Università di Corsica Pasquale Paoli

Interdisciplinary Symposium | 5-6-7 July 2017

Combining high resolution sonar systems (SSS and MBS) for detecting and monitoring *P. oceanica* lower limit

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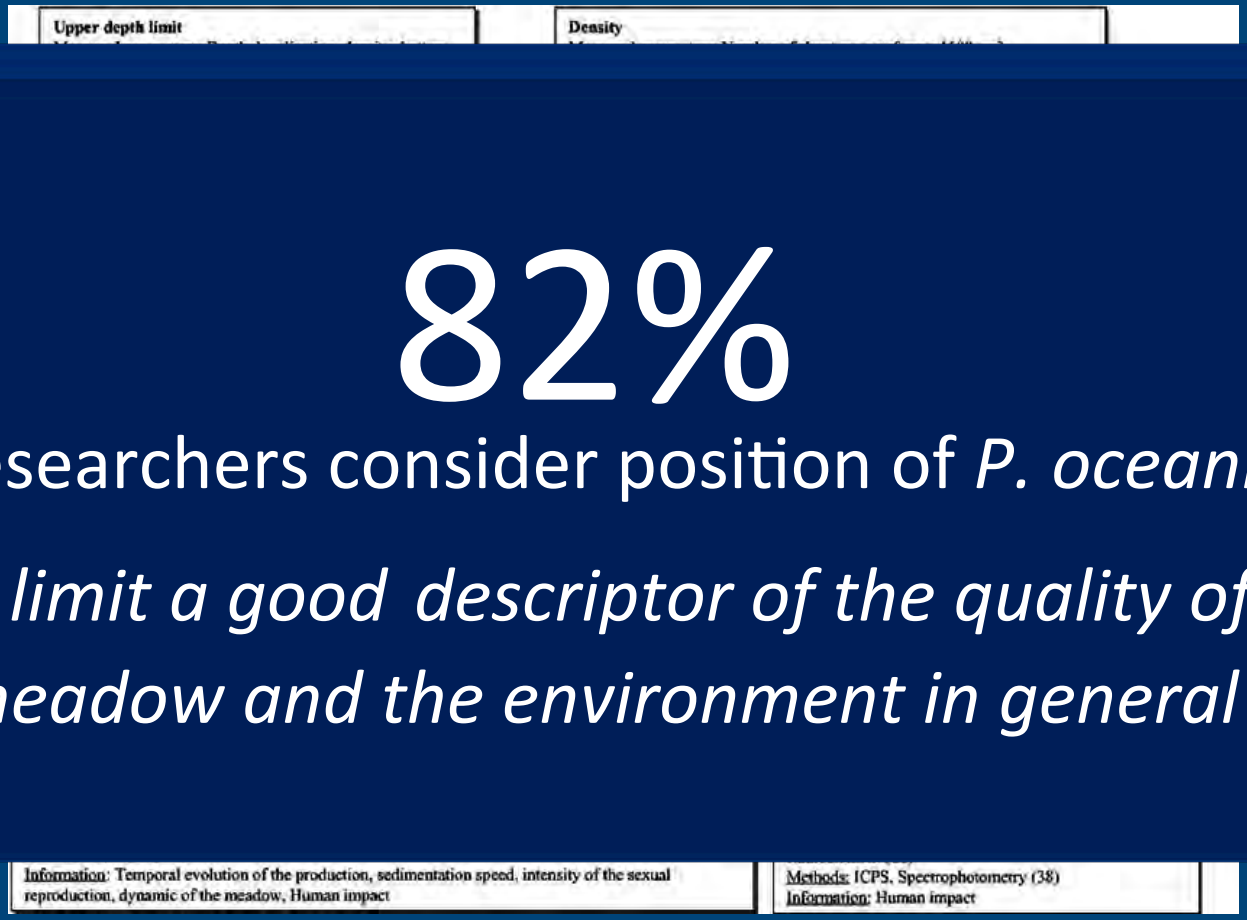
Climate Change - "Scientific knowledges and lack of data"

Lower limit as environmental descriptor

(Pergent *et al*., 2005)



82%

of researchers consider position of *P. oceanica*

lower limit a good descriptor of the quality of the meadow and the environment in general

Monitoring *P. oceanica* lower limit

- ✓ fixed marks
- ✓ acoustic telemetry
- ✓ side scan sonar

Monitoring *P. oceanica* lower limit

FIXED MARKS (BALISE)

Boudouresque *et al*., 2000

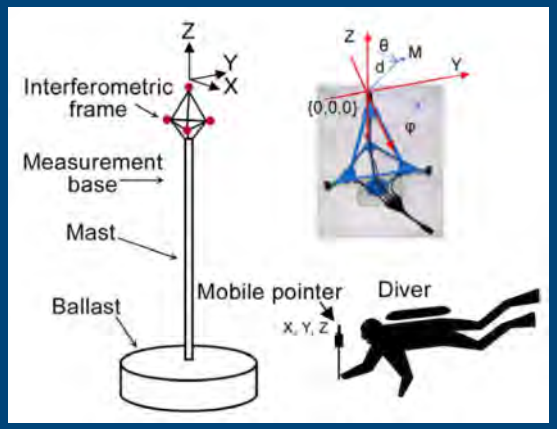
<u>Advantages</u>

- Technically simple and easy to implement
- Very accurate

<u>Difficulties</u>

- Time - consuming at deep stand
- Only few points can be positioned per area

Monitoring *P. oceanica* lower limit



ACOUSTIC TELEMETRY

Descamp *et al.*, 2011

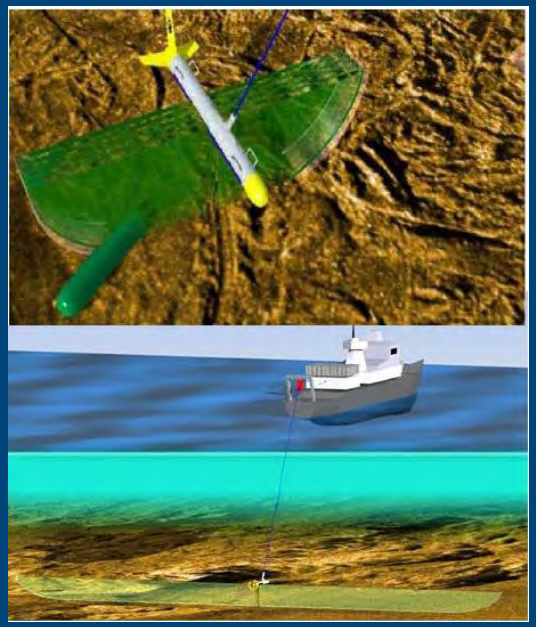
Advantages

- It is faster than a traditional balisage
- There is no need for installing the markings on the sea bottom
- Few dives are required
- Very accurate

Difficulties

- Suitable only for mapping small areas
- The high cost of the device
- It requires specific training for using

Monitoring *P. oceanica* lower limit



SIDE SCAN SONAR

Abadie *et al*., 2015; Pasqualini *et al*., 1997; Montefalcone *et al*., 2014

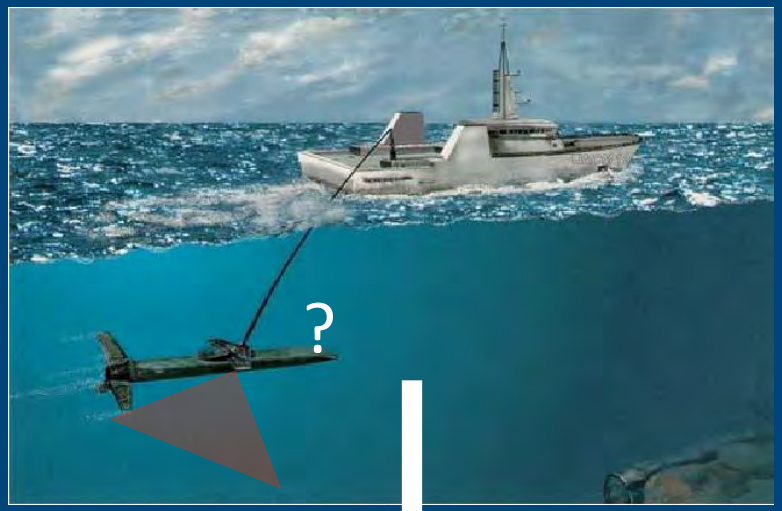
Advantages

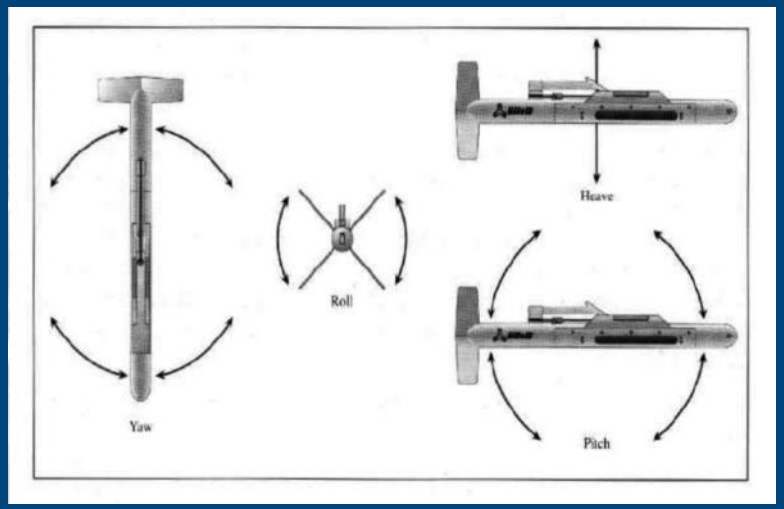
- To allow to map quickly wide areas
- To provide information on seabed colonized by P. oceanica meadows

Difficulties

- It is not able to provide bathymetric information
- The exact position of towed system could be difficult to assess, due to large transient motions and inertial effects
- Subjective interpretation of sonograms

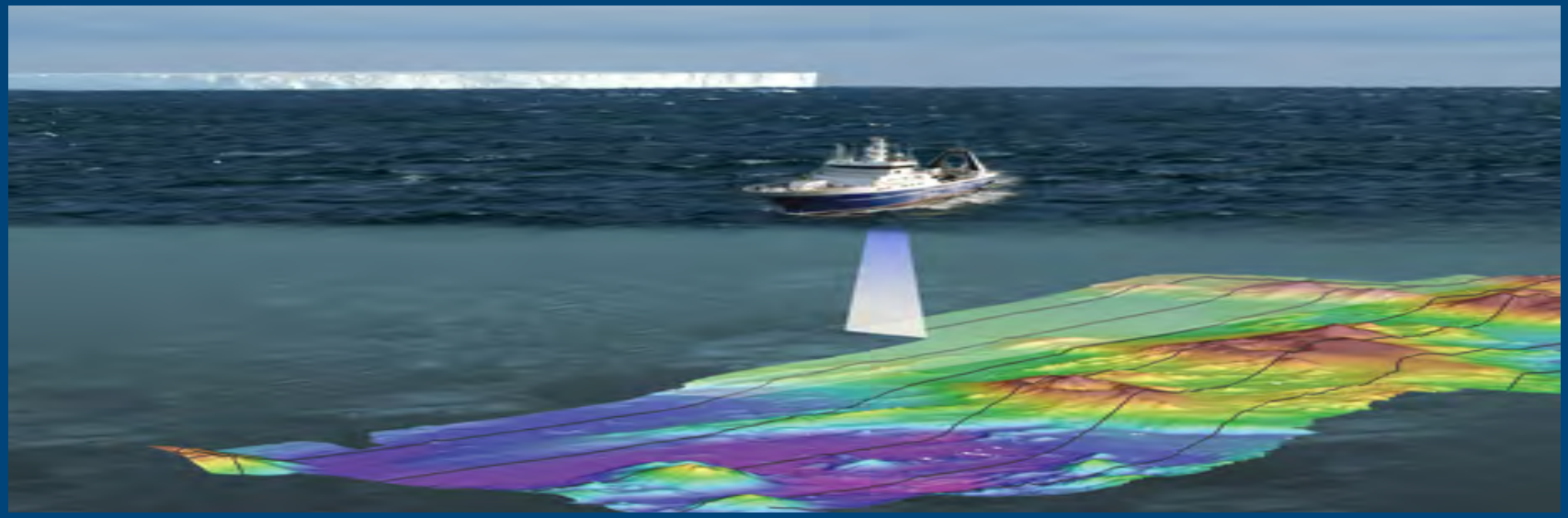
SIDE SCAN SONAR
(Towfish instabilities)





Sonograms mosaic mismatches until several meters with inaccuracy of absolute positioning affecting the final cartography

MODERN HIGH RESOLUTION SONAR SYSTEMS (MBSs) for seagrass mapping



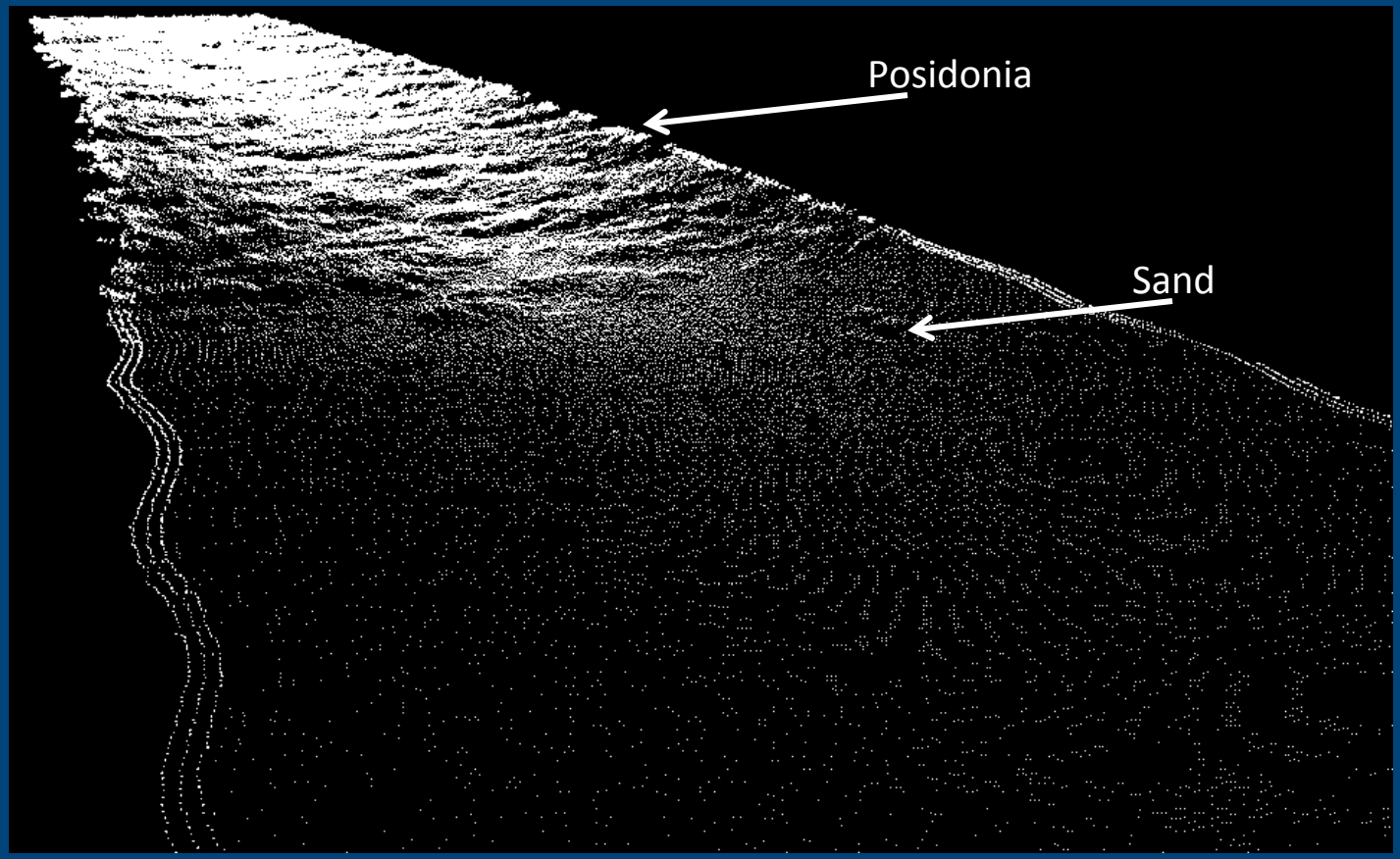
Advantages

Able to obtain bathymetric coverage with an unequalled density and precision of points (Le Gonidec *et al*., 2003), allowing also three dimensional representation of the seabed, including seagrass volume and canopy height (Komatsu *et al*., 2008)

Difficulties

Tested only under optimal conditions i.e. sand *vs* dense meadows at shallow depth (Komatsu *et al*., 2008; Di Maida *et al*., 2011; Silva *et al*., 2012)

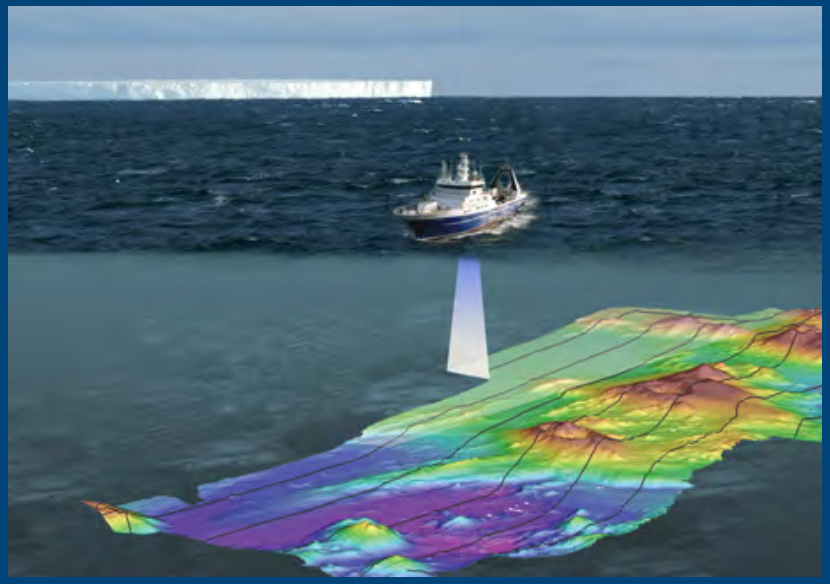
Seagrass mapping by MBS



CAN WE COMBINE THEM?

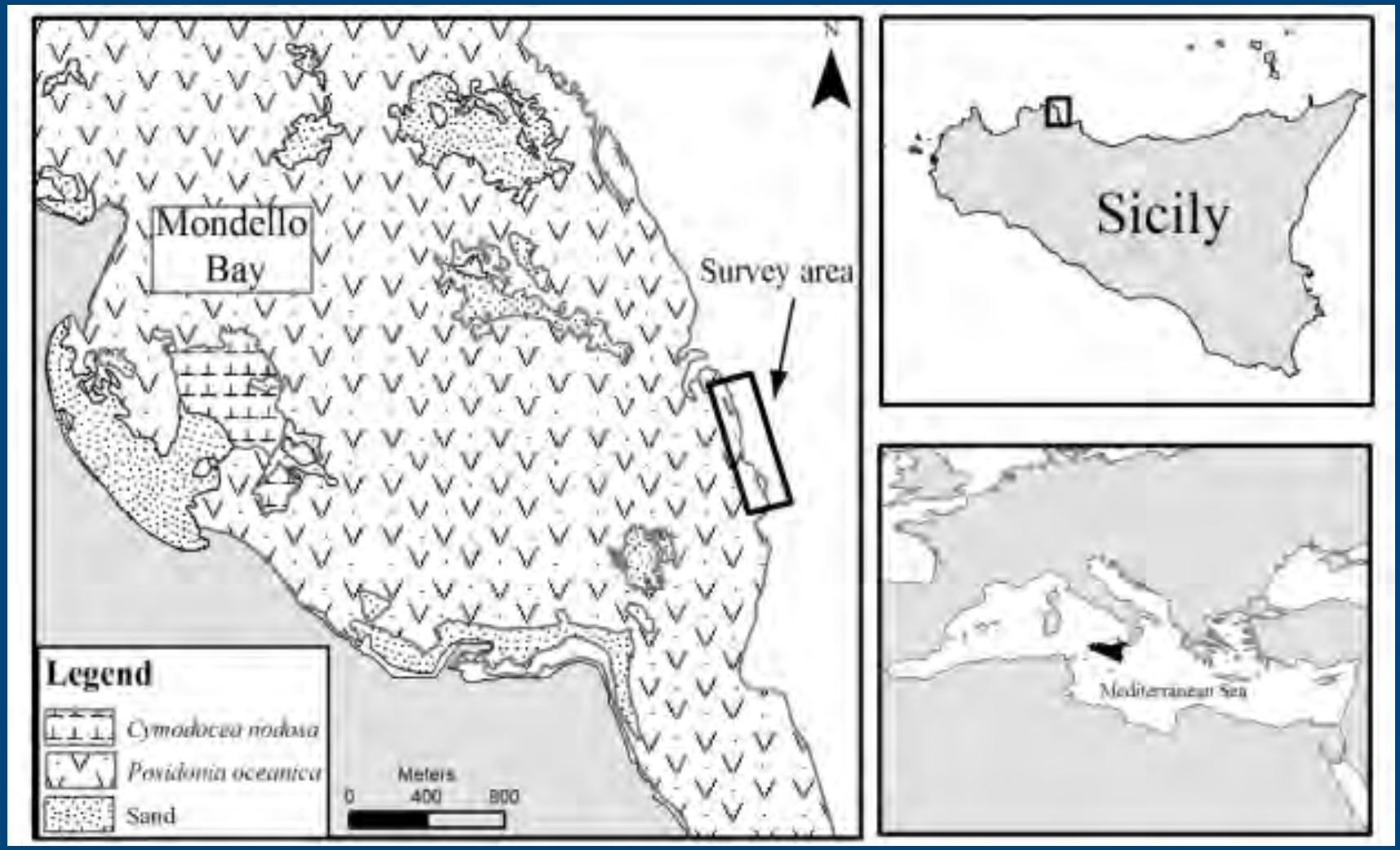
SIDE SCAN SONAR

MULTIBEAM SYSTEMS



The aim of this study is to test if the simultaneous and combined use of SSS and MBS can be an innovative approach for accurate detecting and monitoring of lower limits of *P. oceanica* meadows.

The study area: Mondello Bay (Palermo, Italy)



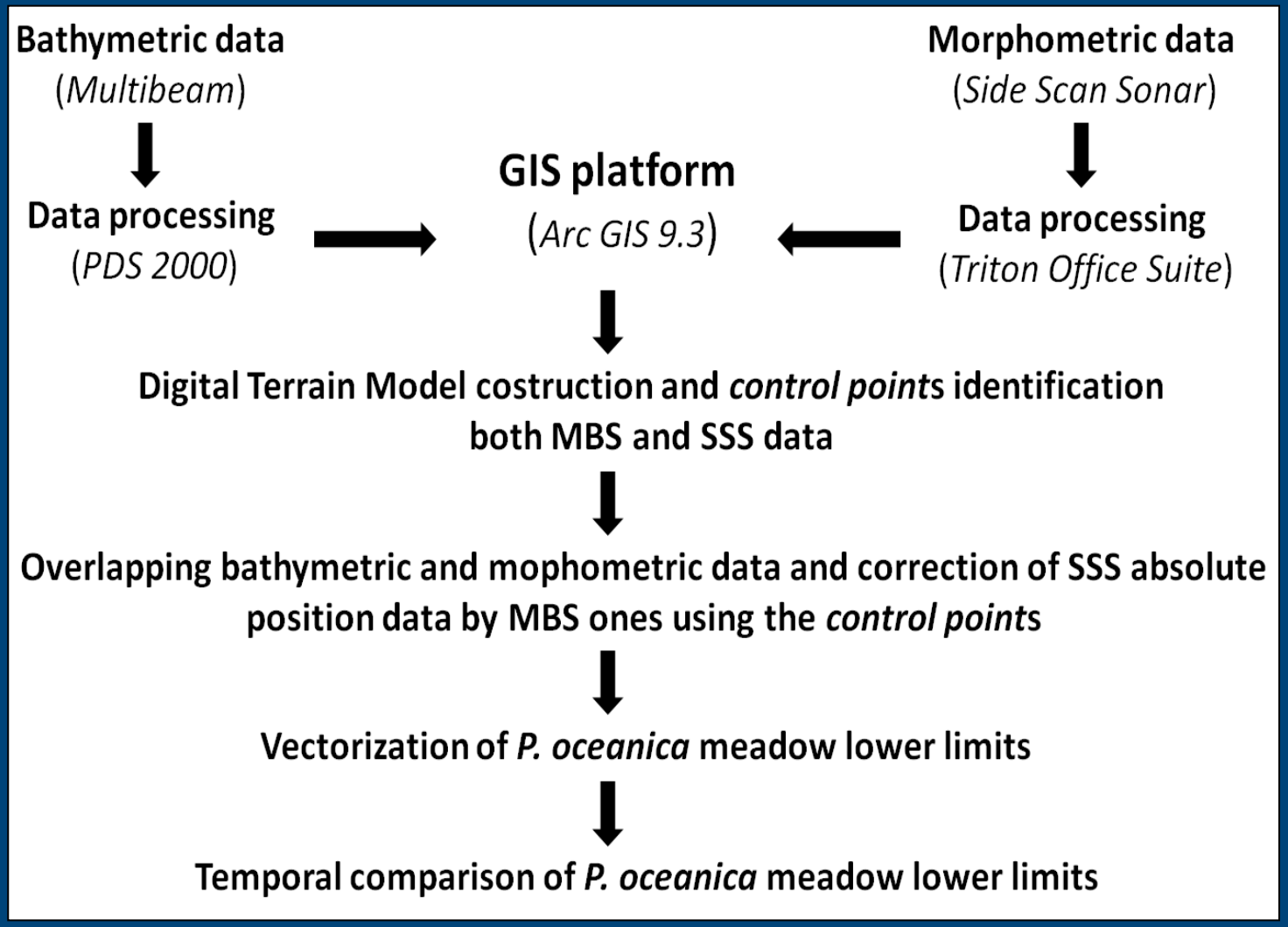
Research vessel “Antonino Borzì”

SSS Klein 3900 at 450 Khz

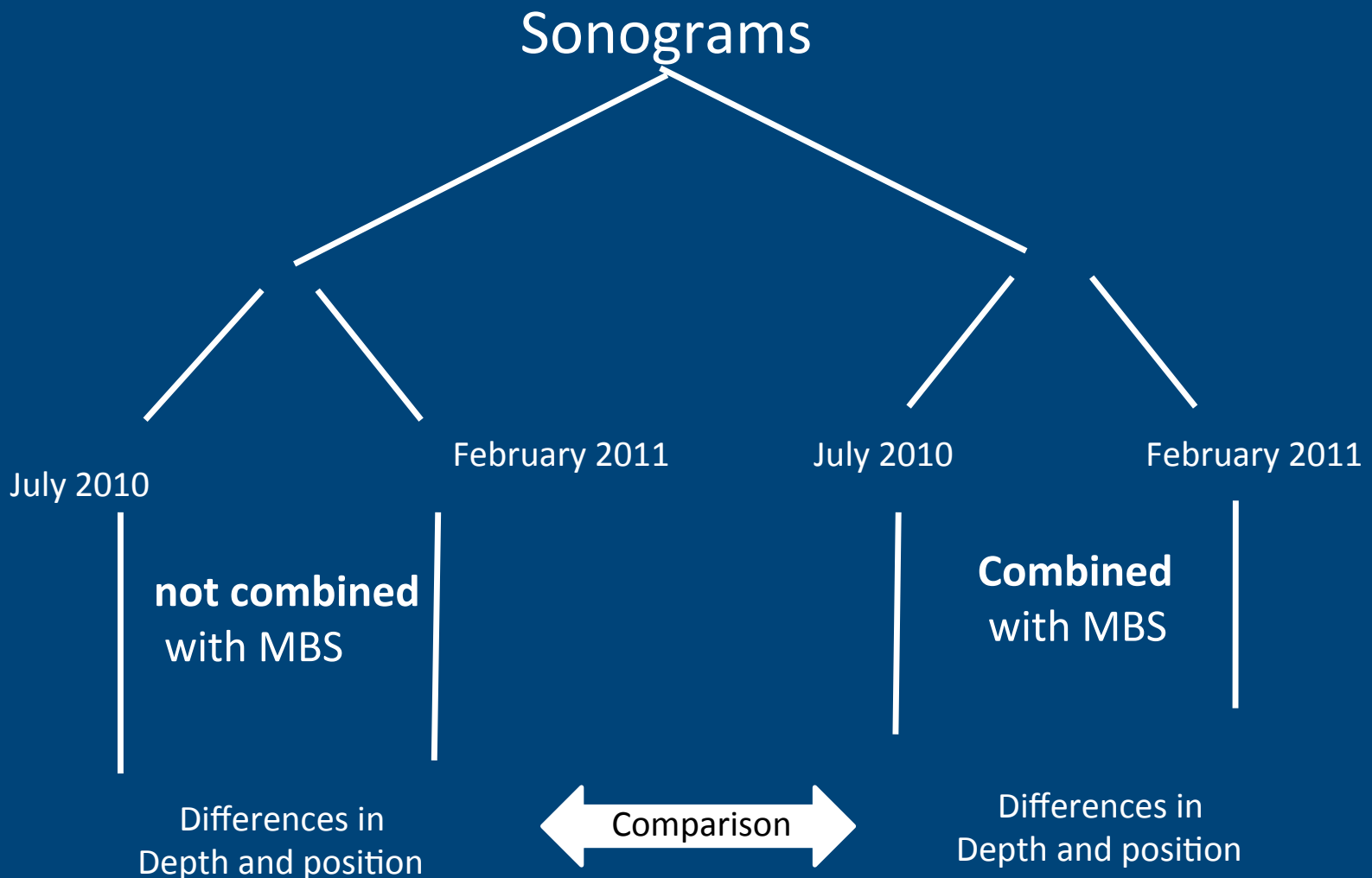
ROV Nautec Sirio Observer Class

MBS ResonSeabat 8125 at 455 Khz, with 240 beams

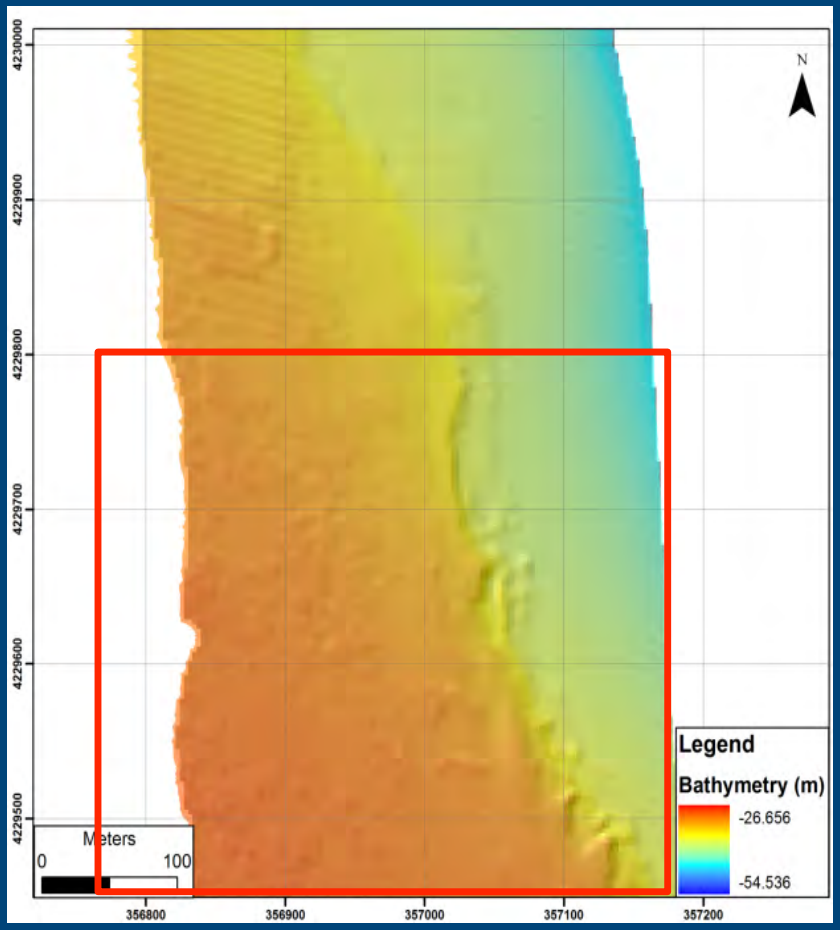
Flowchart: acquisition, treatment and processing of acoustic data

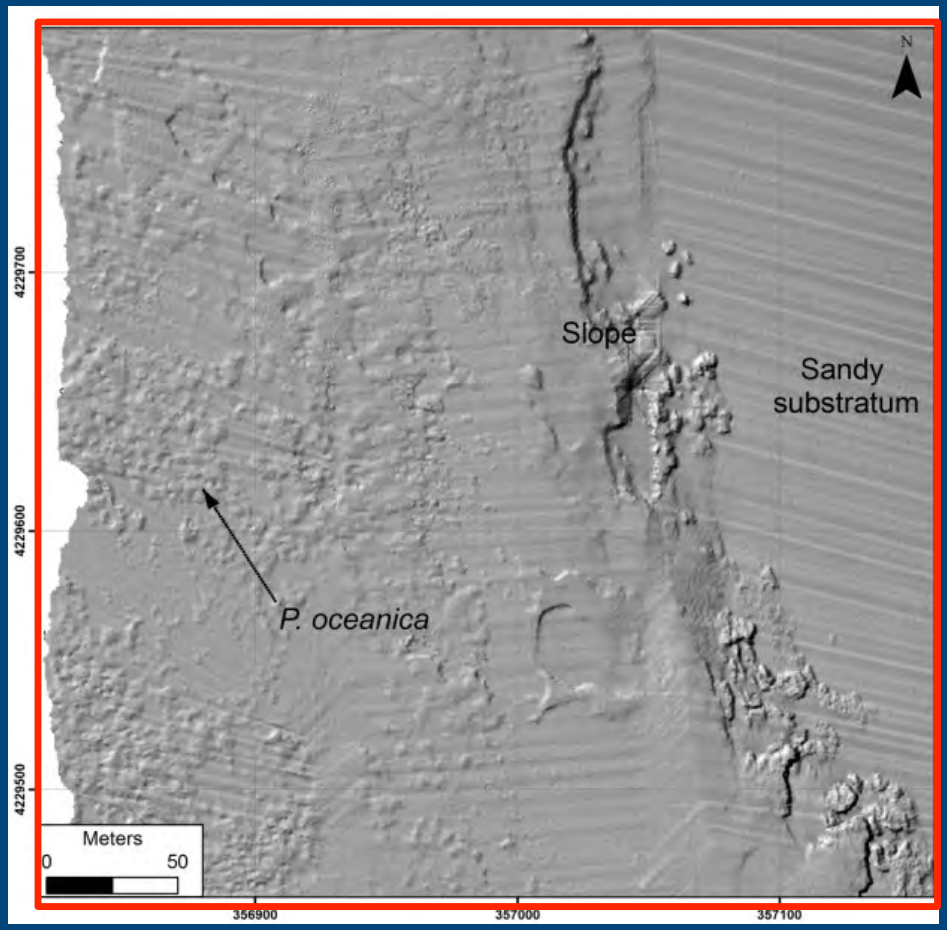


Data analysis



Bathymetric MBS data (DTM) of lower limit section investigated off Mondello Bay where is possible to discriminate sandy substratum and *P. oceanica* meadow.

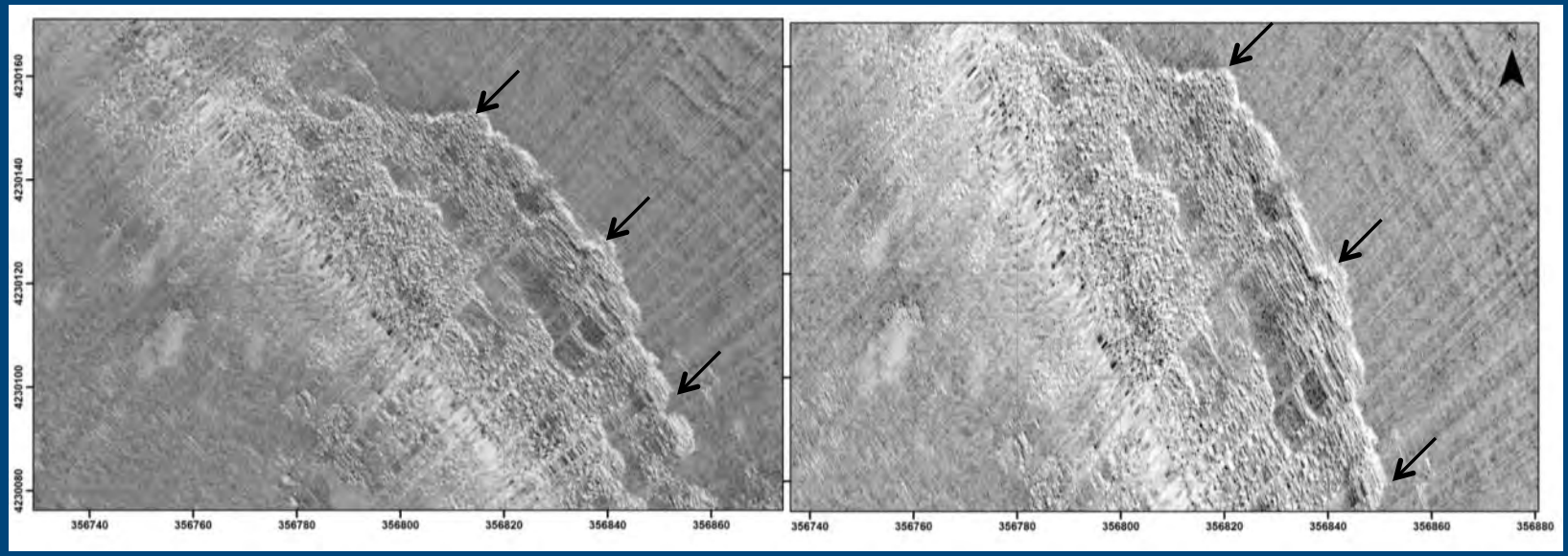




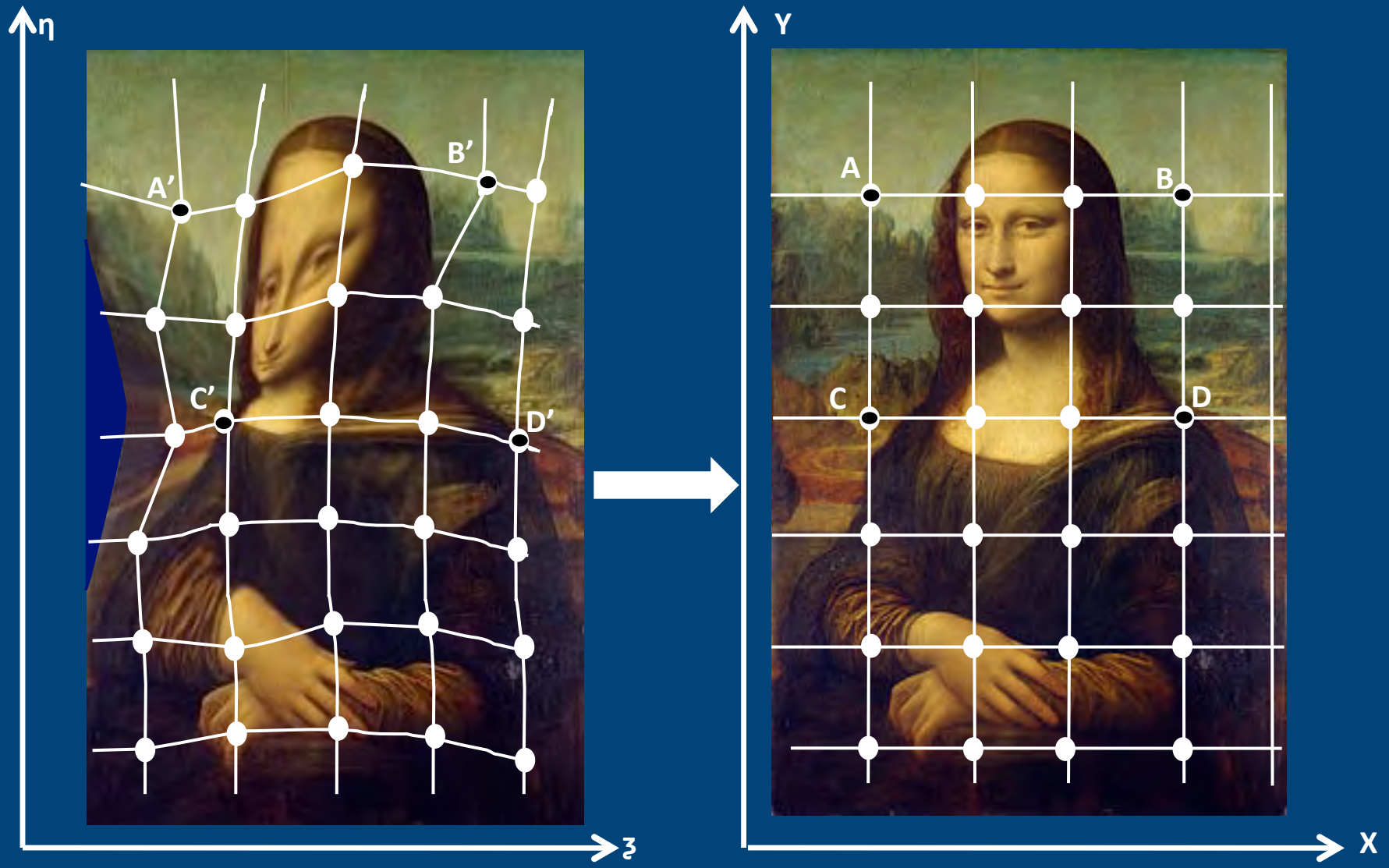
Sonograms were georeferenced by Triton software for the standard correction of basic parameters like speed, direction and Time Varying Gain (TVG)

July 2010

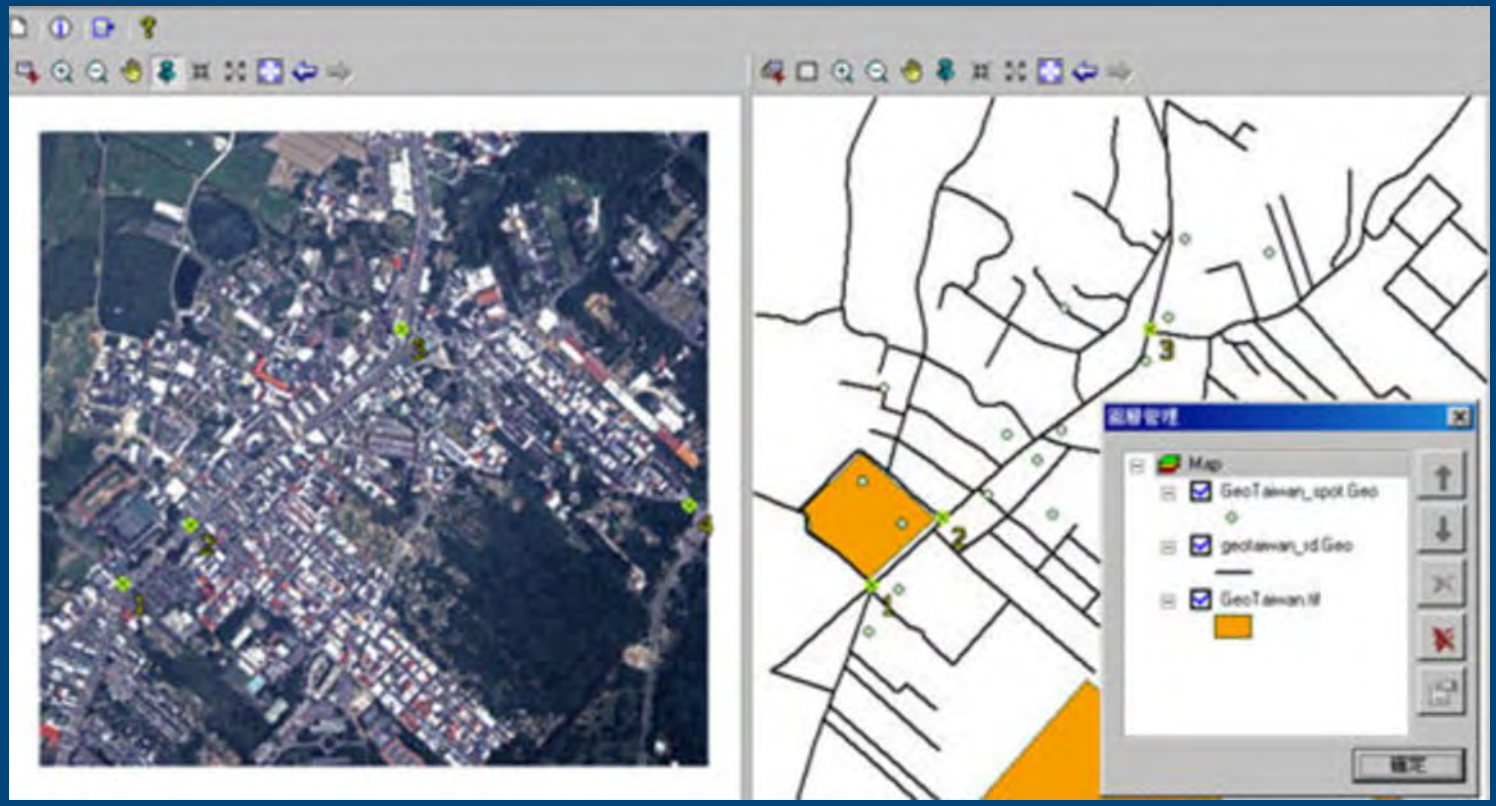
February 2011



Distorsion correction by georeferentiation



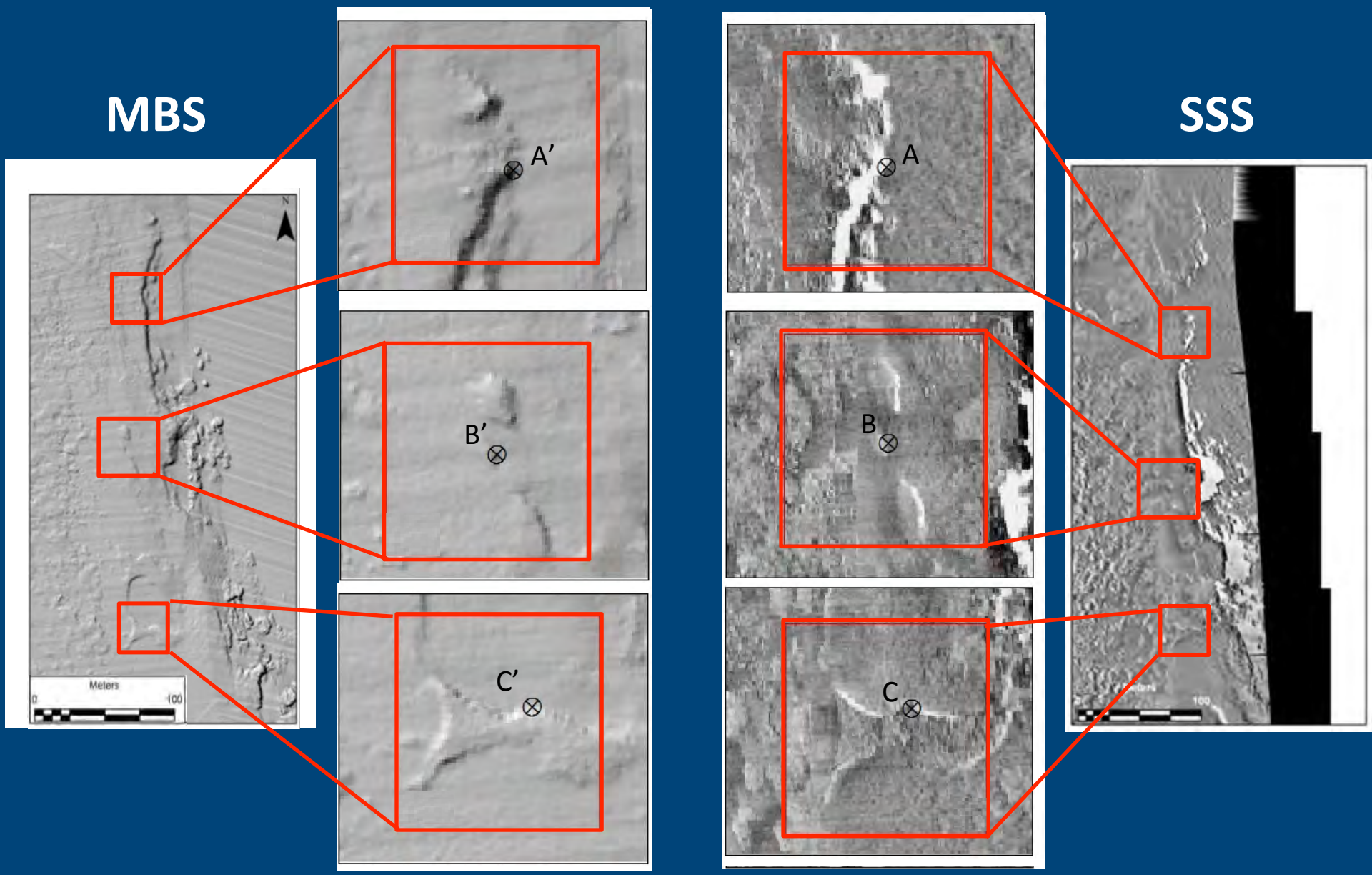
On land, image georeferentiation is a standard procedure because topographic maps with several fixed control points are available



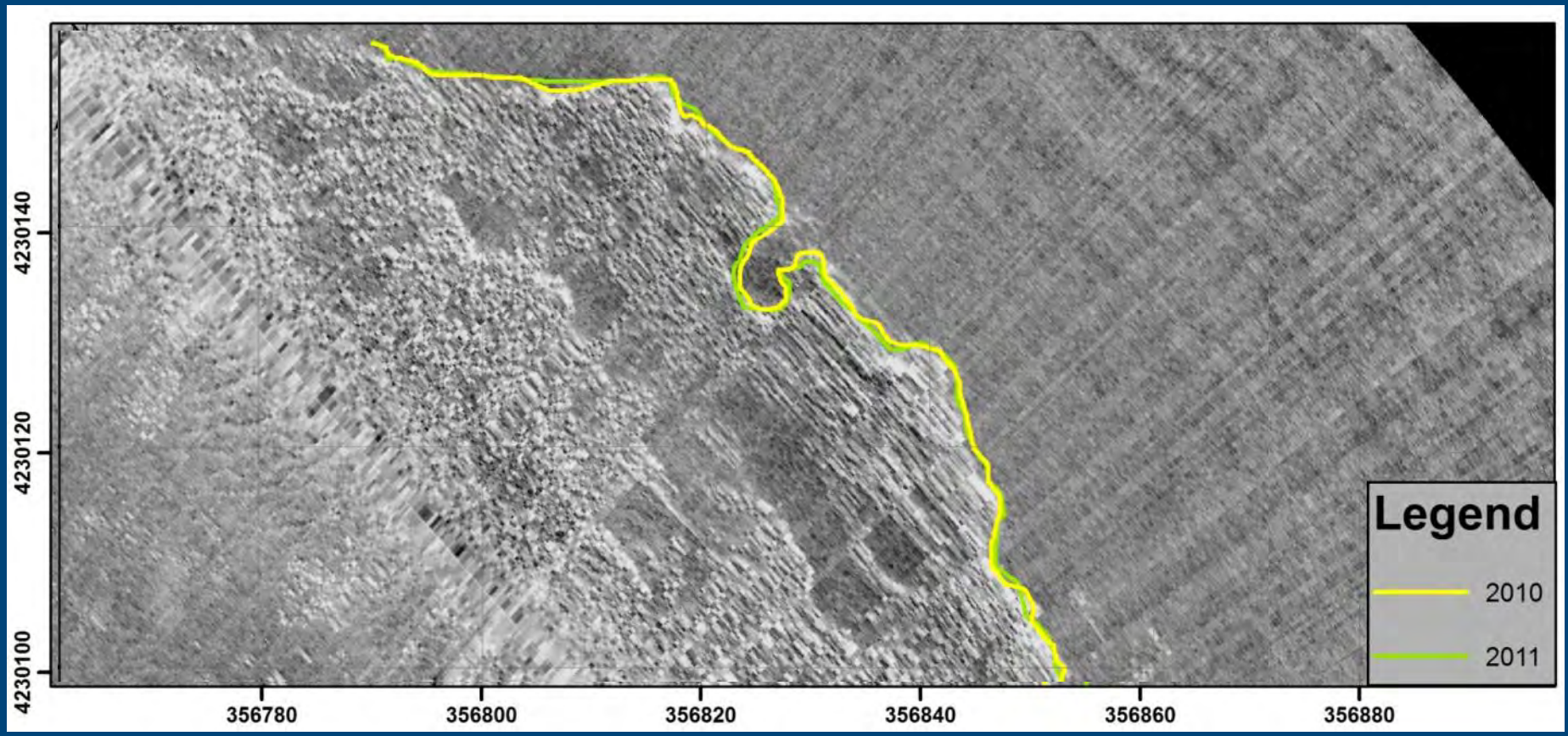
Searching fixed control points under the sea

In marine environment is possible with high accuracy only close to shore line, therefore generally in shallower water

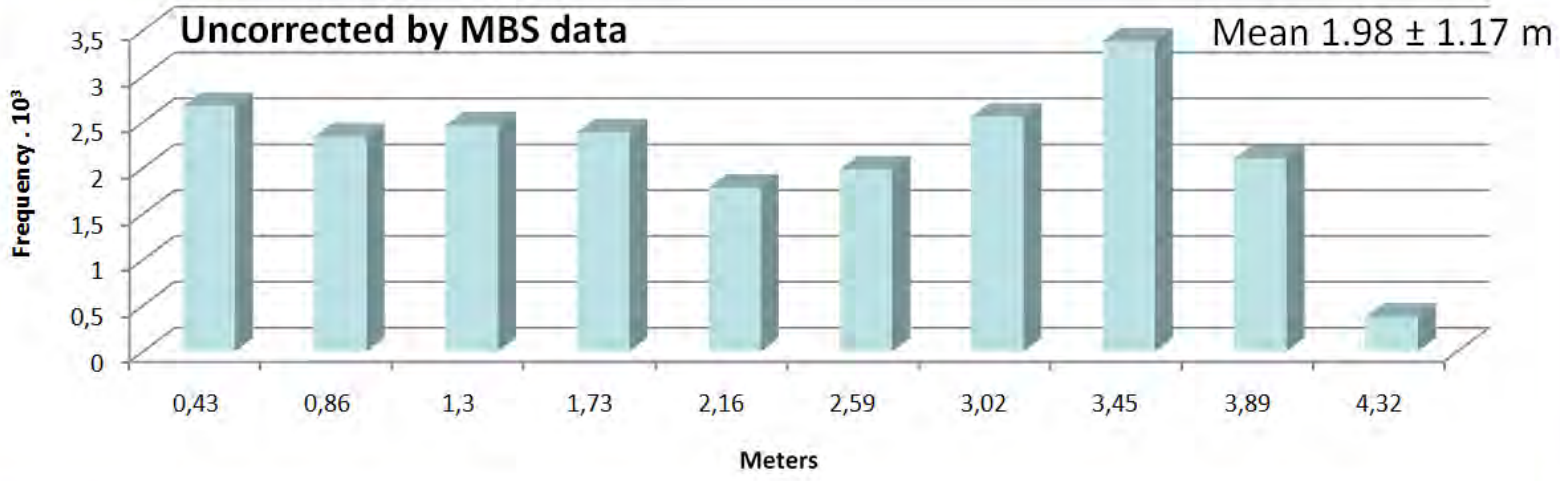
Matching *control points* between SSS and MBS

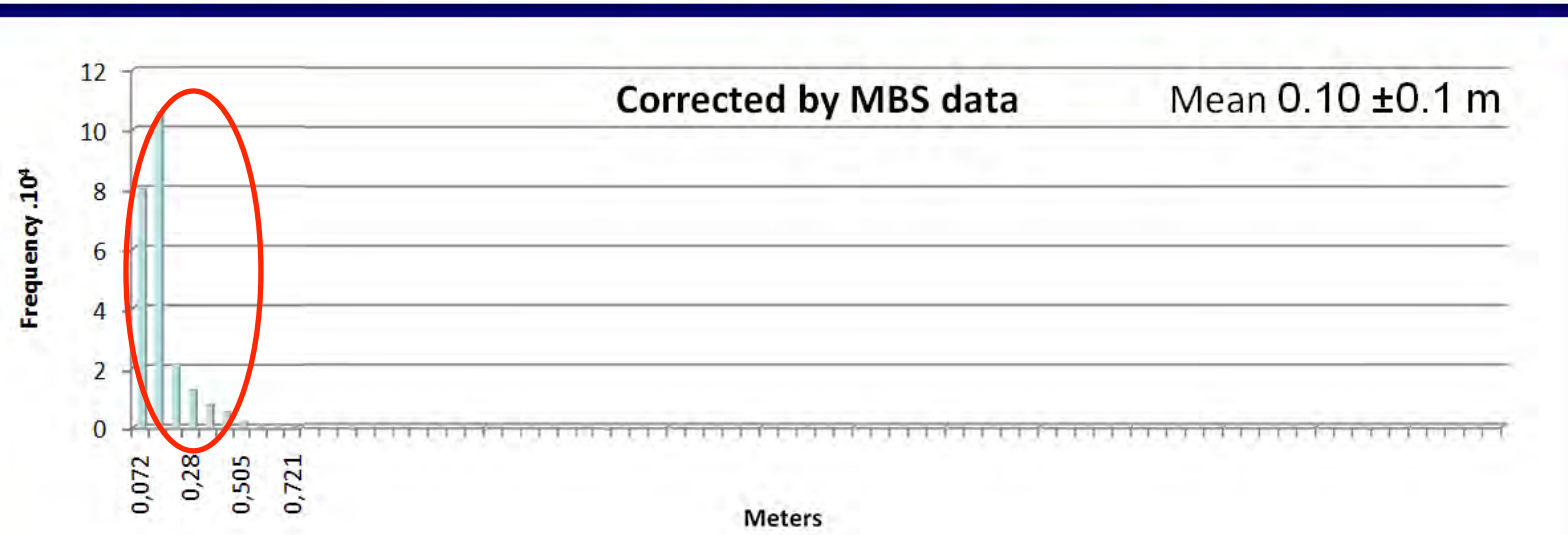


Lower limit according to SSS images with re-georeferentiation by using MBS as control points

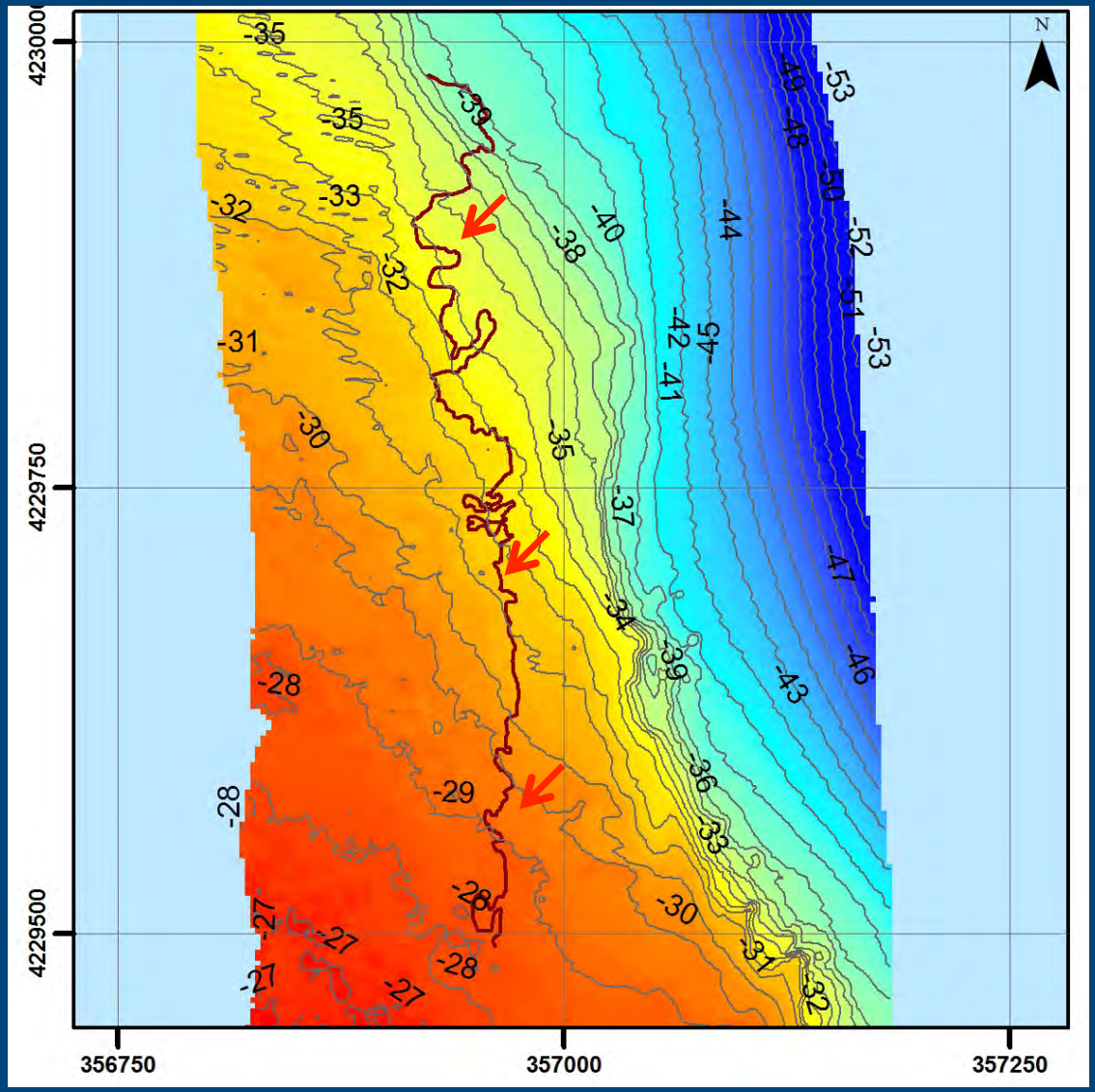


Frequencies of distance values between limits in two periods

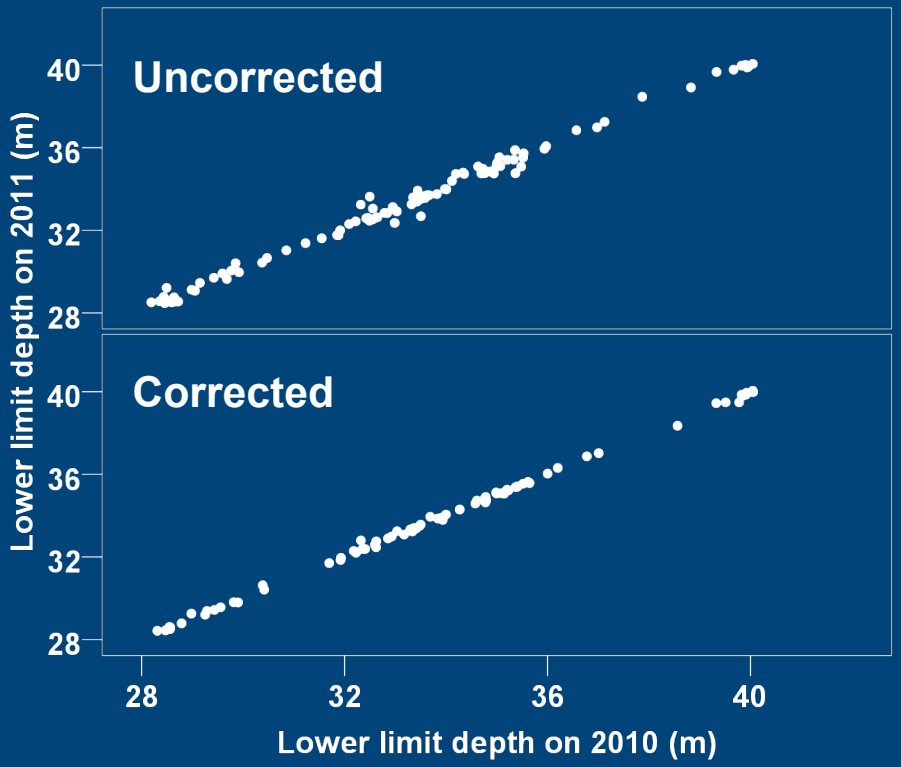


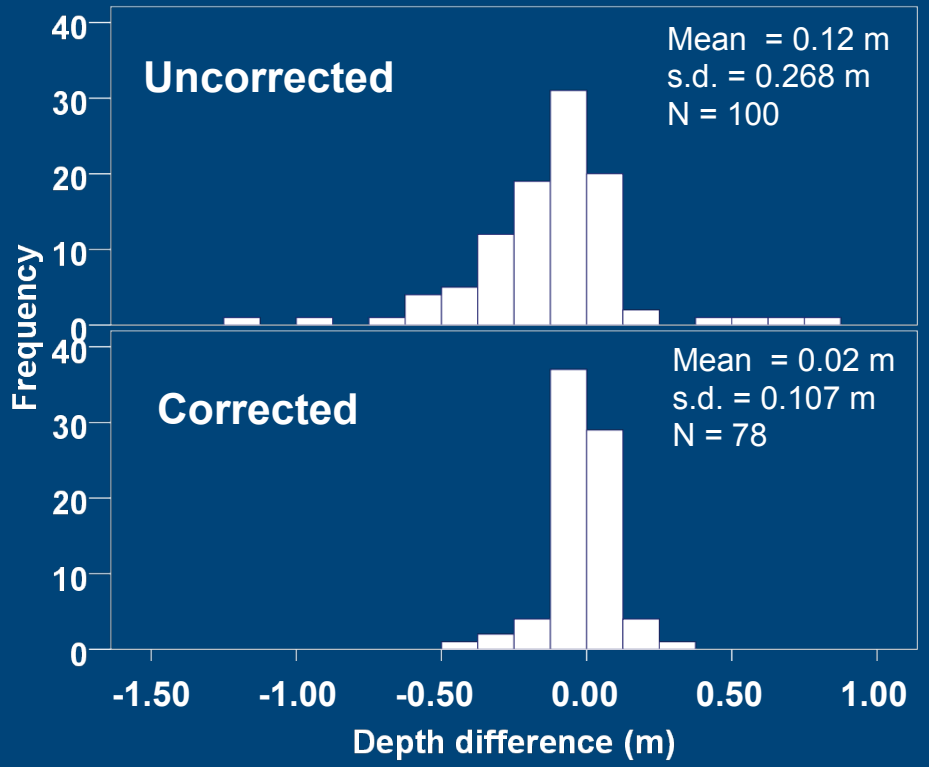


Bathimetric position of lower limit overlapped on MBS data



Variation of bathymetric position of lower limit in two periods (uncorrected *vs.* corrected SSS)





Conclusion

Temporal differences in position of lower limit simply detected by Side Scan Sonar are higher than those recorded by using Side Scan Sonar combined with MBS.

Moreover their combined use allows also to determine very accurately the bathymetric position of lower limit with an error of few centimeters.

This approach may represent a powerful and innovative methodology for improve the accuracy of mapping and monitoring *P. oceanica* lower limit on large scale and meadows distribution in general.


Thank you for your attention