

# PRESSURE-GENERATED WAVES IN THE MIDDLE ADRIATIC SEA

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## Abstract

The paper documents the appearance of large air pressure wave which travelled over the Middle Adriatic region on 27 June 2003. Some coastal areas were flooded due to the generation of resonant waves in the sea, coupled with the seiches and enlarged by the topography. Available air pressure and sea level records are examined and interpreted using 2D numerical model. The model successfully reproduced strong sea level oscillations and strong currents in some parts of the region.

## Introduction

The generation of waves in the sea by travelling air pressure disturbance, also known as Proudman resonance, can produce rather high sea level oscillations in some bays throughout the world seas [1-2]. In the Adriatic Sea the most outstanding event happened in June 1978, when the great part of Vela Luka city was flooded by the waves with amplitude of approx. 3 m and period of 15 min [3]. Later on, the resonance was examined in the Split Harbour [4], but fortunately it resulted in no flooding and damages.

This paper will document the appearance of large air pressure travelling wave which hit the Middle Adriatic region (Fig. 1) in morning hours of 27 June 2003. The wave resonantly excited its counterpart in the sea and flooded lower parts in the city of Stari Grad, also destructing a number of shelf plants in the Mali Ston Bay. Available air pressure and sea level data were analysed, supplemented by 2D numerical model which was calibrated and verified by using Split and Sucuraj tide gauge data. The model was forced by air pressure disturbance only, as measured on the Split digital pressure gauge, travelling with constant speed and direction of propagation. The latter was obtained from barograms collected at the number of meteorological stations (see Fig. 1).

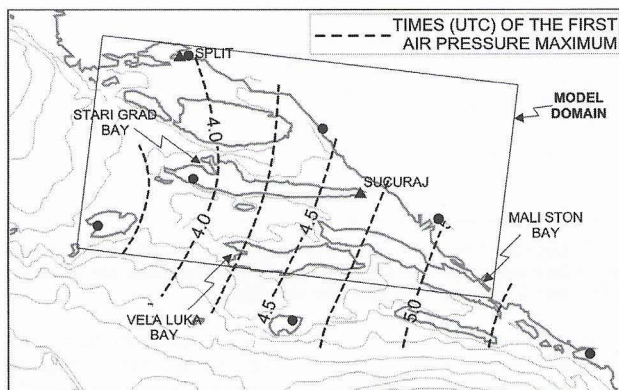


Fig. 1. The area of Middle Adriatic northeastern region, with locations of air pressure stations (circles), tide gauges (triangles) and domain of 2D numerical model. Times of occurrence of the first air pressure maximum on 27 June 2003 are shown too (dashed lines).

## Results

Time series of air pressure recorded on 27 June at Split is given in Fig. 2, whereas the appearance of the first maximum in air pressure, extracted from the barograms, is displayed in Fig. 1. Air pressure wave travelled over the area with the average speed of 22 m/s in the ESE direction, being accelerated somewhat towards the Mali Ston Bay. The shape of the disturbance did not change much in space over the region, keeping its cosine-like appearance at all meteorological stations. It should be added that a gust of wind was recorded during the event; however, it lasted less than 10 min and did not have significant influence on the sea dynamics.

In line with this, model was forced with travelling air pressure wave, as measured at the Split pressure gauge with 2-min sampling interval. Therefore, high-frequency air pressure oscillations (i.e. those having period below 15 min) were also supposed to travel with the major disturbance, which is probably not true and may result in artificial high-frequency sea level response. Thus, sea level series are

smoothed by 15-min running average (Fig. 2). Nevertheless, major disturbance is correctly simulated, especially as the model successfully reproduced sea levels measured at Split and Sucuraj tide gauge stations (Fig. 2). Sea level changes were pronounced at the end of the Mali Ston Bay, having the amplitude of about 50 cm, whereas the current amplitude surpassed 50 cm/s at the bay mouth. On the other hand, the model did not reproduce the flooding of the Stari Grad city, as it has too coarse resolution to catch topographical features that are responsible for the event. Consequently, modelling efforts should continue with the aim of constructing high-resolution nested models of the regions of interest.

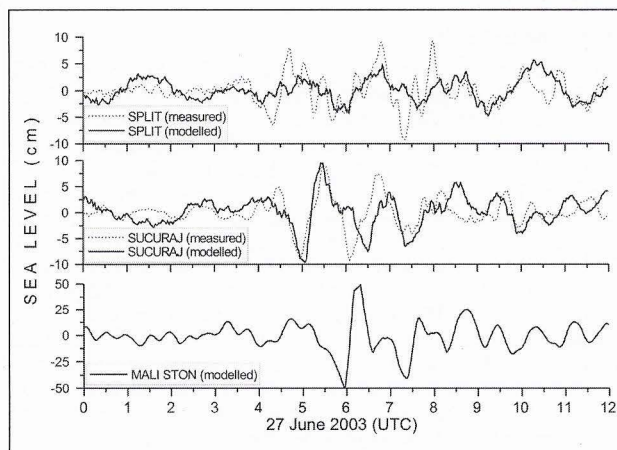


Fig. 2. Air pressure series measured at Split, together with observed and modelled sea levels (smoothed with 15-min running average) at Sucuraj and Mali Ston Bay.

## References

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