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Glacier-permafrost-interaction at a thrust moraine complex in the Val Muragl (Swiss Alps): Investigations using electrical resistivity tomography (ERT) and ground-penetrating radar (GPR)

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Several studies have proofed the existence of an interaction between glacier and permafrost by geophysical surveying and have verified the presence of polygenetic ground ice in several moraine complexes in the European Alps. Exemplarily, the presence of massive polygenetic ground ice within the large thrust moraine complex of the upper Val Muragl (Swiss Alps) was confirmed. However, so far no other structures indicating an interaction of the glacier and sub- and proglacial permafrost were detected inside this moraine complex.
The contribution presents results from recent surveying of ERT and GPR in the Val Muragl. The aim of these geophysical investigations is the detection of the present-day extent of the massive ice core and the identification of internal sedimentological structures that would indicate a glacier-permafrost interaction.
The GPR surveys were performed using a PulseEKKO Pro system with two unshielded 50 MHz antennas. The ERT surveys we conducted using a Syscal Pro Switch resistivity imaging system with 36 electrodes and an electrode spacing of 5 m.
The results of the ERT measurements enabled a clear delineation of the actual extent of the massive ice core and showed a zone of very high electrical resistivity values in the central and proximal part of the moraine body. The high electrical resistivity values reach more than 1 MΩm and give evidence on a polygenetic origin of the massive ice core. In contrast, the GPR imaging revealed boundaries of different substrate zones within the moraine complex that are partly even visible at the surface. In the radargrams these zones appeared as linear reflectors that dipped towards the proximal side of the moraine complex. The course and the extent of the detected boundaries between the different substrate zones indicated the presence of several shear planes within the moraine body.
The combination of ERT and GPR surveying could contribute to a better understanding of the internal structure of the moraine complex in the Val Muragl. The geophysical data make the presence of polygenetic massive ice core likely and indicated as well substrate boundaries inside the moraine body that were interpreted as shear planes.