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Concurrent tectonic and aquifer-compaction deformation around Lorca (SE, Spain)

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Surface ground deformation is the result of an ensemble of numerous processes. The ubiquity of aquifer compaction across a variety of settings might be considered interesting in only exotic cases and of marginal interest for the analysis of tectonic or volcanic activity. In the case of active tectonic (volcano-tectonic) structures the dominant deposition of young (high-compressible) sedimentary formations at relative low-topographic positions (pull-apart basins, grabens, release bends,...) presents a problem. This specific occurrence of sediments could control the pattern of aquifer-related deformation and, even, mask the active tectonic motion.

Here, we present a case at Lorca city and surrounding areas (SE, Spain) where collocated tectonic (coseismic) and high-rate aquifer compaction deformation occurred and was measured using radar interferometry and GPS. We discuss how to analyze both signals in order to isolate the contribution due to the earthquake (coseismic signal). Once the aquifer-related deformation is removed the signal is interpreted using an elastic dislocation model. The elastic modelling of the geodetic data indicates that the nucleation process and main slip area occurred at very shallow depth (2-4 km) on the rupture fault plane along the Alhama de Murcia fault (AMF), which also controls the long-term subsidence related to the aquifer depletion.