Innovative towed marine DC/IP/EM system and ongoing developments for coastal applications

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There is an increasing need to develop new geophysical tools in near shore marine environment, particularly for the first tens of meter below the seafloor, mainly for the development of marine infrastructures such as renewable energies. This concerns geophysical imaging, but also the detection and localization **of** ferrous and non-ferrous metallic debris (UXOs, wrecks, ...), the tracking of cable or pipelines, archeology, etc.

On land, a variety of technology exists to characterized geological and anthropogenic targets, from DC, IP, FDEM and TDEM depending on the objective of the study (mapping, imaging, detection). At sea, the inherent saline nature of sea water weakens considerably electromagnetic fields generated by powered systems (a factor 100 to 1000 smaller than in land) which implies developing specific high current sources and highly sensitive sensors. Also, deploying such systems adapted to the sea conditions is a real challenge as soon as water depths is more than a few meters together with open ocean sea state and tide currents, particularly when organizing large surveys for industrial projects.

Hence there is a high interest to develop a flexible multipurpose marine EM system able to be deployed from relatively small coastal boats with the capacity to survey large areas at a reasonable speed (a few knots). Here we present such a system navigated near the seafloor with a high current electric source from DC to several 10 kHz, 20 electric simultaneous receivers towed behind the source that may be used to image the resistivity below seafloor, detect and localize buried objects (from boulders to UXOs) either in 2-D or 3-D.

We present results from academic and industry studies to illustrate the capacity of the new instrumentation and discuss new applications from renewables, offshore groundwater, etc.

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