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Towards widespread exploitation of high resolution multi-temporal interferometry for monitoring landslide activity: a case-study of Southern Gansu, China

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Although Multi-Temporal Interferometry (MTI) techniques are considered to have already reached the operational level, it is apparent that, in both research and practice, we are only just beginning to benefit from the high resolution imagery that is currently acquired by the new generation of radar satellites. MTI techniques are not applicable in any environment, but, nonetheless, we foresee a strong possibility that in the future these techniques will see widespread exploitation in support of slope hazard assessments. MTI applications will become increasingly important in cases where little or no conventional monitoring is feasible (e.g. remote locations and limited funds). The tremendous potential of MTI is illustrated using selected examples of applications ranging from local to catchment scales. A particular focus is on the use of MTI for the investigation of slope instability in the remote high mountain region of Zhouqu, Southern Gansu, known to be affected by large magnitude (M7-8) earthquakes and catastrophic mass movements. The MTI processing of high resolution ($\sim$3 m) COSMO/SkyMed (CSK) satellite images produced spatially dense information (more than 1000 radar targets/km2) on ground surface displacements. A substantial portion of the radar targets showed significant displacements (from few to over 100 mm/yr), denoting widespread slope instability. In particular, the MTI results provided valuable information on the activity of some very large, apparently slow moving landslides that represent a persistent hazard to the local population and infrastructure, particularly as these landslides are known to undergo periods of increased activity resulting in river damming and disastrous flooding. Given the general lack of field monitoring data on slope instability in Southern Gansu, the MTI-derived displacements offer a unique form of remote displacement monitoring that provides valuable information to experts tasked with formulating strategies for hazard management in these difficult terrains. Furthermore, this study shows that high resolution CSK imagery results in high radar target density, so that MTI can also assist with site specific scale assessments of slope deformation hazards.