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PS-InSAR time-series analysis: Using Sentinel-1 data for monitoring geothermal power plants and oil extraction in southern Germany

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The Upper Rhine Graben, located in the tri-national region between Germany, France and Switzerland, is the most prominent segment of the European Cenozoic rift system. Due to its genesis, the Upper Rhine Graben is characterized by a geothermal gradient above average as well as oil deposits.
In the area around Landau in der Pfalz in the southwest of Germany both industries can be found: geothermal power plants and oil extraction. In the last decade, with incidents like induced seismicity with local magnitudes up to 2.7 in 2009 and significant surface deformations around the geothermal power plant in 2014 Landau attracted attention.
Previous works (Heimlich et al., 2015; Anderson, 2014) investigate the relation between the geothermal power plant, oil extraction and observed uplift deformation signal derived from TerraSAR-X Persistent Scatterer (PS) analysis before the shutdown of the geothermal power plant on 15 March 2015.
In this work, we investigate the period of time after the shutdown in 2014 using Sentinel-1A data sensed between October 2014 and March 2018. PS-InSAR analysis is performed using the open source software packages SNAP (SentiNel Application Platform) and StaMPS (Stanford Method of Persistent Scatterer). We provide a detailed overview of the processing steps for the SNAP-StaMPS processing chain.
The results show exponentially decaying subsidence in the southern area of Landau next to the geothermal power plant, the same area showing uplift before the shutdown. Additionally, subsidence can be observed in the northern part of Landau whose cause is not yet clearly determined.
This study is part of a research project that focusses on an updated map presenting 3D surface displacement rates in the Upper Rhine Graben area from a combination of Levelling, GNSS and InSAR (Fuhrmann, 2016).