3as Jornadas de Engenharia Hidrográfica

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Insights on sediment bypassing at headland-bay beaches: an example at the Portuguese west coast

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Motivation

The understanding of the sedimentary links in headland-bay beaches is a major issue in the assessment of beach sedimentary budget.


Praia da Ursa (Sintra)

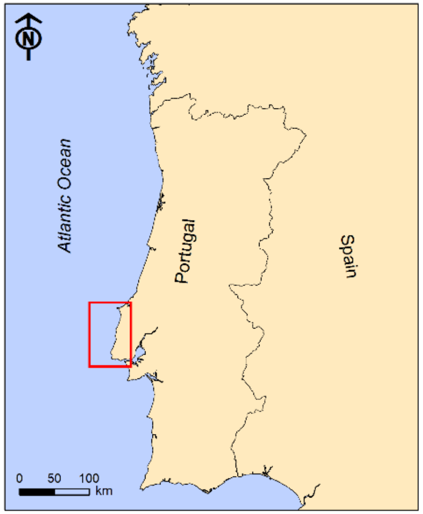
Goals

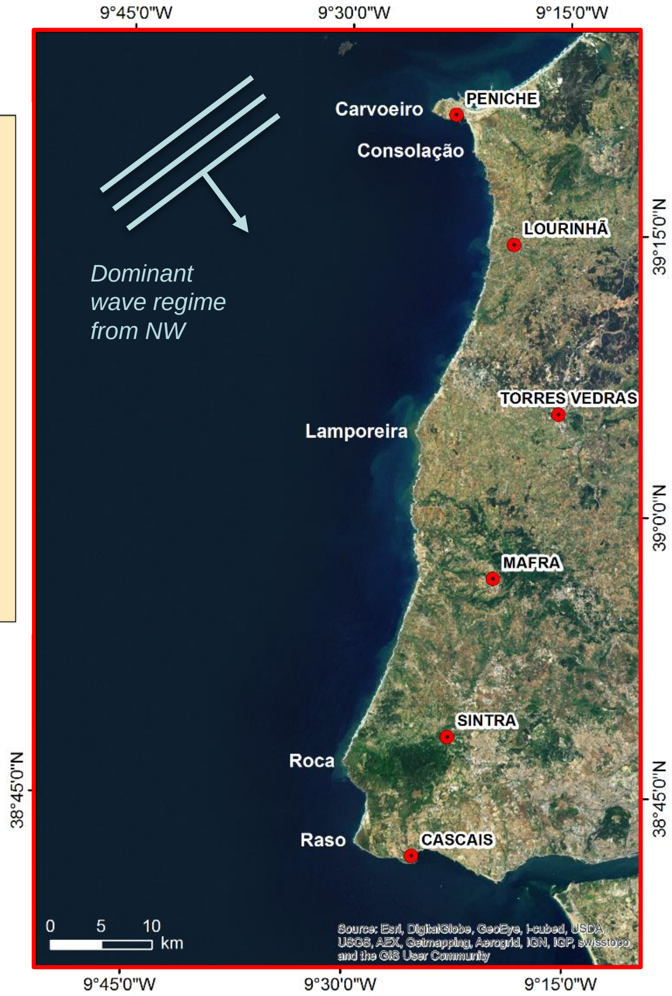
To know and characterize the headland sediment bypassing processes:

- Frequency
- Magnitude
- Direction
- Magnitude vs depth

Study site

- From Carvoeiro to Raso
- ≈100 km long
- NW-SE to NE-SW orientations



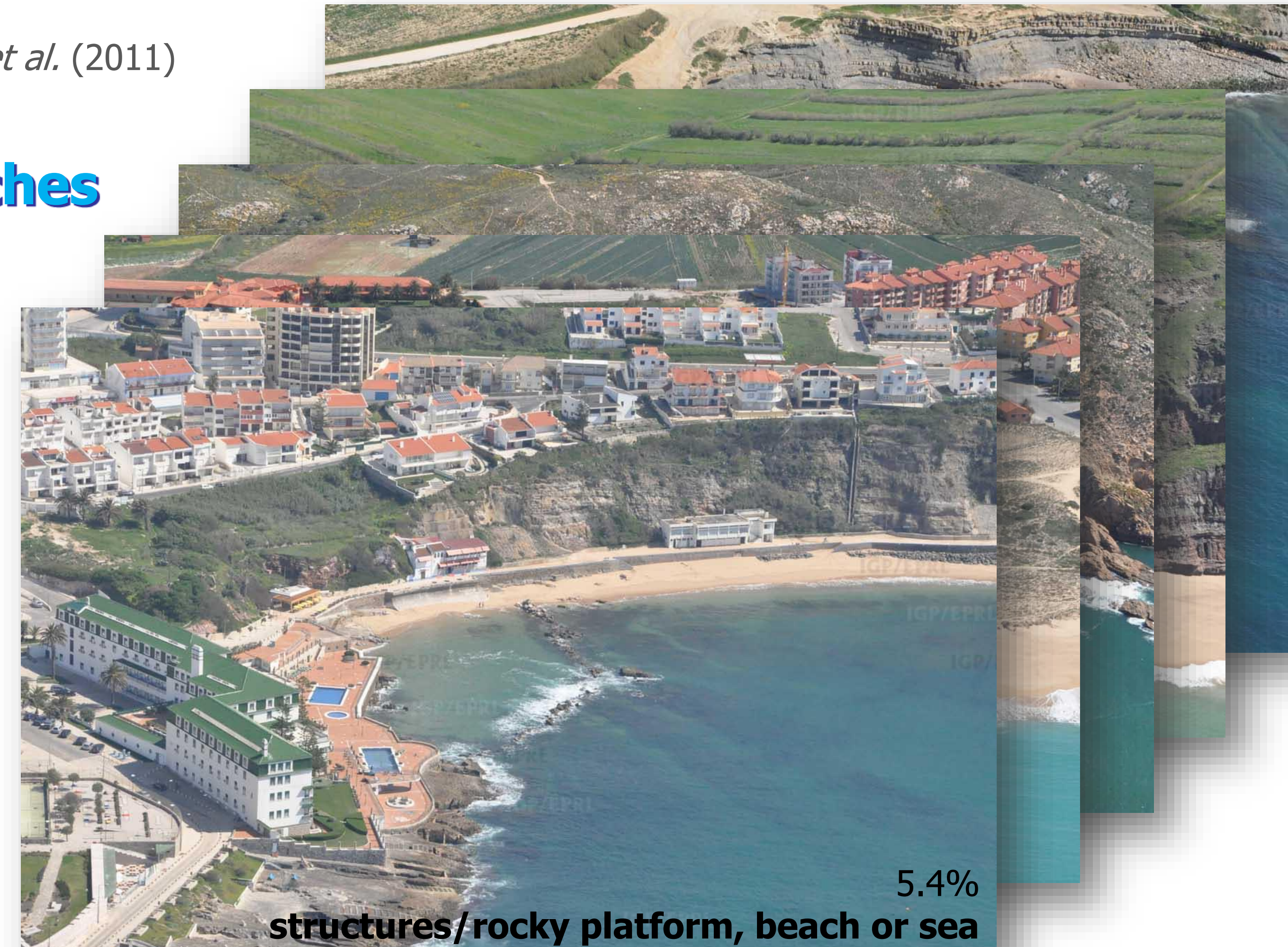


- Semidiurnal mesotidal regime
- Exposed to swells generated in the North Atlantic

Study site

According Andrade *et al.* (2011)

45% Beaches



Photographs (SIARL-IGP, 2011)

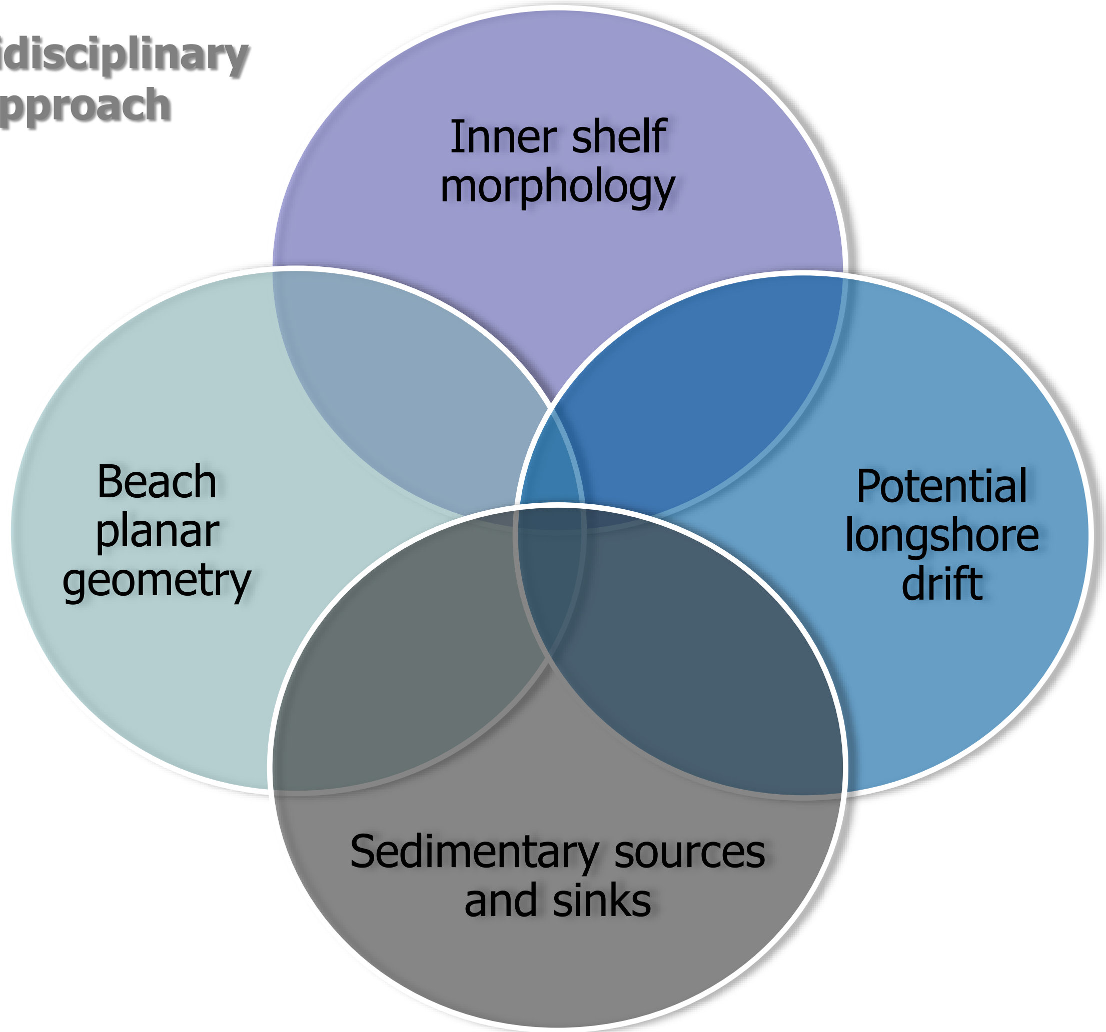
Study site

Beaches

Photographs (SIARL-IGP, 20??)

Methods

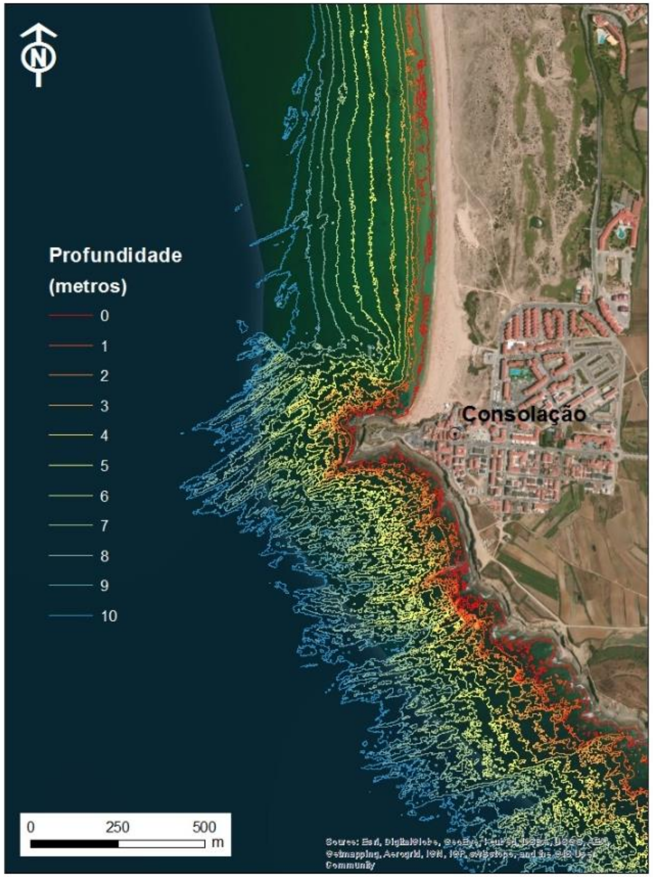
Multidisciplinary approach



Methods

Inner shelf morphology

- LiDAR data from 2011 (DGT)
- 0 - 10 m depths (MSL)
- Length and slope of 69 E-W profiles (1 km spaced)
- Qualitative analysis of bottom type (rocky/sandy)



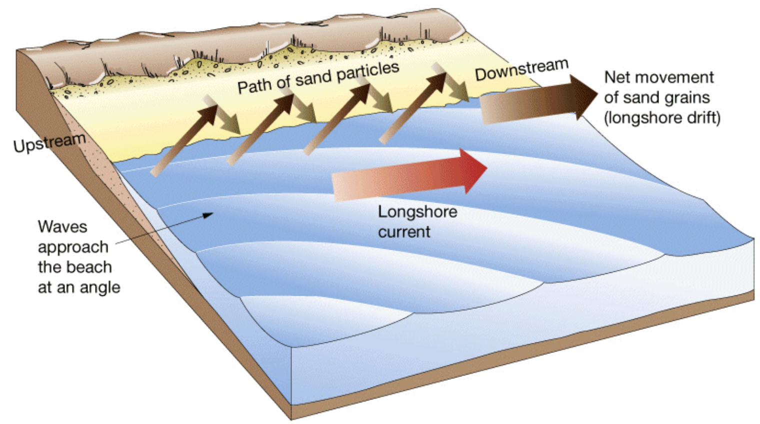
Methods

Beach planform configuration

- Vectorization of coastline from ESRI World Imagery at a fixed scale (1:3000)
- Beach length and orientation

Methods

Potential longshore drift



- CERC formula (Rosati *et al.*, 2002):

$$Q = K\left(\frac{\rho\sqrt{g}}{16\gamma_b(\rho_s-\rho)(1-p)}\right) Hs_b^{\frac{5}{2}}\sin(2\theta_b)$$

- 56 years wave time series reconstructed by Dodet *et al.* (2010)
- waves were propagated up to 15 m depth - SWAN model (Booij *et. al*, 1999)
- wave breaking parameters – Snell law and linear wave theory

Methods

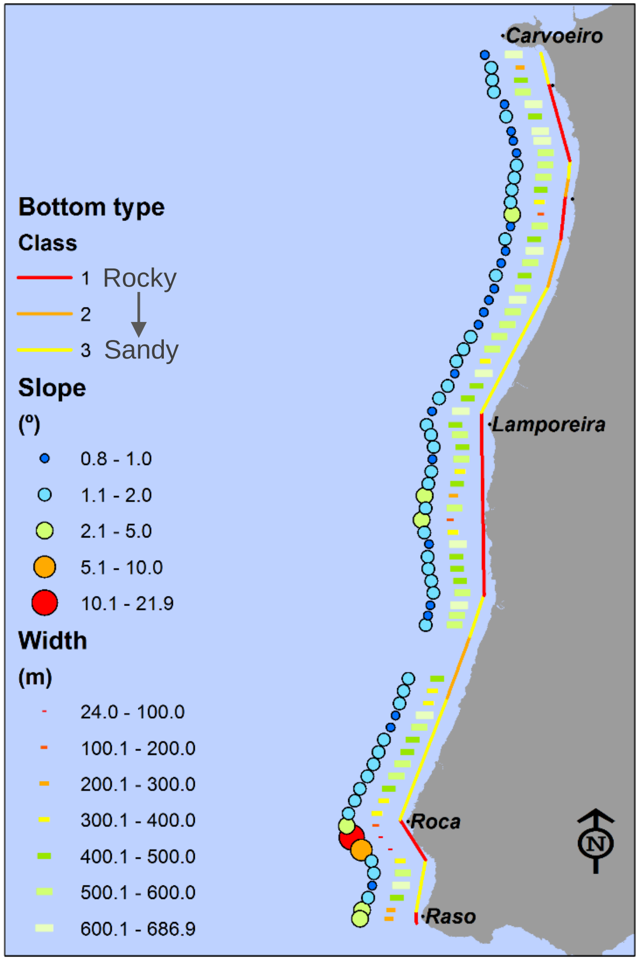
Sedimentary sources and sinks

- Bibliographic references
- Estimation of watershed erosion – RUSLE* model (Renard *et al.*, 1997)

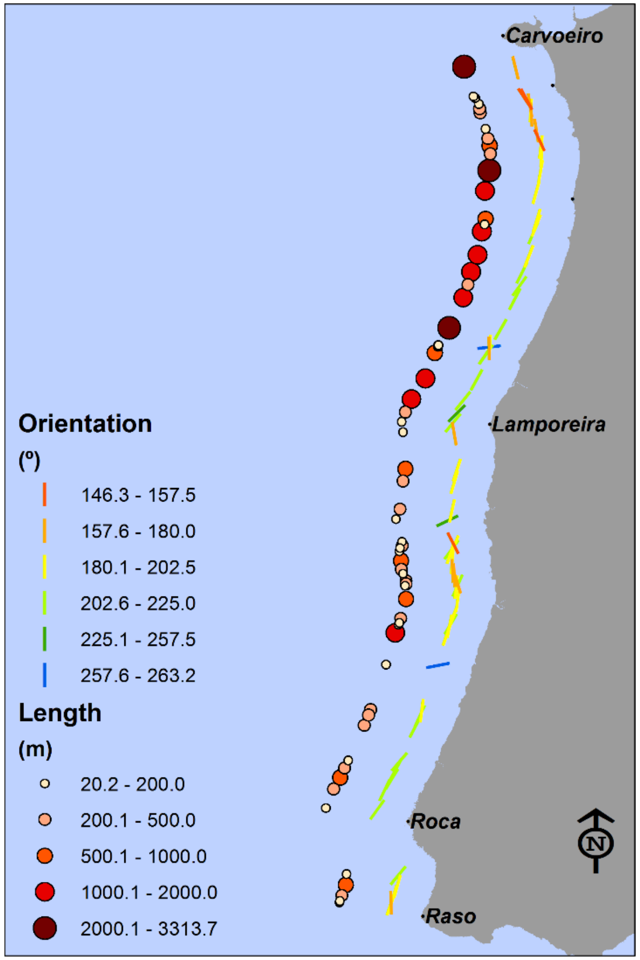
**Revised Universal Soil Loss Equation*

Results

Inner shelf morphology*



Beach planform geometry



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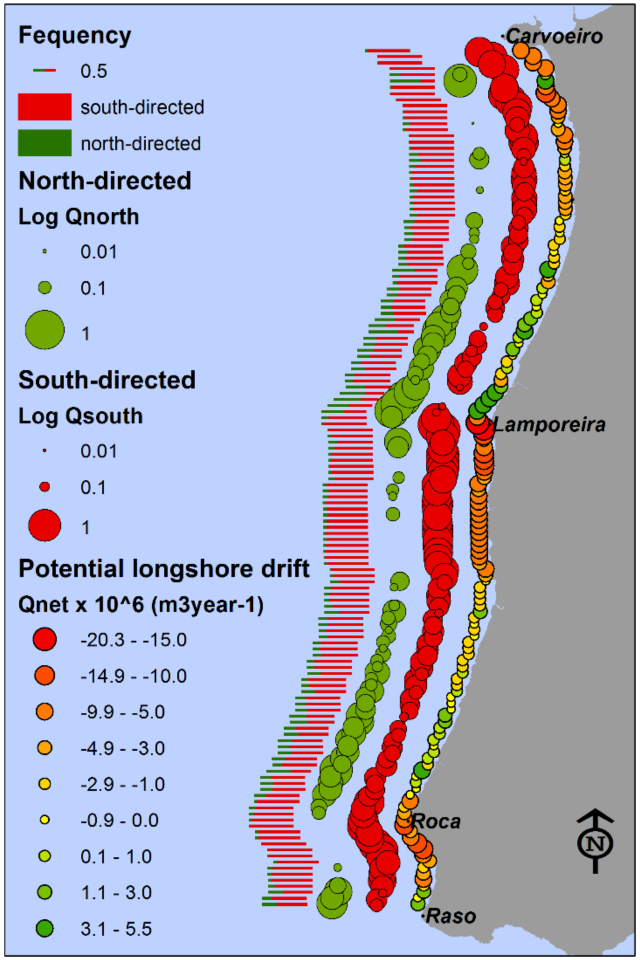
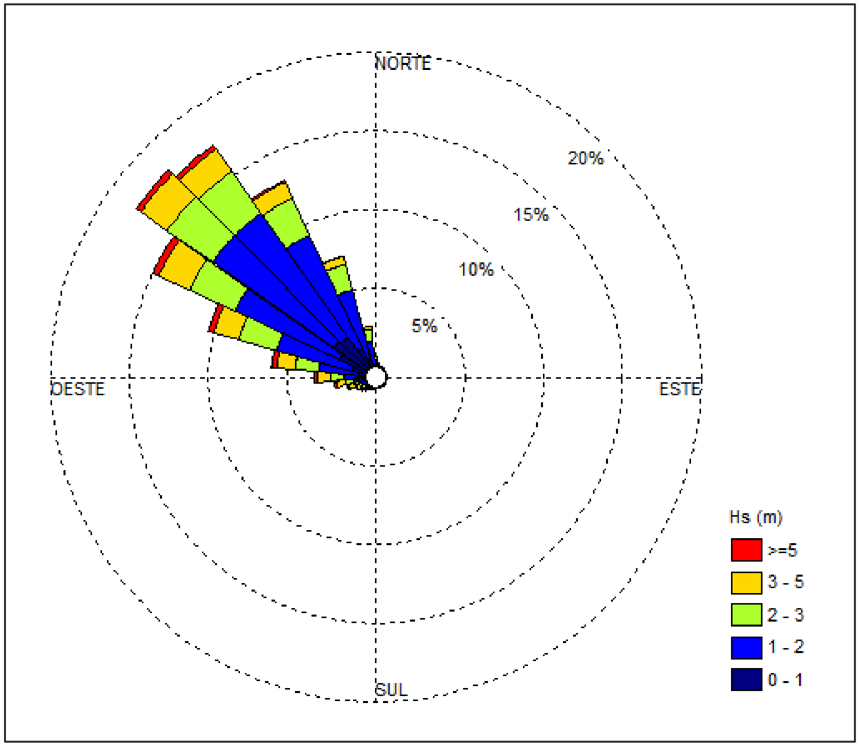
* up to 10 m depth

Results

Potential longshore drift

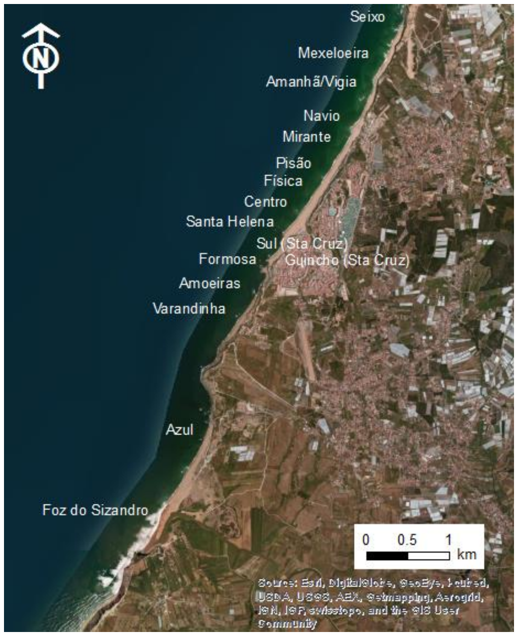




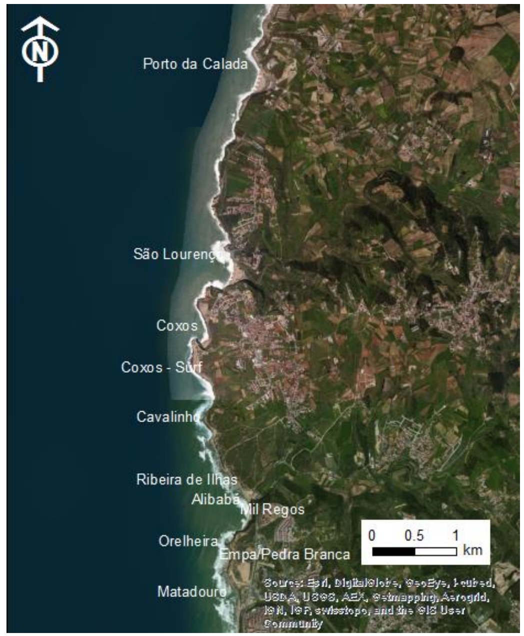
56 years wave time series reconstructed by Dodet *et al.* (2010)

Discussion

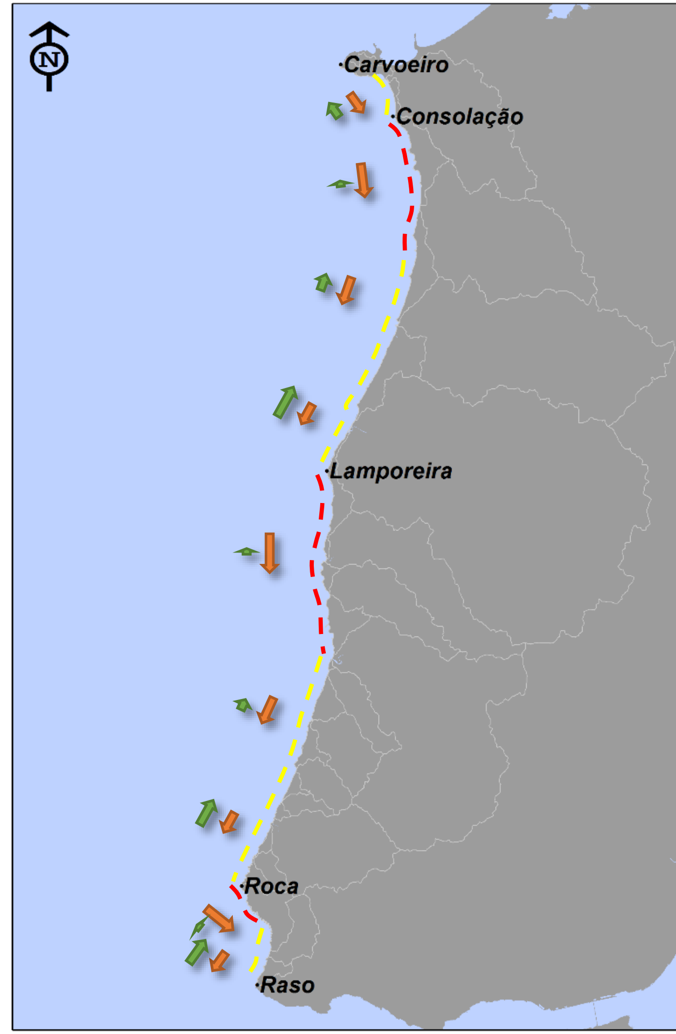
Sandy/straight



Rocky/crenulated



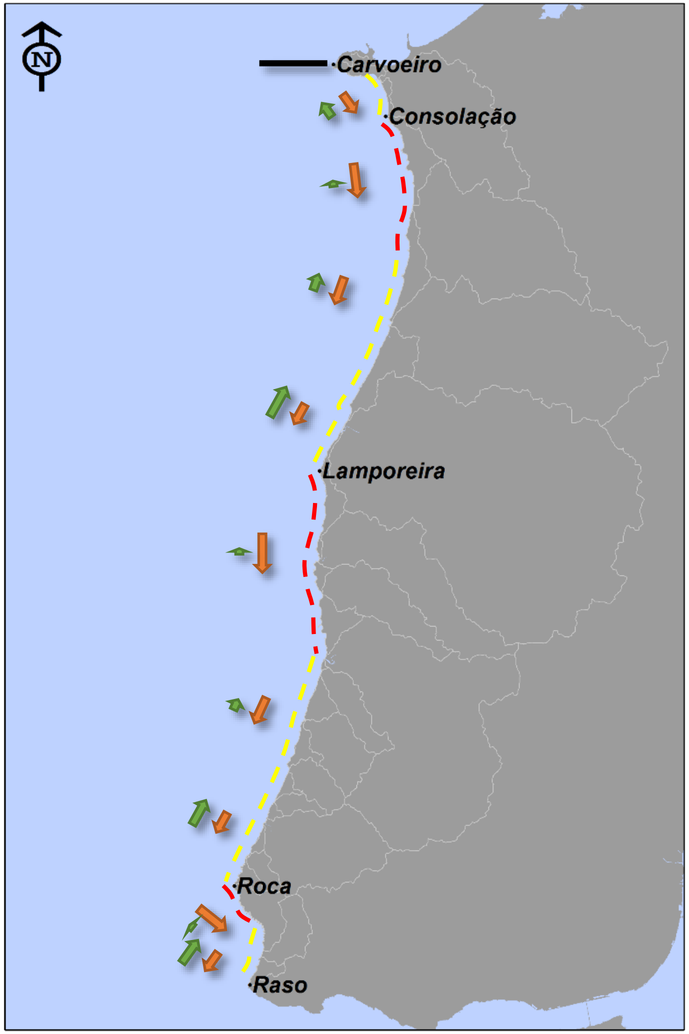
rocky
sandy
northward drift
southward drift



Discussion

Peniche Peninsula

northward drift
southward drift
closed boundary



Discussion

Sedimentary sources

- Cliff erosion

$4.0 \times \mathbf{10^2}$ m^{3}year^{-1} (Andrade *et al.*, 2008)

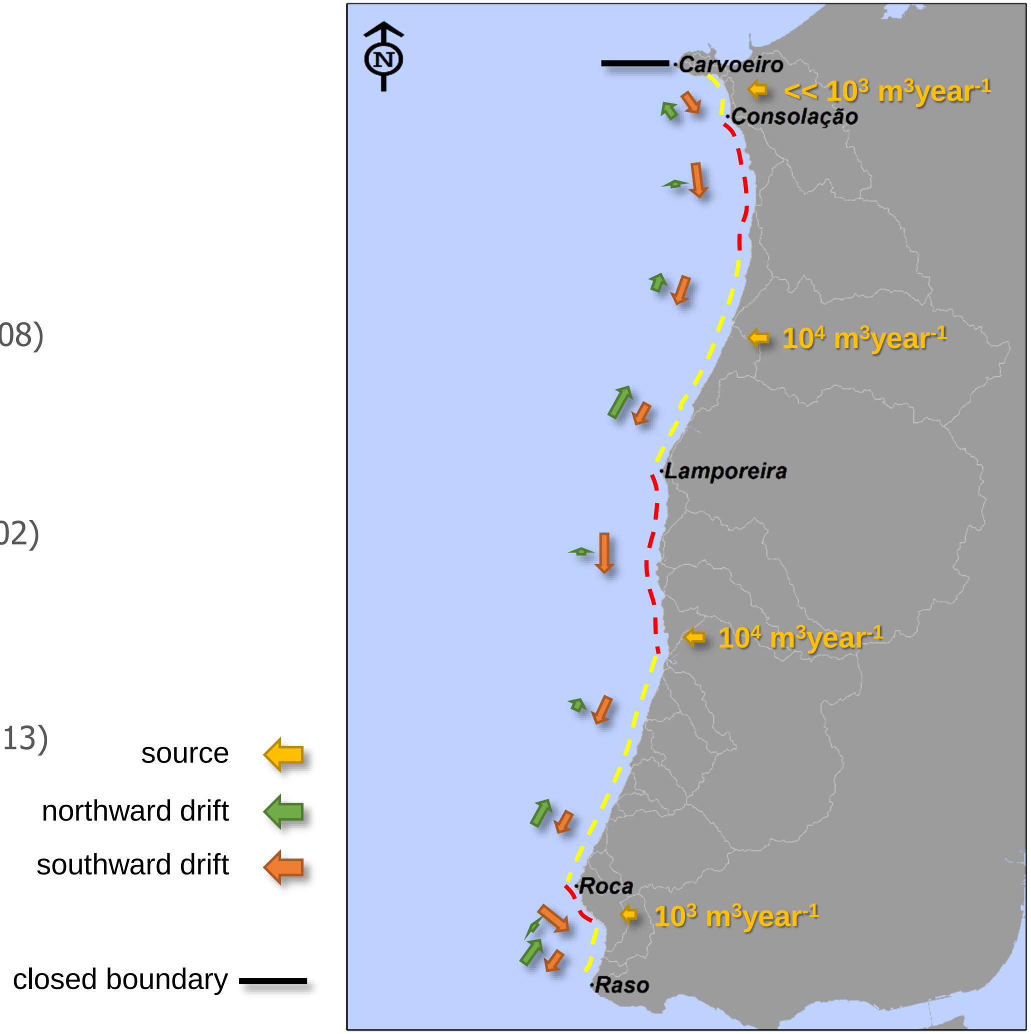
$1.2 \times \mathbf{10^3}$ m^{3}year^{-1} (Oliveira, 2009)

$1.5 \times \mathbf{10^2}$ m^{3}year^{-1} (Taborda *et al.*, 2002)

- Watershed erosion

Order of $\mathbf{10^4}$ m^{3}year^{-1} (Lira *et al.*, 2013)

$5.4 \times \mathbf{10^4}$ m^{3}year^{-1}



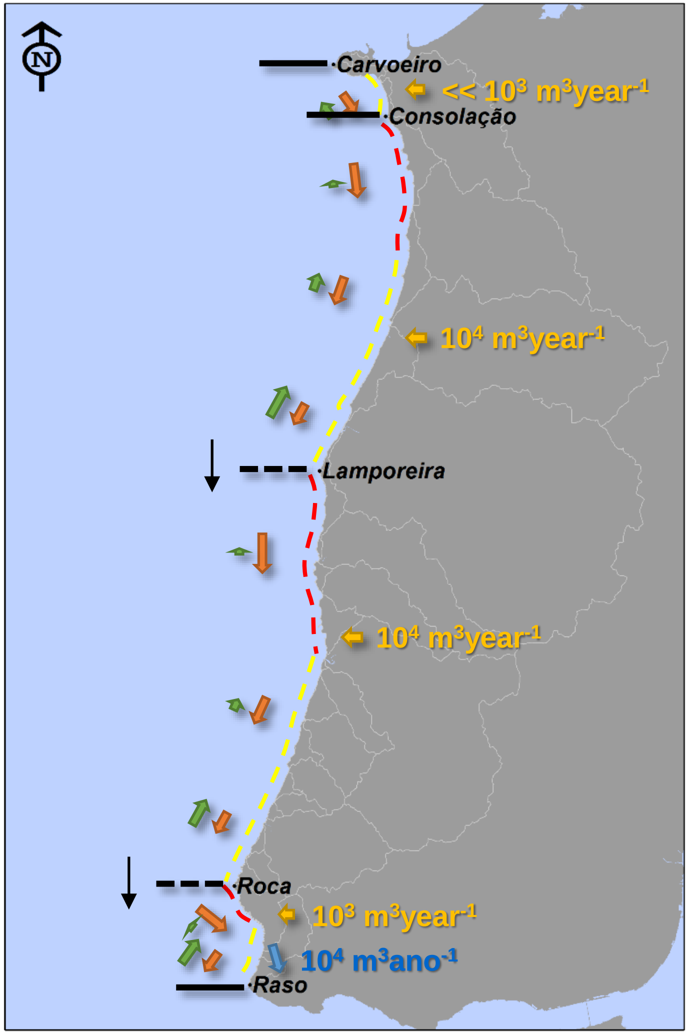
Discussion

Sedimentary sinks

- Guincho dune field

1.2 × **10⁴** m³year⁻¹ (Rebêlo *et al*., 2002)

sink
source
northward drift
southward drift
open boundary
closed boundary



Final remarks

- Results indicate a southward directed sediment bypassing at Lamporeira and Roca headlands, with a magnitude that must match the active sediment supply (10^4 $m^3 year^{-1}$).

- At Raso headland sediment bypassing should be negligible given the magnitude of sand input to the Guincho dune field.

Future work

- Analysis of planform beach changes using Landsat satellite images complemented with field surveys with DGPS-RTK and ground-based photographic monitoring.

- Tracer experiment.

Obrigada pela atenção !

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Acknowledgements

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