Comparing results from a new bottom-towed CSEM system against seismic and core data

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In recent years, the large-scale development of offshore windfarms has seen significant investment and consideration from industry and political entities all around the world. However, before the construction of offshore windfarms can begin, the seafloor must be mapped and characterized to determine the suitability of the area for wind turbine anchors and moorings. Offshore windfarms must be sufficiently anchored to withstand harsh marine environments while still being within sufficient distance to the shore for economic operation of the grid. As these farms will need to withstand a combination of axial loads, torsional moments, and cyclic loading, the anchors and moorings tying these systems in place must have appropriate bonding with the seafloor. The bondage of the anchors and moorings to the seafloor is dependent on geotechnical conditions such as sediment stratigraphy and porosity in the upper tens of meters of the seafloor. We are currently developing a shallow-water bottom-towed controlled-source electromagnetic (CSEM) system that is sensitive to the resistivity, which can be a measure of porosity, of the immediate seafloor and sub-seafloor to around 50 meters depth. Originally developed to detect small changes in porosity related to archaeological artifacts left from Pleistocene hunter gatherers, the CSEM system needed to be able to be deployed in culturally and biologically sensitive regions and be able to resolve small (~3 meter wide and 20 cm thick) subtle targets. Thus, our system is neutrally buoyant, flying between 1 to 2 meters above the seafloor, with a small counterweight to minimize impact on the seafloor. The system is made up of a transmitter that doubles as a depressor weight and three receivers for a final array length of 40 meters. The transmitter emits a square-wave between 1 to 5 amps on a 2 meter horizontal electric dipole which is received by tri-axial receivers. From preliminary results, the system is able to resolve the porosity of the immediate seafloor with good agreement with seismic and core data. Here, we will present the initial inversions and pseudosections from first deployments of the system offshore the North Channel Islands near California, USA.