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Large historical earthquakes and tsunamis in a very active tectonic rift: the Gulf of Corinth, Greece

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The Gulf of Corinth is an active tectonic rift controlled by E-W trending normal faults with an uplifted footwall in the south and a subsiding hangingwall with antithetic faulting in the north. Regional geodetic extension rates up to about 1.5 cm/yr have been measured, which is one of the highest for tectonic rifts in the entire Earth, while seismic slip rates up to about 1 cm/yr were estimated. Large earthquakes with magnitudes, M, up to about 7 were historically documented and instrumentally recorded. In this paper we have compiled historical documentation of earthquake and tsunami events occurring in the Corinth Gulf from the antiquity up to the present. The completeness of the events reported improves with time particularly after the 15th century. The majority of tsunamis were caused by earthquake activity although the aseismic landsliding is a relatively frequent agent for tsunami generation in Corinth Gulf. We focus to better understand the process of tsunami generation from earthquakes. To this aim we have considered the elliptical rupture zones of all the strong ($M \geq 6.0$) historical and instrumental earthquakes known in the Corinth Gulf. We have taken into account rupture zones determined by previous authors. However, magnitudes, M, of historical earthquakes were recalculated from a set of empirical relationships between M and seismic intensity established for earthquakes occurring in Greece during the instrumental era of seismicity. For this application the macroseismic field of each one of the earthquakes was identified and seismic intensities were assigned. Another set of empirical relationships M/L and M/W for instrumentally recorded earthquakes in the Mediterranean region was applied to calculate rupture zone dimensions; where L=rupture zone length, W=rupture zone width. The rupture zones positions were decided on the basis of the localities of the highest seismic intensities and co-seismic ground failures, if any, while the orientation of the maximum axis of the ellipse was determined by following the local fault trends. The tsunami size was calculated in terms of tsunami intensity in the 12-point scale of Papadopoulos-Imamura. We investigated empirical correlations between (i) the tsunami intensity and earthquake magnitude, (ii) the frequency of earthquakes and the frequency of tsunamis, as well as (iii) between the maximum tsunami inundation and the position of the earthquake rupture zone. We discuss our results as for their importance for the development of a tsunami decision matrix in the particular area of Corinth Gulf, an issue which is of interest from the point of view of tsunami early warning.