



InSAR monitoring of deep underground industrial activities: the case study of Landau, Germany

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The deep geothermal anomalies of the Upper Rhine Graben have long been identified (Haas and Hoffmann, 1929). They are typically attached to oil exploitation (Pechelbronn, Landau) or deep geothermal energy (Cloetingh et al., 2010; Vidal and Genter, 2018). We focus here on the area surrounding of the city of Landau (Germany) where both energies are exploited, on one hand, on the north of the city for the oil field and on the other hand, on the south of the city for the geothermal energy. In 2012, geodetic monitoring in Northern Alsace, France has begun (Heimlich, 2016). SAR acquisitions of TerraSAR-X satellite have been scheduled for a Franco-German border area west of the Rhine including the region of Landau. Direct evidence of significant surface deformation was observed in early 2014 south of the city of Landau, where unexplained cracks appeared on the geothermal power plant area during the production phase.

The present work focuses on the results of the PS-InSAR analysis using StaMPS that cover the main period of displacement (2013-2014). The geodetic observations are completed by levelling measurements. These in situ measurements solve phase jump problems due to the high rate of displacement. The results show the time and space evolution of the surface displacements. It evidences also the active geological structures of the area. We developed a hydro-mechanical modelling of the deformation which gives insights into the main origin of displacement at depth related to the deep wells of the geothermal site but also questions the impact of the oil exploitation.