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Experience from InSAR monitoring of transport infrastructure in the Czech Republic: Adaptation of InSAR results to the geodetic standards

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The existence of Sentinel-1 mission and its supreme geographic and temporal data coverage support utilization of persistent scatterers InSAR method in several applications. For promotion of InSAR as a credible method for monitoring of infrastructure objects (such as highways, railways, bridges) to responsible authorities in the Czech Republic several concepts from geodesy needed to be adopted.
Validation of InSAR results with geodetic measurements is not always straightforward and might be hindered due to several reasons: different precision of detected persistent scatterers and its dependence on backscattering properties (and the size of the reflector), ambiguous localization of the reflection cell in high resolution data compared to measured geodetic points, high level of noise of one measurement, precision and the reliability of the estimated (and subtracted) atmospheric phase screen in case of a larger area of interest.

Installation of artificial corner reflectors to be monitored by different means (InSAR, leveling, GNSS) is a widely adopted solution, but in the domain requiring high accuracy there are still some limitations stemming e.g. from thermal dilation, solar illumination of reflectors or other (non-vertical) displacements that cannot be considered/compensated.

Despite the fact that standard InSAR measure of accuracy is coherence, in order to make a decision about significance of detected displacement in monitoring and alerting systems standard deviation of the velocity and standard deviation of one measurement are required by geodesists. We present an empirical method to estimate precision of displacement measurement. The precision estimated by the method is significantly worse compared to precision represented by standard deviation derived from coherence, however it provides more reliable results in the decisioning mechanism. Method is based on processing an area which is assumed stable, the resulting precision is related to a particular coherence value. In addition, results are referenced and validated with regard to a network of multiple reference points defined in cooperation with geodesists and geologists. The solution is presented for different use cases.