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POLINSAR COHERENCE OPTIMISATION FOR DEFORMATION MEASUREMENT IN AN AGRICULTURAL REGION

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ABSTRACT

Surface deformation due to underground mining poses risks to health and safety as well as infrastructure and the environment. Consequently, the need for long-term operational monitoring systems exists. Differential interferometry (dInSAR) techniques are well known for its ability to provide centimetre to millimetre scale deformation measurements. The maturity of dInSAR has, in principle, overcome the limitations associated with field-based techniques and has been extensively used for its ability to monitor deformation over large areas, remotely. However, in natural and agricultural areas, the presence of vegetation and the evolution of the land surface introduce a phase noise component which limits successful interferometric measurement. This paper aims to address the known limitations of traditional dInSAR in the presence of disturbances to reflected signals due to agricultural activities by testing the polarimetric interferometry (polInSAR) technique for its ability to increase interferometric coherence and to detect surface movement in the areas of interest. The results suggest that, although coherence optimisation algorithms results in a statistically significant increase in interferometric coherence, the spatial heterogeneity of the scattering process and how it changes over time caused random phase changes associated with temporal baseline effects and the evolution of the land surface. These effects could not be removed from interferograms using the polInSAR approaches. The heterogeneity of the scattering processes implied that different phase centres were present in interferograms which introduced a spatially heterogeneous topographic phase contribution. Consequently, the polInSAR techniques are considered to be unsuccessful in enhancing the ability to extract deformation measurements in the area of interest.