



Centralized national landslide database for the Kyrgyz Republic: initial steps

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Abstract. Central Asian countries such as the Kyrgyz Republic and Tajikistan are exposed to high-intensity landslides triggered by seismic and hydro-meteorological events. For example, the earthquake-triggered Khait rock avalanche in 1949 caused between 5000–28 000 casualties in Tajikistan. Similar notorious cases have occurred in the Kyrgyz Republic: The Kainama loess flow in 2004 damaged road infrastructures and buried 11 houses with 33 people. To manage disaster risk efficiently, up-to-date landslide inventory data is required to support national-scale risk assessments. Research on landslide processes is often carried out on regional scales, with monitoring done at site-scale. Bringing this multi-scale data together into one central, national database would improve efficiency and provide a stable digital repository for existing and future data. It is also useful to inform engineering projects and building and testing landslide susceptibility models. The British Geological Survey (BGS) has been collaborating with the State Committee for Industry, Energy and Subsoil Use of the Kyrgyz Republic (SCIECU) to develop a Geoscience Data Index (GDI) including a centralized national database for the country that enables data visualization and integration with other key datasets. The data model is generic, and can be tailored to the needs of other countries like Tajikistan, and provides support such as analysis in open source GIS environments and assessing impacts on infrastructure and populations more efficiently.

Key words: landslides, Kyrgyz Republic, database, PostgreSQL

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Создание централизованной национальной базы данных по оползням Кыргызской Республики: первые шаги

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Аннотация. Страны Центральной Азии, такие как Кыргызская Республика и Республика Таджикистан, подвержены высокоинтенсивным оползням, вызванным сейсмическими и гидрометеорологическими явлениями. Например, землетрясение, спровоцировавшее Хаитскую каменную лавину в 1949 г., привело к жертвам в количестве от 5000 до 28000 человек в Таджикистане. Аналогичные печально известные случаи произошли и в Кыргызской Республике: лессовый поток (оползень) в селе Кайнама 2004 г. повредил дорожную инфраструктуру, а его отложения полностью разрушили 11 домов с 33 жителями. Для эффективного управления рисками стихийных бедствий необходимы обновленные данные

кадастра оползней, которые будут использоваться для оценки рисков в национальном масштабе. Исследования оползневых процессов часто проводятся в региональном масштабе, а мониторинг осуществляется в масштабе участка. Объединение этих разномасштабных данных в одну центральную национальную базу повысит эффективность и позволит создать стабильное цифровое хранилище для уже имеющихся и будущих данных. Полезно также информировать разработчиков инженерных проектов, а также строить и тестировать модели восприимчивости к оползням. Британская геологическая служба (BGS) сотрудничает с Государственным комитетом промышленности, энергетики и недропользования Кыргызской Республики (ГКПЭН) в области разработки Индекса данных геонаук (GDI), включающего централизованную национальную базу данных по стране, которая позволяет визуализировать данные и интегрировать их с другими ключевыми наборами данных. Модель данных является универсальной и может быть адаптирована к потребностям других стран, таких как Республика Таджикистан, и обеспечивать поддержку в различных отраслях, таких как анализ в среде ГИС с открытым исходным кодом и более эффективную оценку воздействия на инфраструктуру и население.

Ключевые слова: оползни, Кыргызская Республика, база данных, PostgreSQL

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Introduction

The State Committee for Industry, Energy and Subsoil use of the Kyrgyz Republic (SCIECU) and the British Geological Survey (BGS) working towards to develop a Geoscience Data Index (GDI), geographical information system (GIS) that acts as a portal to geospatial datasets and digital data indexes.

The vision is to hold open geospatial data on a central server and allows SCIESU staff to access the digital data holdings. This approach will facilitate data query, analysis and reporting. Due to the high landslide risk in the country, one of the components of the project is to develop a national landslide database that enables visualize and analyze data in GIS environments, web map tools and data portals.

Landslides in the Kyrgyz Republic

The high-frequency and often high-intensity of landslides in the Kyrgyz Republic, mostly located on the southern part of the country, shown in Fig. 1, poses a significant risk to people, the environment and infrastructure.

SCIESU has been given the remit to study these natural disasters by means of different techniques such as drones. A landslide catalogue exists which records more than 1000 events mainly held as Excel spreadsheets. Previous research efforts have resulted in development of the Tian Shan geohazards database by Havenith et al, 2015. Also, [Strom & Abrakmatov, 2018] compiled a bedrock landslide database for the country. Unification of such important inventories in a central data store by using a robust database management system will enable improved geo-hazard and risk assessment, reducing investor risk to the benefit of society.

Using PostgreSQL instead of Excel spreadsheets

Although utilizing spreadsheets is convenient for making a first inventory, this approach it is not suitable for slope management purposes, such as recording monitoring data, storing information about accomplished remediation works, or impact data for developing building

fragility curves. Within the project, it is intended to use PostgreSQL – a robust and open source software, PostgreSQL database has several advantages over Microsoft Excel for building landslide inventories, as presented in Table.

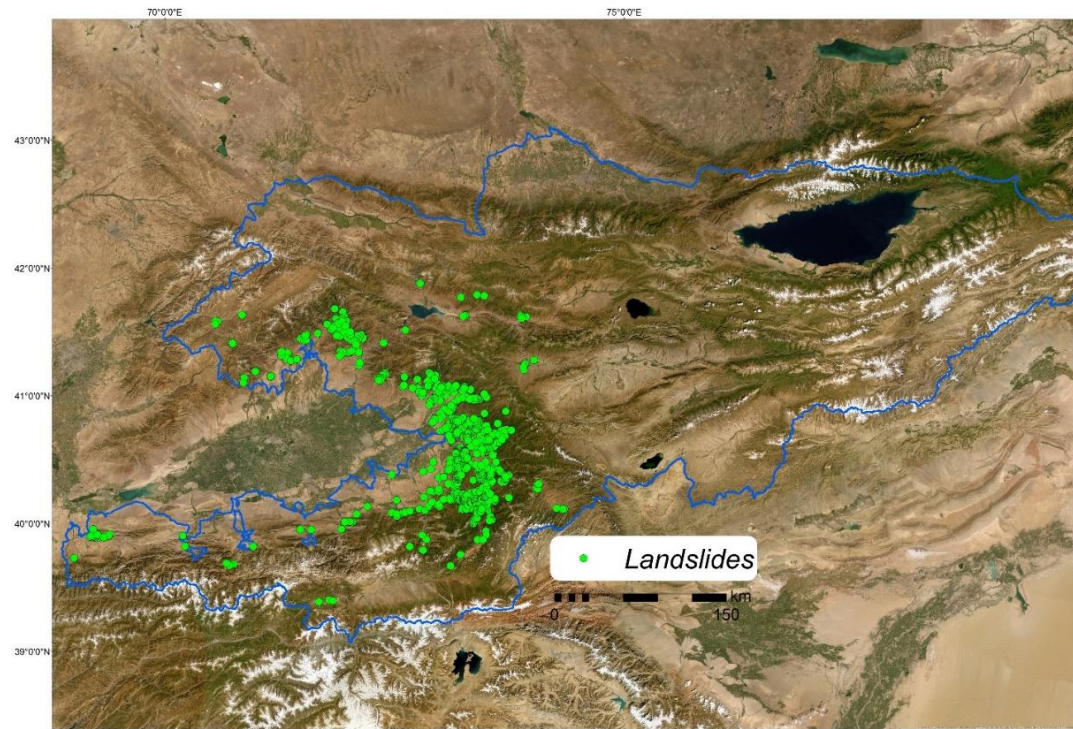


Fig. 1. Geographical location of landslides (Ministry of Emergency Situations in the Kyrgyz Republic, 2017)

Table. Comparison of the MS Excel and PostgreSQL

Feature/Benefit	MS Excel	PostgreSQL
CAPACITY store unlimited data	No	Yes
SECURITY stored in servers with backup protocols	No	Yes
VERSIONING Used by multiple users simultaneously	No	Yes
CONSTRAINTS Controlled for data quality	No	Yes
IMPORT and EXPORT Easy, can be imported from other sources	Yes partly/No	Yes
USER INTERFACE Forms and reports can be created and integration with GIS	No	Yes

The current state of the Landslide Database

The requirements of a future national database are reviewed and a new data model proposed that honours existing inventories. Fig. 2 shows a generic model of the database which is being developed collaboratively between the two institutes.

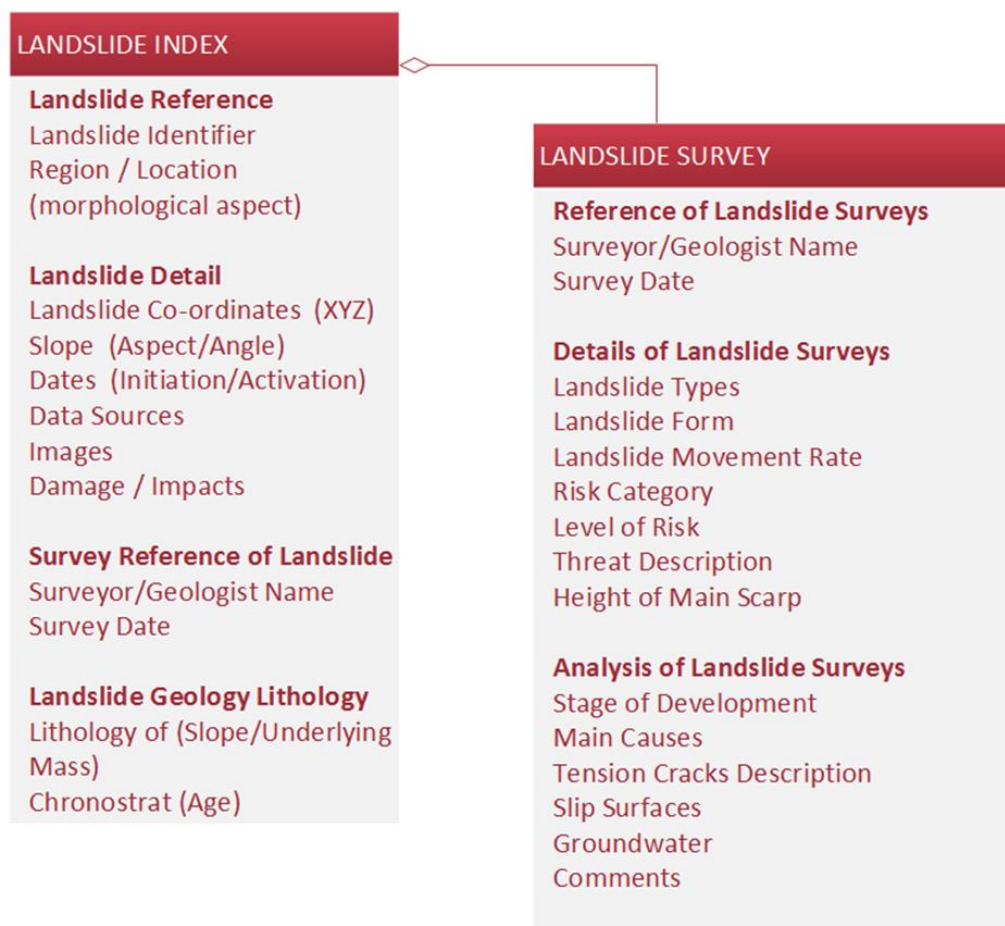


Fig. 2. Generic model of the landslide database

Conclusion

The southern part of Kyrgyz Republic is prone to large-scale landslides which cause threat to population and infrastructure. To try to tackle the issue, BGS and SCIESU working collaboratively to develop a national landslide database which will allow to integrate with other datasets and visualize data in GIS. Due to this reason, an open-source database management system PostgreSQL was selected. As an initial step, a generic data model was created considering existing landslide inventories from various sources. In a current stage, a final version of the landslide data model is being completed and will be implemented into PostgreSQL. Future considerations are front-end development and carry out testing procedures in the country.

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