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On the connection of permafrost and debris flow activity in Austria

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Debris flows represent a severe hazard in alpine regions and typically result from a critical combination of relief energy, water, and sediment. Hence, besides water-related trigger conditions, the availability of abundant sediment is a major control on debris flows activity in alpine regions. Increasing temperatures due to global warming are expected to affect periglacial regions and by that the distribution of alpine permafrost and the depth of the active layer, which in turn might lead to increased debris flow activity and increased interference with human interests. In this contribution we assess the importance of permafrost on documented debris flows in the past by connecting the modeled permafrost distribution with a large database of historic debris flows in Austria. The permafrost distribution is estimated based on a published model approach and mainly depends of altitude, relief, and exposition. The database of debris flows includes more than 4000 debris flow events in around 1900 watersheds. We find that 27 % of watersheds experiencing debris flow activity have a modeled permafrost area smaller than 5 % of total area. Around 7 % of the debris flow prone watersheds have an area larger than 5 %. Interestingly, our first results indicate that watersheds without permafrost experience significantly less, but more intense debris flow events than watersheds with modeled permafrost occurrence. Our study aims to contribute to a better understanding of geomorphic activity and the impact of climate change in alpine environments.