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Development of a Dynamic Landslide Inventory Information System for Southern Kyrgyzstan

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Southern Kyrgyzstan is part of the tectonically active mountain ranges of the Tien Shan. The study area is located at the Eastern rim of the Fergana Basin representing a densely populated region where large landslides regularly endanger human lives and infrastructure. Therefore, GIS-based landslide susceptibility and hazard analysis is of great importance requiring detailed assessment of past landslide activity at regional scale. In Kyrgyzstan, information on past landslide activity is less available than in other more developed and researched regions of the world. Although landslide investigations were conducted since the 1950s, they have been drastically reduced since Kyrgyzstan's independence from the former Soviet Union in 1991 accompanied by loss of existing information. During the last years, information on landslides has been made publicly available mostly in form of derivatives, such as landslide hazard maps. All of these investigations have been limited to inhabited areas with known landslide danger.

The presented research has the goal to develop a GIS-based approach for establishing a dynamic landslide inventory information system which allows efficient integration of the existing heterogeneous landslide data. They consist of reports prepared by Kyrgyz authorities as a result of field campaigns supported by visual interpretation of aerial photographs. These reports vary greatly in their spatial and temporal reliability as well as the format of the contained landslide data. This information has been complemented by multi-temporal satellite remote sensing data analysis carried out by the GFZ Potsdam aiming at interactive mapping of slopes affected by long-term complex landslide processes as well as developing an automated approach for landslide identification for the last 25 years. The used satellite remote sensing data provide a spatially continuous information base, partially with high temporal resolution, and thus enable creation of a dynamic landslide inventory at a regional scale.

The complexity of the landslide processes and the heterogeneous information base require development of customized approaches for data integration and validation in order to establish a reliable and comprehensible digital landslide inventory system. In a first step all existing landslide information was digitized and integrated into a common spatial reference system consisting of the geo-referenced multi-temporal satellite remote sensing database. In combination with results from GPS-based field mapping of landslides, this database has been used for resolving spatial and temporal ambiguities originating from the combination of different information sources as well as for adding new events to the landslide inventory. The goal of establishing a dynamic landslide inventory also requires the development of a GIS-based data structure which is capable of representing spatial and temporal changes in a consistent and reproducible way allowing discrimination between single and multiple slope failures as well as incorporation of spatial information about undated past landslide activity. Besides data structure, determination of appropriate spatial mapping units is of special importance. Present research investigates the suitability of slope units derived from DEM-based watershed delineation. The capabilities of such a dynamic landslide inventory system will be demonstrated in an exemplary way for selected slopes within the study area affected by high landslide activity.