Improved understanding of ground surface deformation caused by underground mining activities using levelling and PSInSAR data

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Abstract

Hazards and unwanted changes to the landscape can occur as a consequence of underground mining activities. The impact of both past and present mining activities is experienced in large parts of The United Kingdom. Present day mining activities are closely monitored and restricted to limit deformation near objects such as landslides and dams. Our study area in North Yorkshire in The UK has been undermined at depths between 1000 and 1300 metres below sea level for potash, from 1976 to present. The mining company has monitored both the excavation dynamics and the deformation dynamics during the total period of activities. Empirical modelling of these two dependent dynamics has lead to new insights about ground surface deformation. Based on this understanding the allowed excavation activities around vulnerable objects at the surface are determined. The reliability of the dataset used for empirical modelling is essential. The existing monitoring of underground mining impact entails annual levelling campaigns along roads crossing the undermined area. Despite low coherence and high atmospheric variability in the study area it was possible to establish a monitoring dataset based PSInSAR, totally independent of the levelling data. Conclusions from evaluation using the PSInSAR dataset are that the InSAR and levelling datasets provide mutually complimentary information. Both have pros and cons, not least due to the different temporal and spatial scales of data collection. As a result of these analyses improvements to both the levelling campaigns and the empirical model have been suggested.