Debris Flows in Rio de Janeiro: Mapping, Modeling and Dating

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In the last few decades, the state of Rio de Janeiro in Brazil has been affected by many catastrophic landslides leading to equally devastating mud and debris flows. The combination of intense summer rain storms, soil-mantled steep slopes, and largely uncontrolled occupation of slopes and stream-side valley bottoms, generates the conditions not only conducive to landsliding but to disaster as the floodplains of streams and rivers become more densely populated. Despite the many scientific advances in prediction and warning systems the number of deaths and the economic losses in the state continue to grown. For example, in one night in January 2011, more than 1300 people were killed in Rio de Janeiro, both on hillslopes and in adjacent floodplains when an intense summer rainstorm (about 350 mm/24h, after a long rainy period) triggered debris flows that were more than 10km long generating huge debris deposits (some more than 7m thick). Therefore, the main objective here is to improve our ability to predict landslide locations, both in space and in time, thus providing a system by which resulting debris flow hazards can be reduced in the state of Rio de Janeiro. In this study we combine field mapping to delineate the extent of that debris flow deposits in selected catchments of Rio de Janeiro state, soil sampling and field experiments to characterize soil properties, dating of debris flow deposits using measurements of ^{10}Be and ^{14}C to constrain the age and recurrence interval of flows, and modeling of landslides and debris flows initiation and propagation using a combination of different mathematical models. The results, although preliminary, attest the effects of local factors in controlling debris flows initiation and propagation. Besides, they also suggest that the quantitative methodologies used here, based on physically-based procedures, are capable of predicting the location of unstable sites to landslides in dense populated areas of Rio de Janeiro.

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Accelerated landsliding due to climate warming? Modeling results from western Germany

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In the 4th edition of the IPCC report the climate change expected until the end of this century is described by different scenarios. For this study, the moderate version A1 B was chosen and, as a tool, the statistical model REMO (Regional Modeling of Present and Future Climate) was taken. The modeled climate evolution of the two periods 2021-2050 and 2071-2100 was compared with the reference period 1961-1990. The model which has been developed by the MPI for climate research in Hamburg is based on pixels of 10x10 km covering central Europe. For each year the following parameters have been calculated: days per months mean temperature lower than 0 °C, and -5°c; daily and monthly precipitation rate and rainy days with P more than 20 mm. As field examples were taken: the vineyards-covered Wissberg in Rheinhessen, built up of tertiary sediments and known as an old landslide area, and a steep slope of the Mosel valley near Puenderich, built up of various devonian rocks. Here, an important railway has been threatened by landslides and rockfalls since 1880. First results are as follows: In both cases frost periods will be eliminated towards the end of this century. Summer rains will be more sparse but more intensive than today. Contrary, winter rains will become more abundant until 2100 with the effect of growing destabilization of the slopes especially by a higher pore water pressure. Roads and railways will therefore become generally more threatened by mass movements than today.