity 2
- Activity 3
- Activity 4
- Conclusion

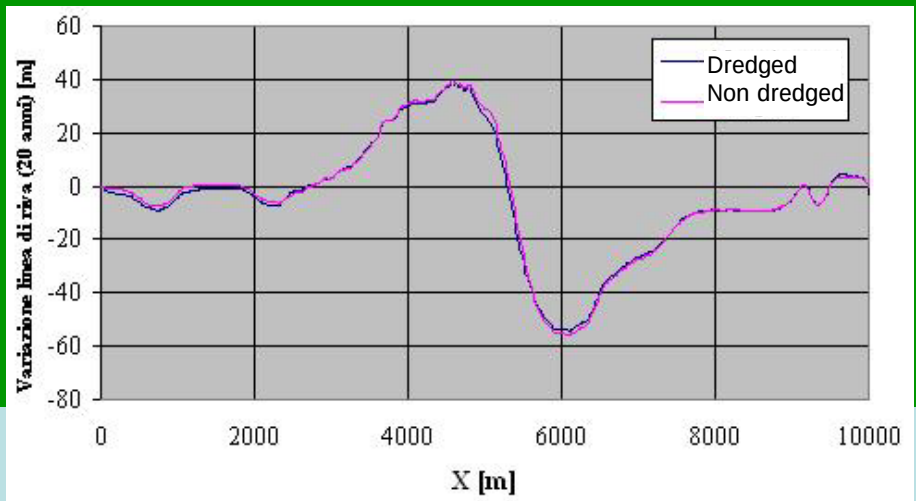
Initial and final shoreline



Shoreline movement (initial-final)



Influence of dredging



4. Laboratory tests on gravel beaches

Activity 1
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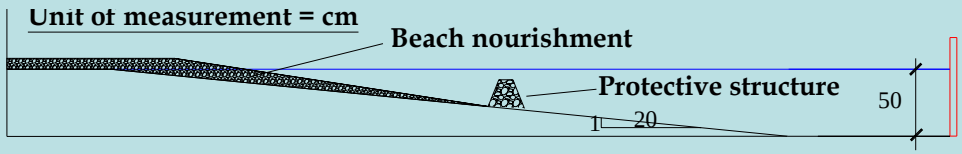
Understanding of the behaviour of gravel beaches with and without protective structures

Wave flume (University of Florence)

Tests:
- 9 wave attacks
- 2 gravel sizes
- 2 beach profiles (with/without structure)

Measures and measuring devices:
- Wave heights (wave gauges)
- Reflection coefficients (wave gauges)
- Beach profile (video-camera, bottom profiler)
- Sediment sampling

Section of the flume with test layout



Expected results:
- Relation between waves and profiles
- Relation between sediment size and profile
- Variation of reflection coefficient over time
- Test available formulae against the new data set

TEST PROCEDURE AND PRELIMINARY ANALYSIS

Activity 1

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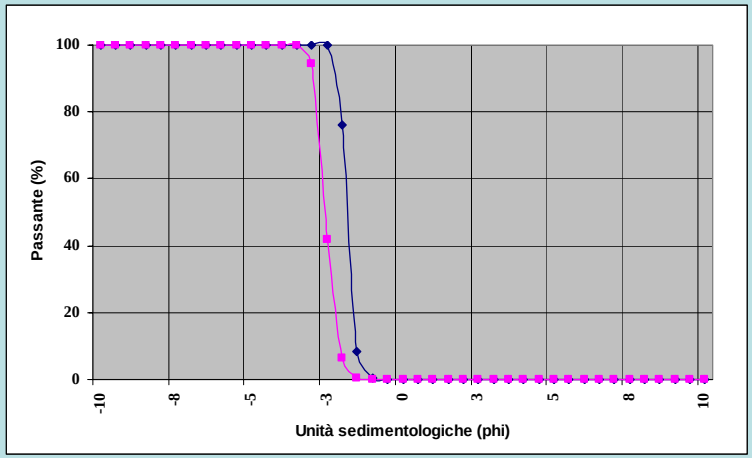
Conclusion

C00: Wave flume with the fixed bottom
C01: Coarser gravel without protective structure
C02: Coarser gravel with a submerged structure made of rubble mound
C03: Coarser gravel with a submerged structure made of sand geocontainers
C04: Finer gravel without protective structure
C05: Finer gravel with a submerged structure made of rubble mound
C06: Finer gravel with a submerged structure made of sand geocontainers

Materials



Irregular waves

H/L_0	0.02	0.04	0.06
$H_{s,0}$ [m]	6	11	16
T_p [s]	0,8	1,1	1,3
	1	1,3	1,6
	1,4	1,9	2,2

Preliminary analysis:
- Spectral analysis and time-domain analysis from whole recorded water level time series
- Image processing to get one image every 60 s

MAIN RESULTS AND FURTHER ANALYSIS

- Activity 1
- Activity 2
- Activity 3
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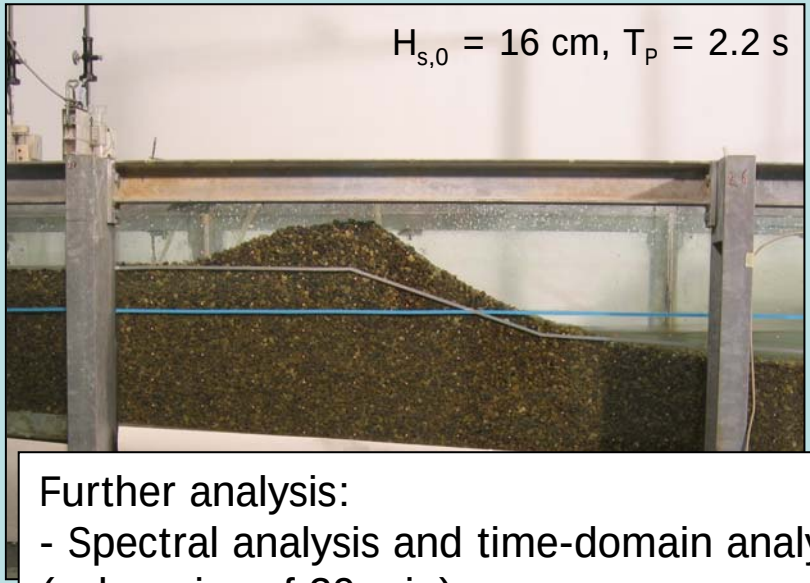
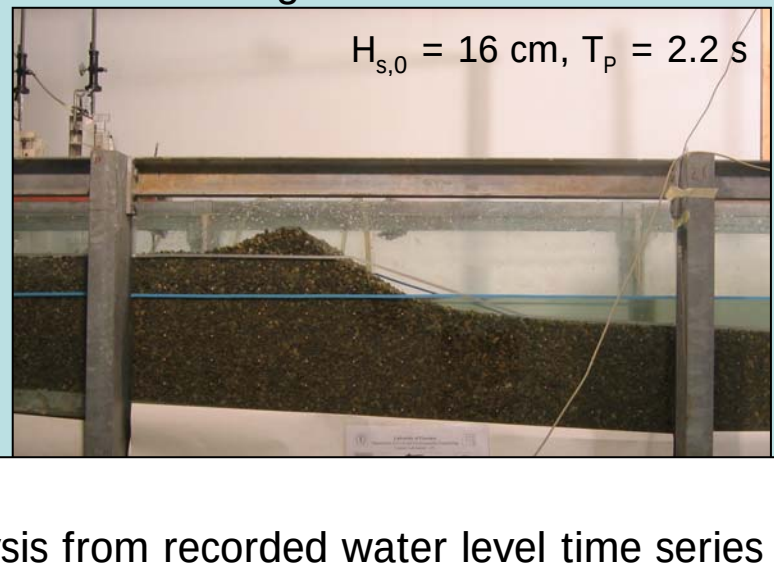
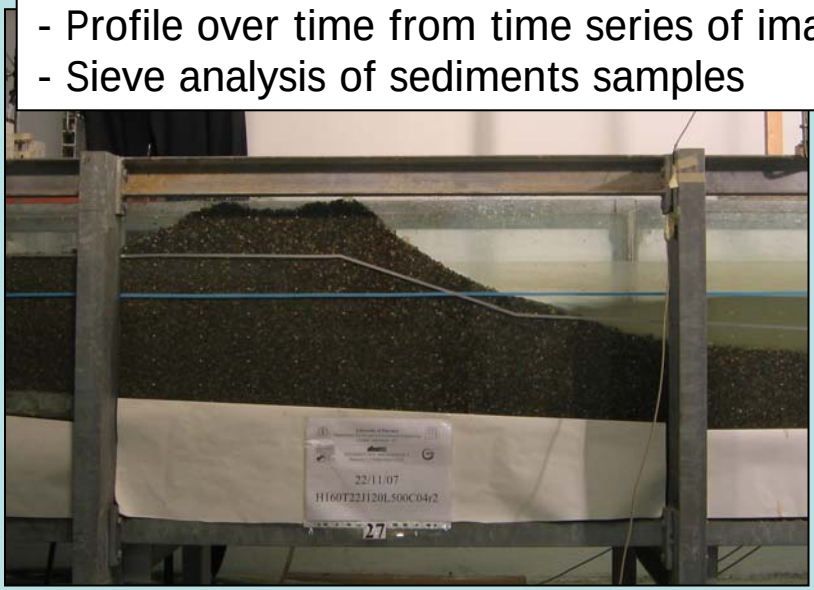
Coarser gravel

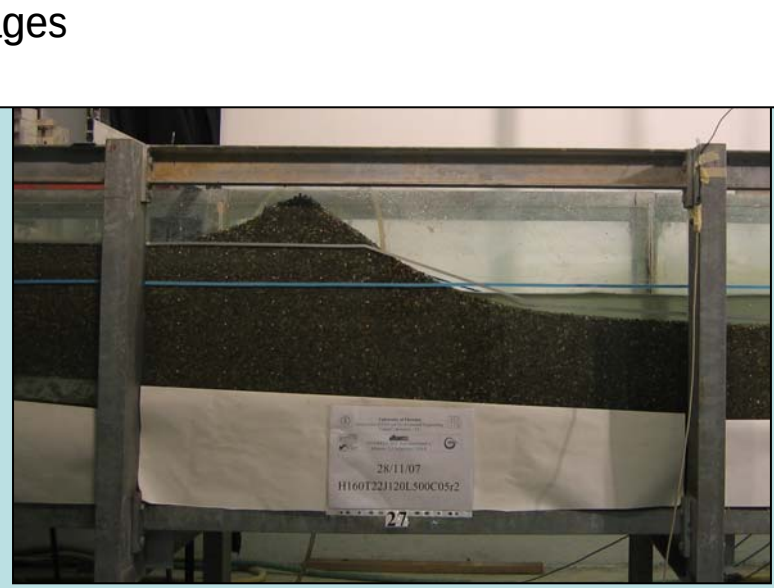


Coarser gravel with structure



Further analysis:
- Spectral analysis and time-domain analysis from recorded water level time series (sub-series of 20 min)
- Profile over time from time series of images
- Sieve analysis of sediments samples





CONCLUSIONS

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- Activity 1:
  - Sediments accumulated for dredging around 17800 m^3 with associated impact after dredging generally low: re-use of materials
- Activity 2:
  - Non-negligible stock only at the Port of Viareggio: evaluation of dredging consequences in activity 3
- Activity 3:
  - Numerical simulation of consequences of dredging with CEDAS shows positive but small effects on beaches
- Activity 4:
  - The whole set of tests reproduces all possible beach morphologies: from stable to equilibrium final profiles under extreme waves

THANK YOU!

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