

# EIGENFREQUENCIES OF VELA LUKA AND STARI GRAD BAYS (EAST ADRIATIC)

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## Abstract

Fine-resolution measurements of water pressure were performed along two elongated bays, where on several occasions extremely large, high frequency sea level oscillations have occurred. The time series reveal spatial variability of the natural modes. At the eigenmode frequencies, energy is strongly enhanced from the open towards the closed end. In the inner part of the basins, natural modes are being excited, giving rise to high-frequency oscillations of large amplitude.

*Keywords* : Adriatic Sea, Sea Level, Coastal Processes.

Occasionally, some bays along the east Adriatic coast experience extremely large, high frequency sea level oscillations that may cause great damage to the coastal infrastructure. Particularly vulnerable are westward-open funnel-shaped inlets. The phenomenon has been observed also in some other parts of the Mediterranean (e.g. Balearic Islands) and elsewhere in the world. It is induced by atmospheric gravity waves which, through the process of Proudman and successively harbor resonance, excite normal modes of propitious basins.

The most intense episodes at the Croatian coast have been documented (Orlic, 1980) and closely studied using available sparse data and mathematical modeling (Vilibic et al., 2004). However, until now, no specific sea-level measurements at the exposed sites have been made to empirically back up the findings. An experiment was therefore designed to investigate spatial variability of normal modes of two harbors where the phenomenon occurs most often, namely Vela Luka and Stari Grad bays. Hence at each site several small pressure sensors with integrated data loggers were placed on the sea bottom along the bay and one was used to measure the air pressure. The pressure was recorded at 3 min sampling interval, during three summer months of 2006.

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## References

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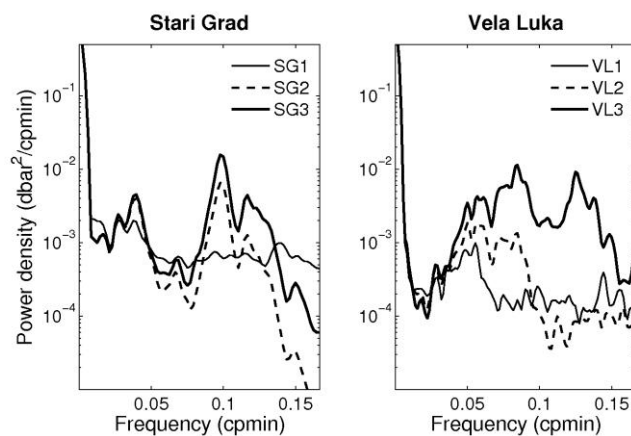


Fig. 1. Power density spectra of the water pressure adjusted for the air pressure, recorded from 18 to 21 June 2006, at three sites along Stari Grad (left) and Vela Luka bays (right), from the open (SG1/VL1) to the closed end (SG3/VL3) of the basins.

During the experiment several intervals of intense seiche activity, particularly in the inner part of the basins, have been recorded. Power density spectra for one episode that occurred simultaneously at the two locations are shown in Figure 1. At both locations there is a general growth of energy as we move from the open end towards the head of the basin. In Stari Grad Bay, three distinct energy maxima, at periods of 25.7 min, 10.2 min and 8.6 min, are resolved, the latter two being observed only at the two inner stations. In Vela Luka Bay, at the outermost station only a peak at 20.0 min period is seen. As we advance towards the closed end, the oscillations at this period become larger, but also natural modes of the inner part of the basin are being excited; oscillations of 11.8 min period are observed at both inner stations, the energy being largely enhanced at the closed end. Moreover, the innermost part of the bay oscillates with an eigenmode of 8.0 min.