Climate extremes relevant for permafrost degradation

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During the past several decades, Arctic regions warmed almost twice as much as the global average temperature. Simultaneously in the high northern latitudes, observations indicate a decline in permafrost extend and landscape modifications due to permafrost degradation. Climate projections suggest an accelerated soil warming, and consequently deepening of the active layer thickness in the near future. Except air temperature, two other parameters i.e. precipitation and snow depth are the most important climatic parameters affecting the thermal state and extend of the permafrost. The key research question of this study is whether or not certain climatic conditions can be identified that can be considered as an extreme event relevant for permafrost degradation. Here we apply data mining techniques on meteorological re-analysis to develop a coherent framework for the identification of extreme climate conditions relevant for active soil layer deepening and a decline of permafrost extend.

Several key types of events have been classified based on various combinations of temperature, precipitation and snow depth statistics. Then, the respective events have been identified in ERA-Interim reanalysis and evaluated against in situ observations in West Siberia region. The evaluation proved that the developed algorithm could successfully detect relevant extreme climate conditions in meteorological re-analysis dataset. It also indicated possibilities to improve the algorithm by refining definitions of extreme events. Refinement of algorithm is currently work in progress as well as the evaluation against satellite observations and a hierarchy of numerical models. Nevertheless, the method is applicable for all kinds of gridded climatological datasets that contain air temperature, precipitation and snow depth.

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