An accurate way of predicting landslides

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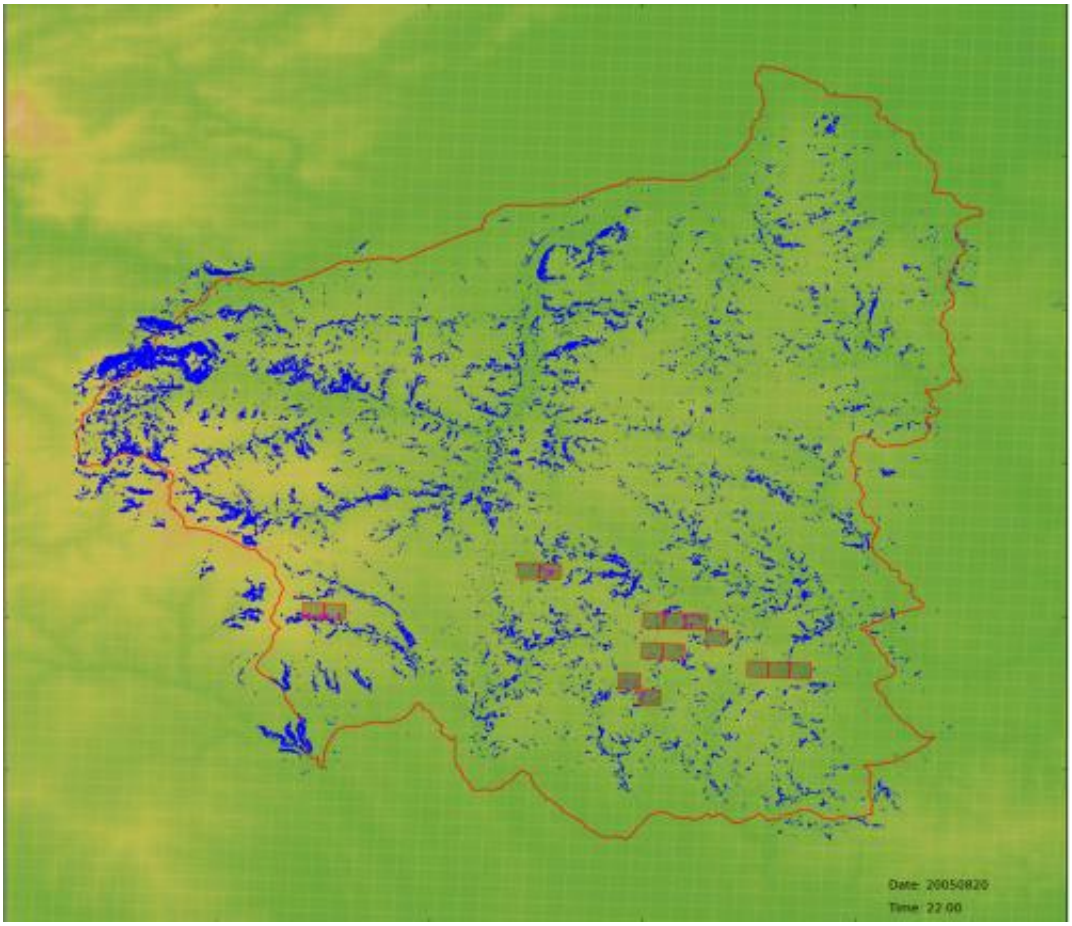

An example of one of the risk maps for Burgenland in Austria. The red boxes mark areas with an elevated risk of landslides. Credit: Fraunhofer IOSB

A landslide can seriously injure or even kill people. Now, a new early warning system will be the first to employ geological data in tandem with the latest weather forecasts to provide a concrete warning in emergency

situations.

A deluge of rain pelts down on the already thoroughly sodden ground. Rivers burst their banks as local residents haul up sandbags to protect themselves from the rising waters. In hilly areas, people are no less anxious, knowing that the waterlogged earth on a hillside can easily slip, burying cars and houses beneath it and, if the worst comes to the worst, even people. Experts use maps marked with danger areas to determine the probability of a specific slope succumbing to a landslide. But these maps only cover a specific point in time, and do not take current weather conditions into account. Of these atmospheric factors, heavy rain in particular can trigger catastrophes.

Now, safety experts are to be supported by the ELDEWAS early warning system. This system makes use of regularly updated weather conditions and forecasts, coupling these to regional information on elevation profiles, slopes and land use, allowing it to issue an early warning in case of danger. ELDEWAS stands for "Early Landslide Detection and Warning System" and is being developed by research scientists at the Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB in Karlsruhe. "The ELDEWAS early warning system goes hand in hand with INCA-CE, a project co-financed by the EU in which researchers are working on improving short-term weather forecasting, or 'nowcasting'," says Dr. Oliver Krol of Fraunhofer IOSB. While standard meteorological data is for the most part only updated once an hour, with a spatial resolution of ten kilometers, the experts working on the INCA-CE project are able to provide weather forecasts at 15-minute intervals with a spatial resolution of one kilometer.

Factoring in current weather conditions

The early landslide warning system is initially being developed by

researchers for use in the state of Burgenland in Austria, with the regional safety center providing all the necessary data. Which slope is this and how steep is it? What type of ground are we dealing with – sand, clay or rock? How is the land used? Where are the installations, houses or roads? Where is wooded and where is open land? Researchers then combine these parameters, which stay stable over the long term, with weather data, which is constantly in flux. The weather data is provided online by Austrian meteorological service ZAMG, which is also taking part in the INCA-CE project. Initial practical testing is planned for the spring, when current weather information will be incorporated into the early warning system for the first time. The prototype is due to be ready in the autumn. "The software will of course also then be available for use in other countries and regions," says Krol. He also explains the aim behind the research, describing how the system will constantly assess the situation in the background until it perceives a danger, at which point it will independently issue a warning comprising the relevant coordinates and the contact details of the person with responsibility for the area concerned. This contact person is then to be automatically warned of the impending incident via text message, giving them time to take appropriate action, evacuating the populace or locking down the area concerned.

Researchers still have a few challenges to overcome before this vision can be realized, however, including how to integrate the online weather data into the system and how to analyze the data received. "There's no doubt that the bulk of the work lies in answering the question of when a situation can be said to become critical. Given that setting rigid threshold values only allows for a binary yes or no answer, offering protection only against the worst case scenario, we have opted to model the problem using fuzzy logic," explains Krol. This means qualifying the threshold values of the various contributory factors, allowing us to link the variables. In this way, we can get as realistic as possible an assessment of the risk posed."

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