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Wide-scale coastal geo-hazard identification and ground truthing using persistent scattering InSAR and terrestrial laser scanning.

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The nature and pattern of pre-failure movements in slopes has been acknowledged as indicative of the likely type and timing of failure, but identifying and then focussing monitoring resources upon critical slopes pre-failure remains problematic. The Yorkshire coast of North East England is has experienced both rapid rates of cliff retreat and several catastrophic high magnitude mass movement events, with considerable impact on infrastructure. This paper presents results from a large multidisciplinary research project; the first element of this project is the development of a persistent scatterer based radar interferometry technique for measuring and monitoring surface deformation; the second is a detailed study of the nature and pattern of coastal cliff erosion processes using a newly developed terrestrial laser scanning (TLS) approach. TLS collects a high resolution dataset across a wide area, generating deformation data of comparable precision to the interferometry.

An approach is presented in this paper which attempts to combine these two elements as a method for wide-scale monitoring of a long coastline. The application of this technique is to firstly monitor the development of known failed slopes, and secondly to identify and mobilising further detailed site monitoring of previously undetected movements. Results are presented from the interferometric analysis which identifies and measures deformation on the coastal cliff face on an area of known large rockfall activity. The technique appears particularly appropriate to the bare and angular morphology of coastal cliffs and has the potential to identify sub-centimetre displacements over a 35 day time period. The measurements, derived from ERS 1&2 archive imagery

since 1992 to 2002, are compared to 2 years of terrestrial monitoring of the site, using TLS. A comparison of the deformation results derived from both the satellite and the ground base technique is promising. An assessment of a larger section of coastline, with known mass movements suggests the applicability of this approach to the wider scale hazard assessments. The technique offers both the resolution and precision to monitor pre-failure slope deformations in coastal environments and beyond.