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Which one of the three latest large earthquakes in Zagreb was the strongest – the 1905, 1906 or 2020 one?

Marijan Herak[1], Davorka Herak[2], Mladen Živčić[3]

[1] *Full professor*, University of Zagreb, Faculty of Science, Department of Geophysics, Zagreb, Croatia, *mherak@gfz.hr*
[2] *Full professor (ret.)*, University of Zagreb, Faculty of Science, Department of Geophysics, Zagreb, Croatia, *dherak@gfz.hr*
[3] *Head of Seismology Division*, Slovenian Environment Agency, Seismology Office, Ljubljana, Slovenia, *mladen.zivcic@gov.si*

Abstract

Following the damaging 2020 earthquake of 22 March 2020 (Mw 5.3), a question was raised if this was the largest event after the Great Zagreb earthquake of 1880. The counter-candidates are the events of 17 December 1905 and 2 January 1906. Relevant earthquake catalogues largely disagree when the magnitudes of the Zagreb earthquakes of 1905 and 1906 are concerned. The reported magnitudes range between 5.1 and 5.6 for the 1905 event, and between 5.3 and 6.3 for the earthquake of 1906. Epicentral intensities for the two earthquakes are stated between VII–VIII and IX. To try to resolve the question, we (re)analysed all available macroseismic data for the two historical events, in order to compare the observed intensity distribution with the one of the 2020 earthquake.

Key words: Historical earthquake quantification, macroseismic magnitude, historical seismograms, Zagreb epicentral area

Following the damaging 2020 earthquake of 22 March 2020 (M_w 5.3), a question was raised if this was the largest event after the Great Zagreb earthquake of 1880 (I_{max} = VIII MSK). The counter-candidates are the events of 17 December 1905 and 2 January 1906. Relevant earthquake catalogues largely disagree when the magnitudes of the Zagreb earthquakes of 1905 and 1906 are concerned. The reported magnitudes range between 5.1 and 5.6 for the 1905 event, and between 5.3 and 6.3 for the earthquake of 1906. Epicentral intensities for the two earthquakes are stated between VII–VIII and IX (various scales). To try to resolve the question, we (re)analysed all available macroseismic data for the two historical events, in order to compare the observed intensity distribution with the one of the 2020 earthquake. Additionally, we analysed the seismograms of the 1905 and 1906 events recorded at the Göttingen observatory (Fig. 1), and computed their magnitudes.

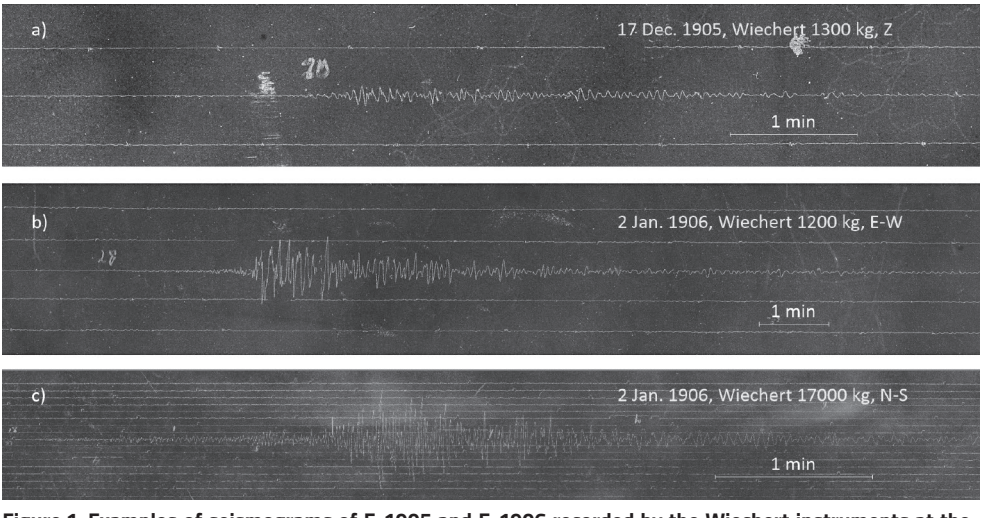

Figure 1. Examples of seismograms of E-1905 and E-1906 recorded by the Wiechert instruments at the Göttingen station (GTT, Germany). a) Vertical component, 17 December 1905; b) EW component, 2 January 1906; c) short period NS component, 2 January 1906, from [1]

To this end, we also use reported amplitudes of the two events, as given in various station bulletins of the time. Preliminary analyses clearly put the 1905 event out of contest, and indicate the earthquakes of 1906 and 2020 to be of similar magnitudes. However, the strongest shaking in the centre of Zagreb was caused by the 2020 event. While it has been suggested that the 2020 earthquake occurred on the North Medvednica boundary fault [2, 3], the macroseismic locations and distribution of observed intenities of the 1905 and 1906 events suggest that the Kašina fault may have been the source of these two earthquakes.

References

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