

Fig. S1 Map of the four study sites centred approximately at 56°14'55" N, 37°59'54" E. Imagery © Airbus, 2026; imagery © Airbus, CNES / Airbus, Maxar Technologies, 2026; map data © Google, 2026

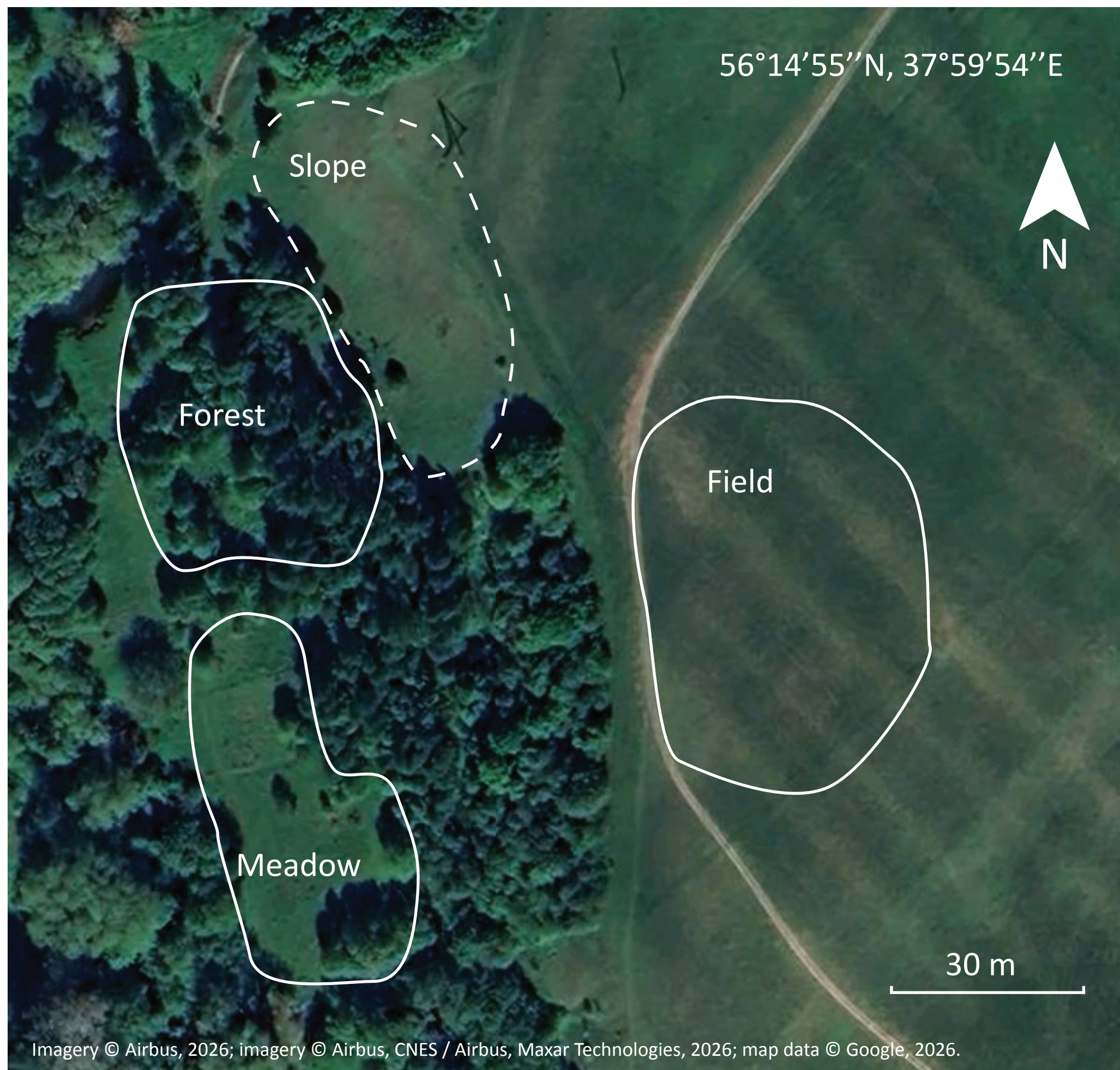


Fig. S2 In-situ photography of the meadow study site (a); typical percolation column after excavation (b); the cleared interface between the bottom crust and the column body (c). Note the presence of several liquig entering points at that level. 23 December 2024.

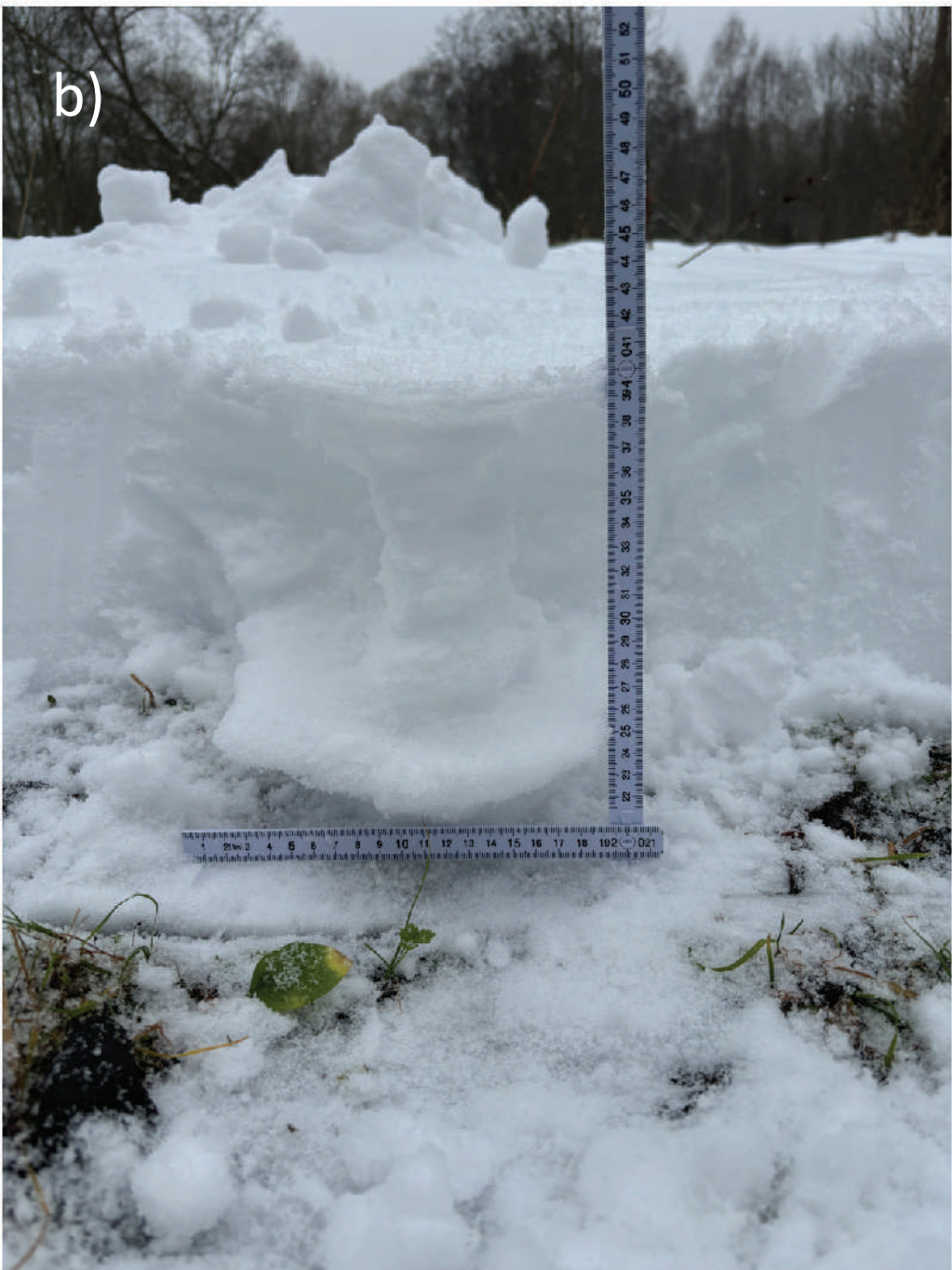


Fig. S3 In-situ photography of the field study site (a); typical percolation columns after excavation (b, c). 23 December 2024.

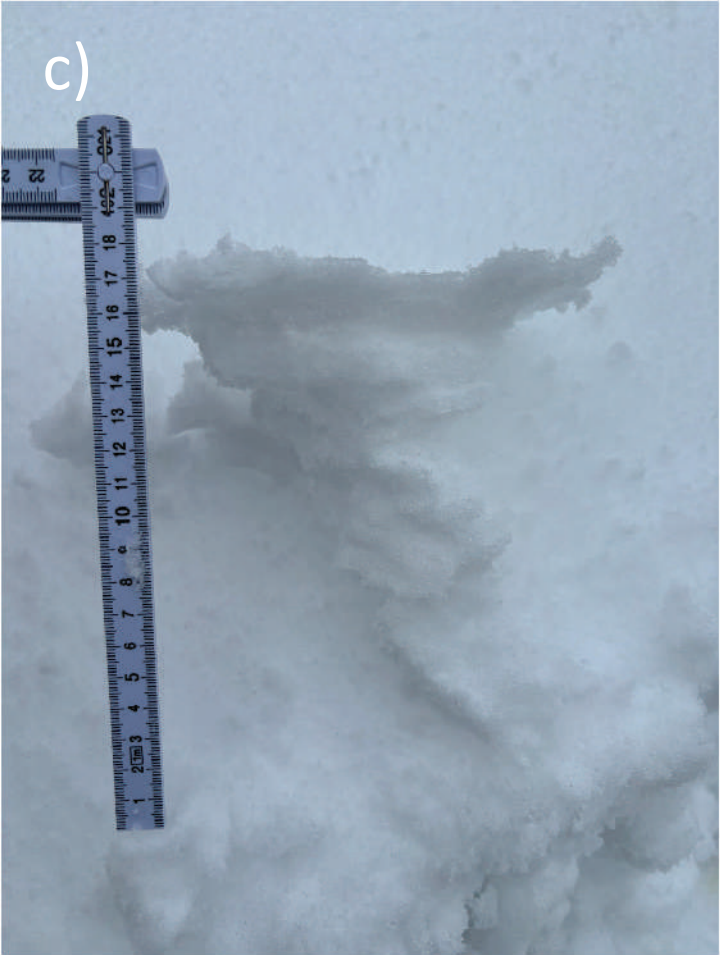
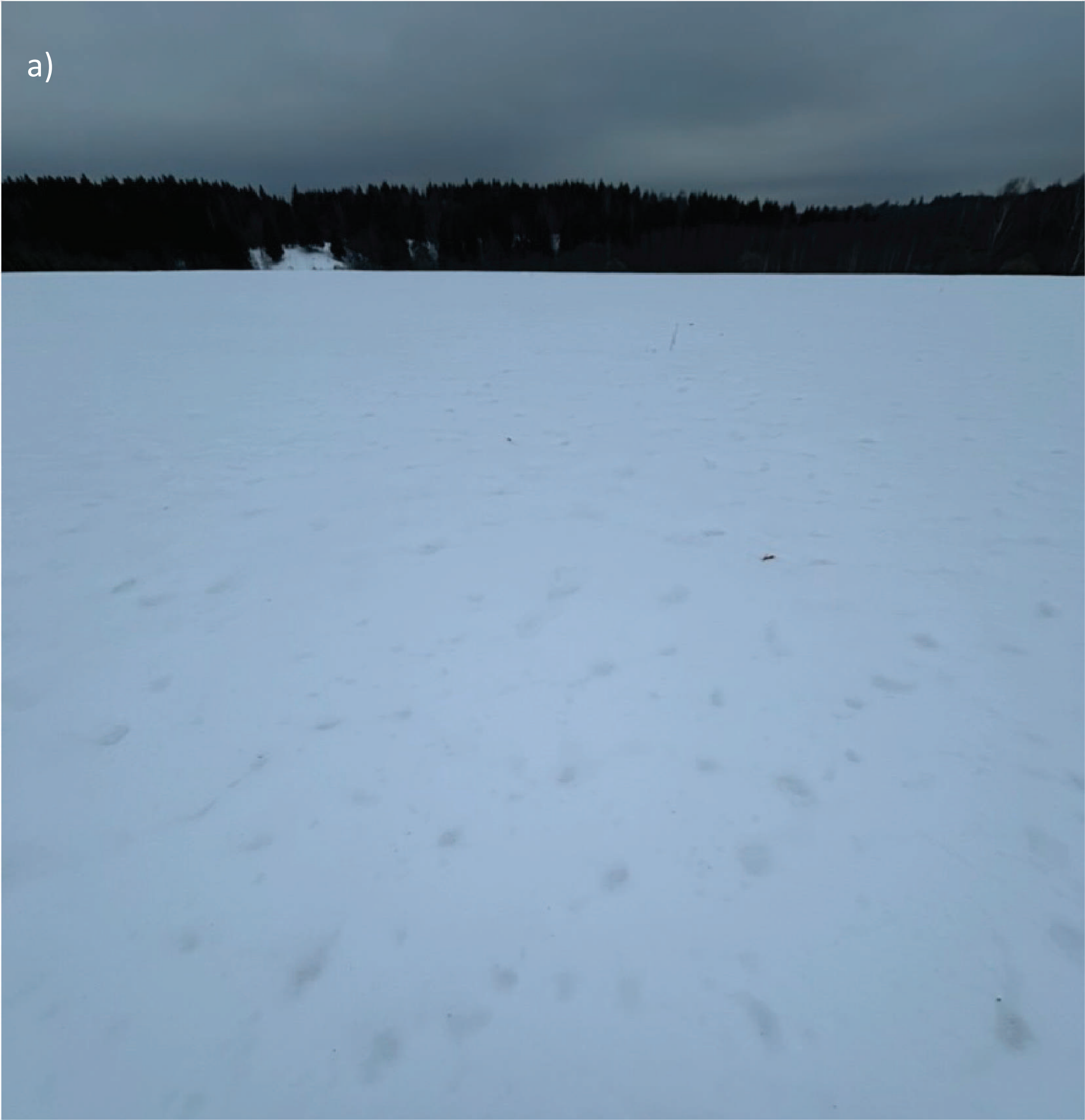


Fig. S4 In-situ photography of the forest study site (a); microscale surface ice crust roughness due to water droplets falling from the canopy (b, c). 23 December 2024.



Fig. S5 In-situ photography of the slope study site (a); surface linear percolation features formed due to water flow along the slope (b, c). 23 December 2024.

