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Offshore ground movements in the Campi Flegrei caldera during the last ~12 ka

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Appraisal of morphodepositional markers tied to ancient sea-levels in high-resolution seismic profiles together with geo-archaeological markers along the coast of the Pozzuoli Bay provided insights into the vertical deformation of the submerged part of the Campi Flegrei caldera (Southern Italy).

The collapse of the central part of the Campi Flegrei caldera is associated with the eruption of the Neapolitan Yellow Tuff (NYT) at ~15 ka. The NYT caldera collapse was followed by central dome resurgence associated with alternations of fast uplift and subsidence displacements that accompanied with discrete phases of intra-caldera volcanic activity. Previously, the evolution of ground movement in the Campi Flegrei caldera has been reconstructed using marine deposits uplifted onland or archaeological evidence and historical accounts and thus offers a mainly 2D appraisal of the deformation pattern. However, a complete reconstruction of post-collapse deformation suffers of the limitation that nearly two-thirds of the caldera are submerged beneath the Pozzuoli Bay.

We contribute to fill this gap by providing a reconstruction of offshore and coastal deformation through estimation of the vertical displacement of morphodepositional markers in high-resolution seismic reflection profiles and geoarchaeological markers directly surveyed at shallow depths. Our interpretation reveals the occurrence of different sediment stacking pattern whose provides evidence of rapid and oscillating ground movements. Whereas the offshore morphodepositional markers provide displacement information for the last ~12 ka, for the last ~2 ka our interpretation is supported by ancient Roman sea-level indicators. The multi-dataset analysis has allowed disentangling the signal related to the post-caldera dynamics from a broader deformation signal that affects this part of the extensional margin of the Apennines.

The integration of offshore data in the study of past episodes of ground deformation, by yielding a more complete picture of the ground motions associated to the post-collapse evolution of the Campi Flegrei caldera, bears a significant contribution for a 3D reconstruction of this high-risk resurgence caldera. Besides, the multidisciplinary approach presented here can be relevant for investigations of other calderas spanning the sea-land transition.