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Monitoring slow uplift and subsidence in shallow seafloor environments using bottom pressure measurements

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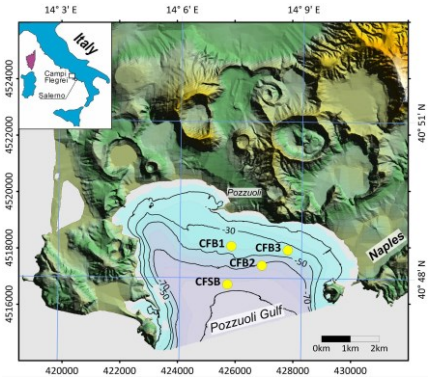

Long term, slow seafloor deformations are frequent in different marine environments such as volcanic calderas, offshore oil and gas extraction fields subject to subsidence, and river delta regions. In particular in shallow coastal water areas where strong oceanic effects occour, the measurements are challenging. Here we present a new method to recover the slow longterm vertical seafloor deformation using bottom pressure recorder (BPR) sensors. We convert pressure data into sea level using barometric and sea level data recorded in the same area and compare this result with data acquired by a reference tide gauge outside the deformation area. At the same time we developed an innovative recursive procedure to obtain a high-resolution seawater density variation over time. We used data from two BPRs installed on the seafloor within a permanent marine monitoring system in the Campi Flegrei volcanic area, Southern Italy. This system consists of four geodetic buoys equipped with GPS receivers and a seabed module hosting geophysical sensors, a including high-resolution pressure sensor. Each module is connected via cable to its own buoy. One BPR located at sea depth of 39 m and operating continuously for about 24 months and a second BPR at a sea depth of 75 m operating for about 19 months, but in a different time window. We obtained for the two BPRs an uplift of 25±1.3 cm and 7±1.2 cm respectively. We compare the results with data acquired by GPS installed on the top of buoys, deployed at the same sites as the BPRs. These two independent datasets show strong correlation and very good agreement in both the trend and the amplitude of vertical movement, confirmed by a high correlation coefficient of 0.98 and 0.87, demostrating the reliability of BPRs in accurately measuring the vertical seafloor deformation.