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Characterization of gas related processes in shallow sediments, based on combined interpretation of acoustic and seismologic datasets

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We here present geophysical evidence of gas emissions observed on a multi-parameter dataset from the submerged section of the North Anatolian Fault, within the Sea of Marmara. An acoustic bubble detector (BOB) was deployed on top of the Central High, giving insight on the spatial and temporal variations of the gas emissions. The instrument insonified horizontally the water column over 24 angular sectors of 7° during seven days, providing multiple passes for a given sector. The acoustic data indicate that the gas emission is not a steady process with observed temporal variations of one hour up to 24 hours. A 4-component ocean bottom seismometer (OBS) was also placed on the Central High, only tens of meters far from the BOB. On this instrument, in 3.5 months, 80000 non-seismic micro-events have been identified with an automatic detection procedure. These non-seismic micro-events have the following characteristics: they are recorded by geophones but not by hydrophones, they are characterized by short durations of less than 0.6s with frequencies ranging between 5 and 30 Hz and they have variable amplitudes. A previous experiment proposed that gas migration followed by the collapse of fluid filled cavities or conduits could be the source of these events. Here the acoustic data provide indisputable evidence for the presence of gas bubbles in the water column. Thus the combination of acoustic and seismologic recordings do confirm the gas related origin of the observed non-seismic events. This works shows that the OBSs may provide valuable information to improve our knowledge on natural degassing processes from the seafloor. Further work is needed to asses rather the monitoring of these non-seismic signals may eventually be used in the future for the evaluation of geohazard.