Workshop on Advanced Techniques for the Assessment of Natural Hazards in Mountain Areas

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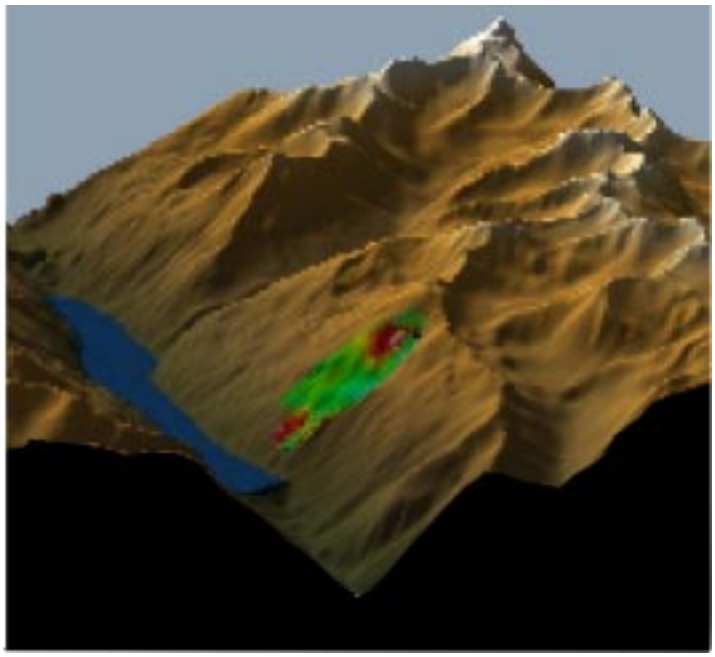
PROCEEDINGS



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Optical remote sensing for landslide investigations

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Optical (visible-infrared) spaceborne and airborne remote sensing can be effectively used in various landslide investigations including recognition and mapping, monitoring and hazard and risk assessment. To this end, a number of remotely sensed data and image processing techniques can be employed depending on the task pursued, the type of landslides, their surface extent, their activity and land cover setting.

Automated textural segmentation methods based on the image texture spectrum can be applied to discriminate landslide hummocky surfaces, scarps and vegetation and land cover pattern disruption due to slope movements, as a partial alternative to stereoscopic analysis when stereo images are not available. Lithological distinction using colour enhancement and discrimination techniques combined with edge enhancement has made possible to detect slid rock masses and hence identify old complex landslides in heavily eroded, low vegetated terrain. In addition, generation of interactive 3D views of unstable areas from very high-spatial resolution satellite products derived, for example, from fusion of 30m-resolution Landsat TM multispectral images and 2m-resolution KVR-1000 panchromatic images draped over a high-resolution DEM can greatly help to delineate landslide boundaries.

Very recent experiments have shown that it is possible to derive slope motion vectors of pixel magnitude from sequential digital aerial photographs using digital photogrammetry and cross correlation techniques. However, their application still appears to be restricted to specific ground conditions, such as extensive rock outcrops and lack of major internal deformation within the landslide body. On the contrary, the application of image change detection and thresholding techniques to very-high resolution multitemporal imagery can be effectively used to map and monitor ground surface changes due to either new landslide occurrence or reactivation of existing landslides in a wide variety of terrain settings, at 1:10,000 and somehow larger scales.

Land use and land use change maps, DEMs and linear geological structure maps can be derived from optical satellite imagery for input to GIS for assessing landslide hazard and risk at medium scales (1:25,000 to 1:50,000). Likewise, the above-mentioned 3D image products, as well as 3D image animations and user-defined simulated perspective views of landslide maps overlaid to land use maps (derived from classification of multispectral satellite images) can also be employed to investigate and illustrate landslide hazard and risk to urban settlements and infrastructure.

Advantages and constraints of spatial resolution, spectral and temporal coverage of most popular optical remote sensing systems used for landslide investigations are discussed, as well as image pre-processing methods in mountainous areas. Examples of the application of the above-mentioned techniques on Landsat TM, SPOT XS and PAN, IRS 1C PAN, Daedalus ATM and simulated Ikonos-2 panchromatic imagery (derived from digital aerial photographs) are illustrated for Alpine settings, Mediterranean low-vegetated areas and Atlantic volcanic islands.