

Landslide, debris flow, and flash flood (LaDeFloFF) events in Northern Vietnam under changing climate conditions and human impact

Many parts of the World and their societies are significantly exposed to geohazards. This includes North Vietnam, where heavy rainfalls during monsoon season are responsible for the most tragic natural events: landslides, debris flows and flash floods. These events require constant attention, monitoring, and prevention to mitigate their adverse outcomes. As is also expected, these events can even intensify in the future due to ongoing climate warming. The problem is mainly unrecognized and negatively affects forest ecosystems, agriculture and societies. The current project aims to evaluate the spatial and temporal clustering of landslide and flash flood disasters and isolate the key contributing factors triggering these events. We want to understand their triggering mechanisms, formation and consequences in two spatial scales: regional and local. A deep understanding of the regional patterns (provinces and river catchments) will require the recognition of the study problem from the viewpoint of historical events, precipitation patterns, and the spatial redistribution of landslide areas. This aim is planned to be achieved by evaluating and integrating historical resources, climate data, and satellite images. The local scale of the analysis will cover the recognition of the landslide body topography through geomorphic mapping and aerial laser scanning, soil and weathering material analyses, and the interpretation of the erosion and accumulation effects of flash floods. The significant scope of regional and local information will allow us to construct models of spatial and temporal dependencies between external and internal factors of landslide occurrence. As the outcomes, we will propose maps of landslide probabilities. Through local analyses, geomorphic mapping, airborne laser scanning, and soil analyses, we will maximize our chances for a deep recognition of all processes and forms associated with concurrent landslides, debris flows and flash floods. In addition, it will allow us to formulate spatial management recommendations and follow the landscape change trajectories as close to the actual scale as possible.

The project has considerable potential to offer new results on several aspects of landslide investigation in Vietnam and other countries. Its novelty includes as complete as possible landslide chronology for NV territory and new information on the geomorphology of landslide areas through detailed geomorphic mapping of selected landslide areas with an in-depth evaluation of the concurrent landslide triggering factors. New results about soil and weathering profile features will reveal information on factors predisposing landslide movements. In addition, we will propose new models of landslide probability in the NV territory and new landslide probability maps for NV based on machine learning techniques.