



Synoptic conditions corresponding to the Adriatic meteorological tsunamis

Jadranka Sepic¹, Nikola Metlicic¹, and Mirko Orlic²

¹University of Split, Faculty of Science, Department of Physics, Split, Croatia (jsepic@pmfst.hr)

²Department of Geophysics, Faculty of Science, University of Zagreb, Zagreb, Croatia

An online catalogue of meteorological tsunamis in the Adriatic Sea was recently published. The catalogue contains information on 36 meteorological tsunamis, all with a wave height of at least 1 m, which occurred between 1931 and 2021. During this period, there were 10 exceptionally strong events with observed tsunami wave heights of over 3 metres. The strongest event was characterised by tsunami waves of up to 6 m. For all 36 events, available sea level and air pressure measurements, atmospheric synoptic conditions (using ERA5 reanalysis) and satellite images were analysed. Based on the background sea level height (from the nearest tide gauge), the meteorological tsunamis were divided into three categories: (1) storm surge meteotsunamis, i.e. tsunamis that occur at the time of a storm surge; (2) ordinary meteotsunamis, i.e. tsunamis that occur when the background sea level is low; (3) transitional tsunamis. All three types were associated with a strong south-westerly to westerly jet stream in the middle and upper troposphere, which mainly led to the advection of warm air from the southern Mediterranean to the Adriatic Sea. Similarly, convective clouds were observed over the Adriatic Sea during most events before or at the time of the meteotsunamis.

At the surface, three types of events were distinguished from each other. Storm surge meteotsunamis (10 events in total) were associated with a mid-latitude cyclone, centred over the northern Adriatic or the Bay of Genoa, with the cyclone warm sector or advancing cold front over the area affected by the meteotsunami. The associated surface winds were strong and usually of a south-easterly direction (sirocco). The meteotsunamigenic air pressure disturbances were therefore probably generated in the areas of strong updrafts related to the advancing temperature fronts. Ordinary meteotsunamis (21 events) were associated with fair weather, i.e. with a gradient-free mean sea level pressure field over the Adriatic and very weak surface winds. In this type of event, the meteotsunamigenic atmospheric pressure disturbances were probably due to convective disturbances or the atmospheric gravity waves. Transitional events (5 of them) were associated with either a weak gradient of mean sea level pressure field over the Adriatic, with corresponding southeasterly winds of moderate strength, or with a closed shallow low over the Adriatic.

Stronger events were more likely to occur under fair weather conditions but were also observed under stormier weather. The analysis suggests that meteotsunamis in the Adriatic occur under

variety of conditions, all of which should be considered when assessing the risk of meteotsunamis.