



Underwater electromagnetic remote sensing

Study programme: Nanosciences and Nanotechnologies
Jožef Stefan International Postgraduate School

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Introduction

Underwater remote sensing technology:

- investigation of the underwater environment and detection of unknown objects
- acoustic, **electromagnetic** and optical devices



EM propagation in water is very different from the propagation through air:

- high permittivity
- high electrical conductivity
- greater attenuation loss
- lower propagation velocity
- smaller wavelength

Applications of underwater remote sensing EM methods

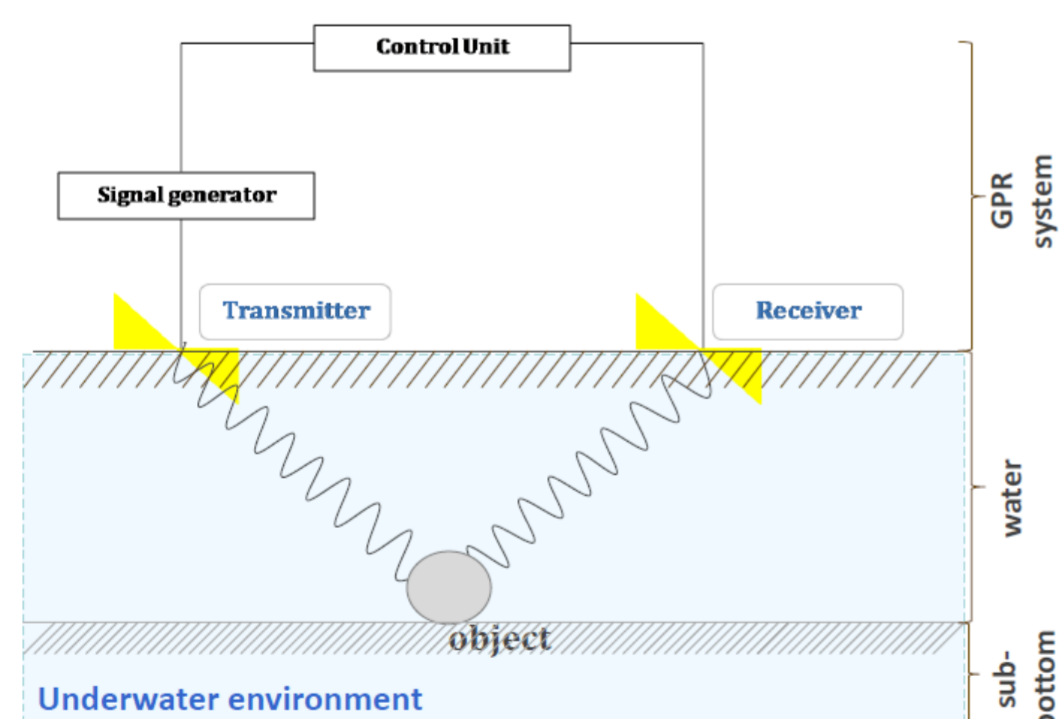
- mapping the location of objects buried under the bottom sediments or vegetation
- maritime security and safety
- harbour surveillance
- dams investigation
- oil and gas industry

Experimental work and results

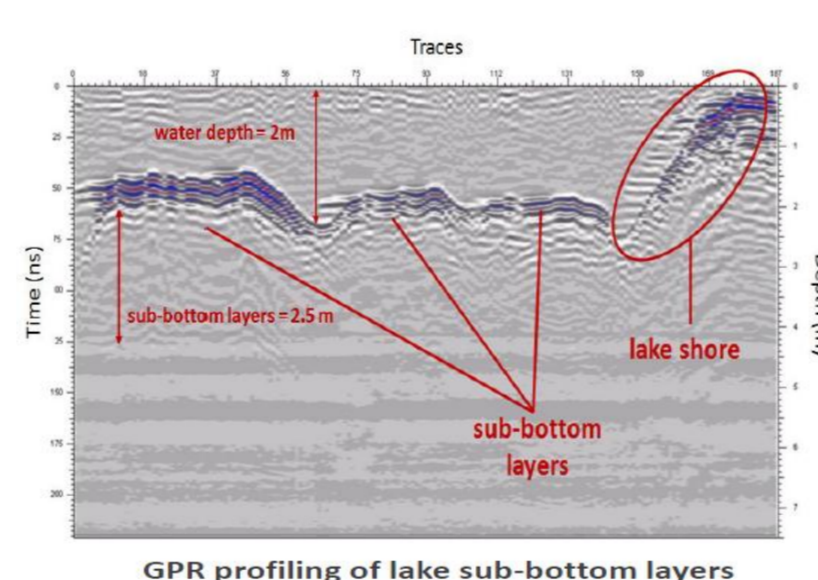
selected EM sensing methods

I. Ground penetrating radar (GPR)

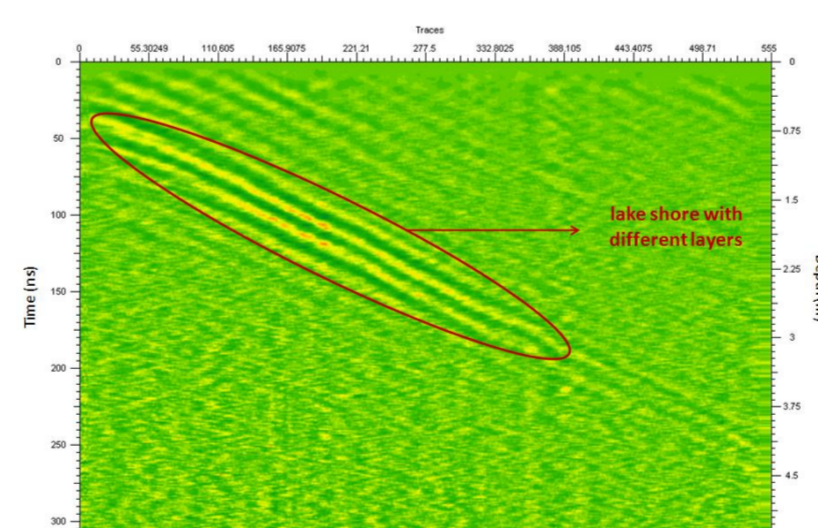
- images structures in the ground that are related to changes in the dielectric properties



250 MHz antenna

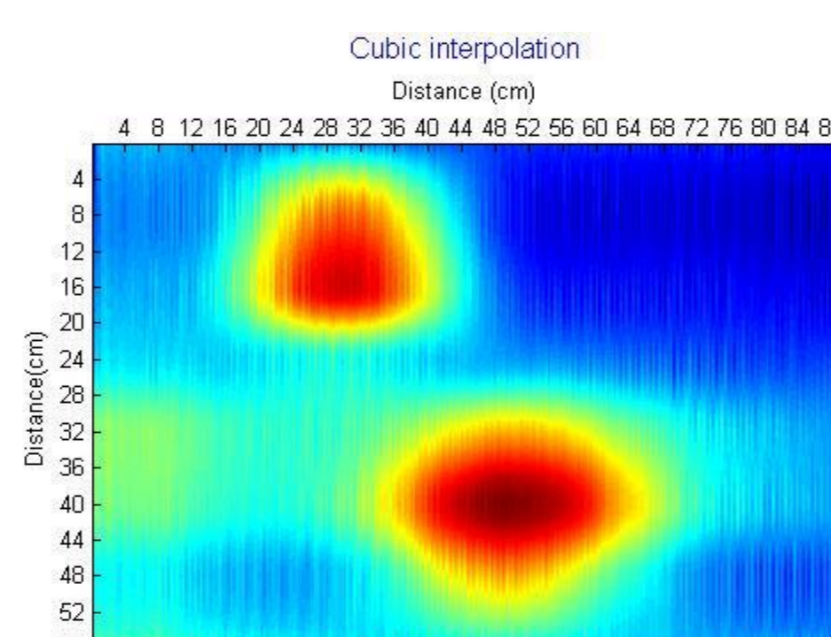
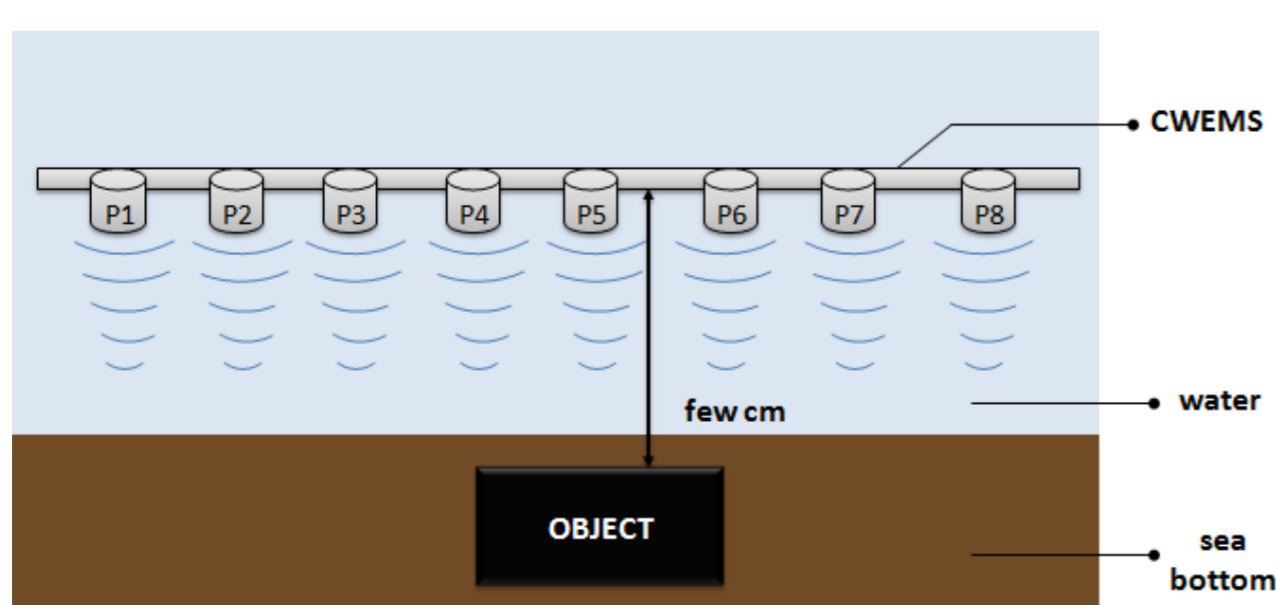


50 MHz antenna



II. Continuous wave electromagnetic sensor (CWEMS)

- The primary magnetic field produced by the transmitter is changed in such a way that a higher density of magnetic flux lines occurs due to the presence of metallic objects.



Conclusions

- GPR with the 50 MHz antenna is capable to observe the subsurface below 10 m and through more than 3 m of the water layer
- more detailed structure can be obtained with a higher frequency 250 MHz antenna
- CWEMS sensor is capable to image several metal objects of different sizes and shapes as well as different material composition

References

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