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Liquefaction field reconnaissance following the 29th December 2020 Mw 6.4 Petrinja earthquake (Croatia)

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Earthquakes and related coseismic effects at the surface, both primary and secondary, such as liquefaction and lateral spreading, can impact humans due to induced economic or social disruptions (e.g. slope, bridge and building foundation failures, flotation of buried structures). In this respect, it results of primary interest to map liquefaction induced evidences soon after an earthquake. On the 29th December 2020, a major earthquake (Mw 6.4) occurred in Croatia, close to Petrinja, 45 km south of Zagreb, generating widespread liquefaction and lateral spreading phenomena in a radius of approximately 20 km from the epicentre. A European team of researchers (geologists and engineers), in strict collaboration with the Croatian Geological Survey, performed field reconnaissance campaigns with the aim to provide a detailed identification and characterization of the primary and secondary geological and geotechnical coseismic effects induced by the Croatian earthquakes. Specifically with reference to the liquefaction phenomena, the Working Group integrated the data collected directly in the field with those from remote survey by drone aerial photos acquired in the post-event immediate. The adopted process allowed the collection of the liquefaction record with the highest possible completeness both in terms of pattern and distribution of the phenomena. The database includes several detailed case studies typified by the following characteristics: (1) liquefaction occurring on alluvial plain sites (Kupa river, Sava river and Glina river); (2) blows made by sand and/or gravel with local presence of shells and armored mud balls; (3) lateral spreading phenomena along road and river embankments; (4) sand ejecta of different grain size and matrix, even at the same site; (5) sand and/or gravel ejecta along fault traces. The characteristics of these features are discussed with reference to the alluvial setting and tectonic context. All together, the detailed survey of these recent liquefaction features will assist to build new empirical relations, to update the existing ones and to mitigate the effects of future earthquakes recognizing liquefaction prone areas for a correct land use planning, as for seismic microzonation studies.