16th International Congress of the Geological Society of Greece
17-19 October, 2022 - Patras, Greece
Bulletin of the Geological Society of Greece, Sp. Publ. 10
Ext. Abs. GSG2022-064

ILIDA-KIT tool: First results of near surface geophysical investigation techniques for successful management of coastal erosion

J.D. Alexopoulos[1], G.S. Mitsika[1], I.K. Giannopoulos[1], V. Gkosios[1], A. Konsolaki[1], Emm. Vassilakis[1], S.E. Poulos[1,2]

(1) Faculty of Geology and Geoenvironment, National and Kapodistrian University of Athens, jalexopoulos@geol.uoa.gr
(2) Institute of Applied and Computational Mathematics, FORTH-Hellas.

Introduction

Coastal landforms owing their formation to sediment availability and nearshore hydrodynamics, appear quite sensitive to both anthropogenic activities and effects arising from climate change. ILIDA-KIT will be an innovative and multi-parametric decision-making tool for successful management of coastal erosion and floods events, induced either by natural factors and/or human intervention (including climate change). The project ILIDA-KIT is based on multiple levels of information organized in a multi-disciplinary interactive GIS platform, which lead to the development of a set of appropriate indicators (e.g., environmental, geographical, economic). The ultimate purpose of the Tool is in the selection of the most appropriate anthropogenic intervention; the latter is based on a cost-benefit analysis that takes into account both the need for protection and the sustainable development of the coastal zone. In particular, the geophysical research aims to identify the thickness and the characteristics of the uppermost lithostarigraphic substratum of the coastal zone.

Study area

The selected location of investigation for the development of ILIDA-KIT tool is the west coast of Peloponnesus (Greece) (Fig. 1a); the coastal zone of the Helonitis Gulf and Kyparissiakos Gulf; the former is characterized by the presence of the extended Kotichi lagoon while the latter by the most extensive dune field in Greece and one of the largest along the European Mediterranean coast (Poulos *et al.* 2011).

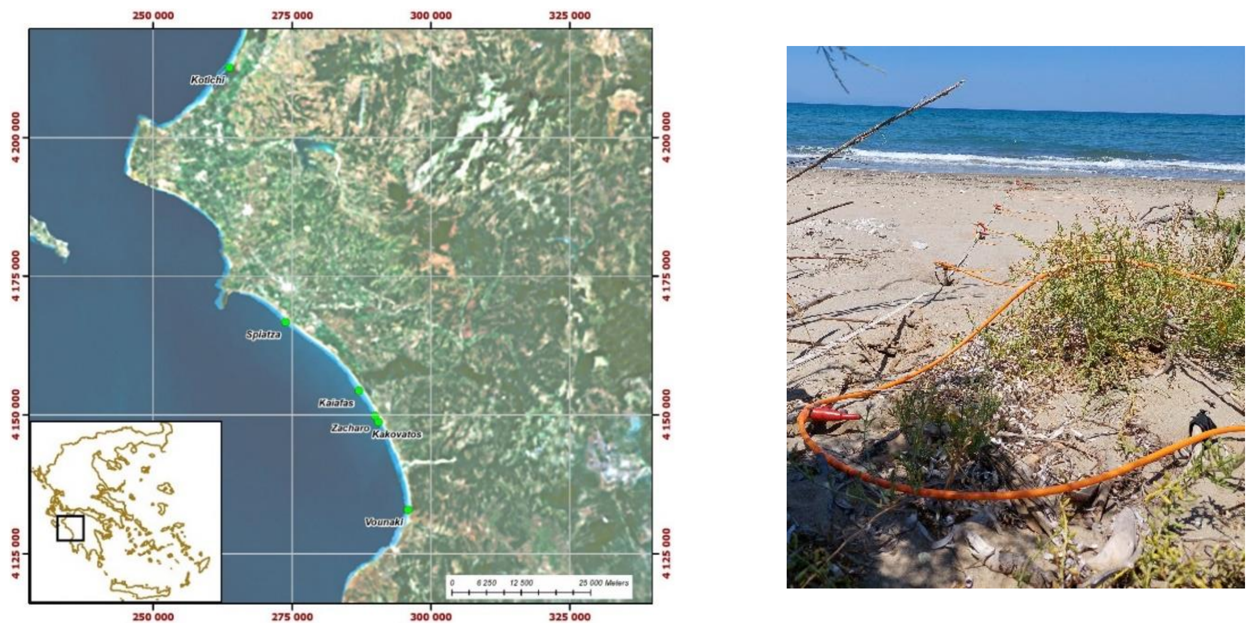

Figure 1. Index map with the sites of the geophysical campaigns (a) and data acquisition at Kotichi site (b).

Applied Methodology and Results

The geophysical techniques of electrical resistivity tomography (ERT), vertical electrical soundings (VES) and transient electromagnetic soundings (TEM) were applied. The ERT sections were carried out with a general trending normally to the shoreline whilst the VES and TEM soundings were applied at the midpoint of each ERT section. Resistivity methods have been successfully applied before in coastal environment (Alexopoulos *et al.*, 2019) and the electromagnetic method will contribute as supplementary data acquisition for detecting deeper structures and layers.

A first initiative of field data acquisition was made at Kotichi site (Fig. 1b) and the distribution of measured resistivity values, yield relatively low values near the shoreline (Fig. 2); this is in conjunction with the low relief landscape, lead to the conclusion that there is a high risk of erosion, in cases of extreme wave events and inundation.

The resistivity models of the two sounding curves (VES and TEM) appear to correlate quite well (Fig. 3). The surficial resistive layer appears in both sounding curves with resistivity values about 40 Ohm.m and the latter seems to correspond to the non-consolidated (loose) sand cover of dune. The underlying formation of relatively low resistivity (1 Ohm.m) and about 15m thickness is interpreted as a layer of saturated transgressive Holocene deposits. The deepest identified layer with resistivity values of 5-15 Ohm.m is interpreted to be Pleistocene marine deposits (Haenssler *et al.*, 2014).

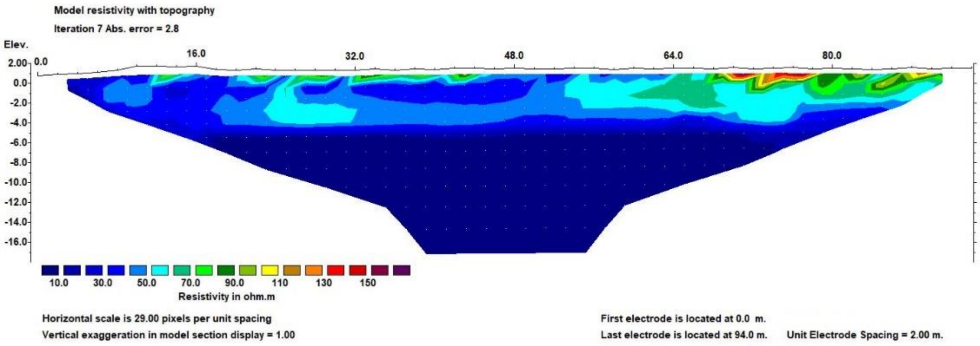

Figure 2. Electrical resistivity tomography at Kotichi site.

Table 1. Resistivity model of VES Sounding

Depth (m)	Resistivity (Ohm.m)
0-1.7	>100
1.7-7.0	45.0
7.0-20.0	1.2
	5.0

Table 2. Resistivity model of TEM Sounding

Depth (m)	Resistivity (Ohm.m)
0-8	36
8-24	1
	17

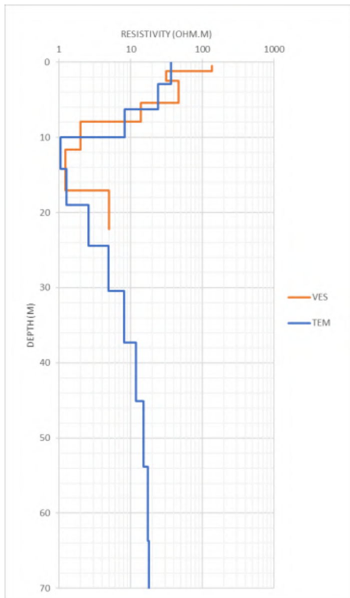

Figure 3. Resistivity models (left) of the corresponding VES and TEM sounding curves (right).

Conclusions

The combined application of the aforementioned techniques has the potential to provide valuable information regarding the thickness of the weathering layer that can be used as input data to ILIDA-KIT Tool. Additionally, the preliminary ERT results have shown that a minimum spacing of 0.5-1.0 m could provide more detailed information about the characteristics of the coastal sandy sediments and the erosion prone areas.

Acknowledgements

This research was funded by the project “Decision-making tool for the confrontation of coastal erosion and extreme wave events in the coastal zone, in the context of climate change” (MIS 5129417), financed by the Sectoral Operational Programme «Competitiveness, Entrepreneurship and Innovation» (NSRF 2014–2020) and co-financed by Greece and the European Regional Development Fund (ERDF).

References

Alexopoulos J.D., Dilalos S., Poulos S., Ghionis G., Mavroulis S. (2014). Application of geoelectrical techniques in the investigation of a coastal sand dune field. In: 20th European Meeting of Environmental and Engineering Geophysics. Vol. Tu_PA2_01. Athens, Greece; pp. 5.

Haenssler, E., Unkel, I., Dörfler, W. & Nadeau, M.-J. (2014): Driving mechanisms of Holocene lagoon development and barrier accretion in Northern Elis, Peloponnese, inferred from the sedimentary record of the Kotychi Lagoon. – E&G Quaternary Science Journal, 63 (1): 60–77.

Poulos S., Gaki-Papanastasiou K., Gialouris, P., Ghionis G. and Maroukian, H. (2011). A geomorphological investigation of the formation and evolution of the Kaiafas sand-dune field (Kyparissiakos Gulf, Ionian Sea, eastern Mediterranean) in the Late Holocene. Environmental Earth Sciences - ENVIRON EARTH SCI. 66.