EGU23-6467, updated on 04 May 2023
https://doi.org/10.5194/egusphere-egu23-6467
EGU General Assembly 2023

Spatial modeling of cryospheric hazards: predicting retrogressive thaw slumps in Alaska

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Classifying a given landscape on the basis of its susceptibility to surface processes is a standard procedure in low to mid latitudes. Conversely, these procedures have hardly been explored in peri-glacial regions, mostly because of the limited presence of human settlements and thus of the need for risk assessment. However, global warming is radically changing this situation and will change it even more in the years to come. For this reason, understanding the spatial and spatio-temporal dynamics of gemorphological processes in peri-arctic environments can be crucial to make informed decision in such unstable environments but also to shed light on what changes may follow at lower latitudes. For this reason, here we explored the use of artificially intelligent models capable of recognizing locations prone to develop retrogressive thaw slumps (RTS). These are cryospheric hazards induced by permafrost degradation and their development can negatively affect human settlements or infrastructure, change the sediment budget dynamics and release greenhouse gases. Specifically, we test a binomial Generalized Additive Modeling structure to estimate probability of RTS occurrences/development in the North sector of the Alaskan territory. The results we obtain show that our binary classifier is able to accurately recognize locations prone to RTS, in a number of goodness-of-fit and cross-validation routines. Overall, our analytical protocol has been implemented with the idea in mind of building an open source tool scripted in Python.