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Project-based learning: Preliminary investigation of potential sites for SAR corner reflectors at SAPOS stations of the state survey

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The satellite positioning service SAPOS, a joint project of the Working Committee of the Surveying Authorities of the Laender of the Federal Republic of Germany, provides correction data that improve the accuracy of GNSS position determination from originally 3 m - 10 m to less than 1 cm. For this purpose, a nationwide network of permanent GNSS stations with a mean station distance from 30 km – 40 km archived data since the beginning of 2000.
Interferometric SAR, especially Persistent Scatterer (PS) time series analysis, provides a method for spatially dense detection of deformation with an accuracy of 1 cm - 3 cm. Unlike GNSS, the location of natural PSs, which are used to create time series of ground displacement from radar images, is not known exactly.
The combination of GNSS and SAR interferometry has great potential. To better link the two techniques corner reflectors can be used, which represent artificial PSs.
However, installing the corner reflectors, several aspects have to be considered. To avoid interference, there should be no natural PS point within the same and adjacent resolution cell of the Corner Reflector. Similarly, cells should be avoided in which a diffuse signal of high intensity is detected, but no PS is established. For these reasons, preliminary studies at potential sites were carried out as part of a student project in cooperation with the State Office for Geoinformation and Land Development Baden-Württemberg (LGL) and the Surveying and Cadastral Administration Rhineland-Palatinate (VermKV).

Besides this task, the students dealt with the following questions:
What effect does the choice of the master scene have on the number of PS points?
Does higher time coverage of six days (Sentinel-1A and -1B) result in a gain in the number of PS points compared to twelve-day time coverage (only Sentinel-1A)?
Which polarization (VV or VH) is better suited for PS analysis?

In total, ten training sessions took place in which the students had to determine the location and number of PS points using the free software packages SNAP (SentiNel Application Platform) and StaMPS (Stanford Method of Persistent Scatterer).
Finally, a presentation event took place in which the students presented their results in the presence of representatives of the VermKV as well as the LGL.
In addition to the results of the project, we give an insight into the project progression, challenges and valuable additional enrichment for all participants.