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Sources of short-term sea level oscillations in a natural harbor and their influence on sediment resuspension (Maó, Mediterranean Sea)

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Episodic short-term sea level oscillations (from minutes to hours) play a fundamental role in the biogeochemistry of coastal environments. This is particularly notorious in bays, harbors, and other semi-enclosed environments where wind waves are attenuated and resonant effects (seiching) acquire importance in the regulation of benthic-pelagic exchanges. A detailed assessment of the impact of seiching on the marine ecosystem requires first an understanding of the seiche structure. As part of EHRE project (biogeochemical consequences of episodic events in harbors with restricted exchange), three real-time stations consisting of some combination acoustic Doppler current meters (ADCP), tide gauges, conductivity and temperature recorders and meteorological data were installed in the Maó harbor (Menorca Island). Current and sea level spectra reveal a fundamental resonant period of 38 min, a first resonant period of 14 min and other oscillations of higher frequency and lower energy. The waves generated by the seiche have typical amplitudes of 3-5 cm, but they can increase up to amplitudes of 15-20 cm locally causing sediment mobilization. Although these episodic increases are usually associated with synoptic atmospheric scenarios, ferries and cargos ships operating in the port also excite oscillatory motions on a daily basis that resuspend bottom sediments. Using a high-resolution three-dimensional ocean circulation model we analyze the conditions that contribute to sediment resuspension in this microtidal harbor.