NHC-2022, 15.-18.08 Tallinn

AIR MOVEMENTS IN SOIL

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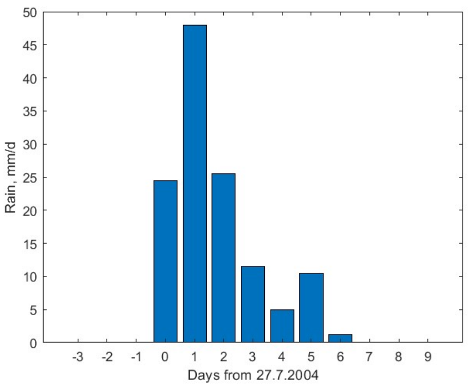
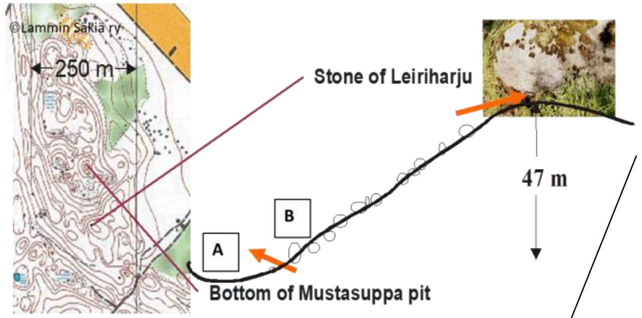


In this rain event in position B no outflow of air in Day 3, but in Day 9 there was the air outflows with 0.1-0.5 m/s velocities.

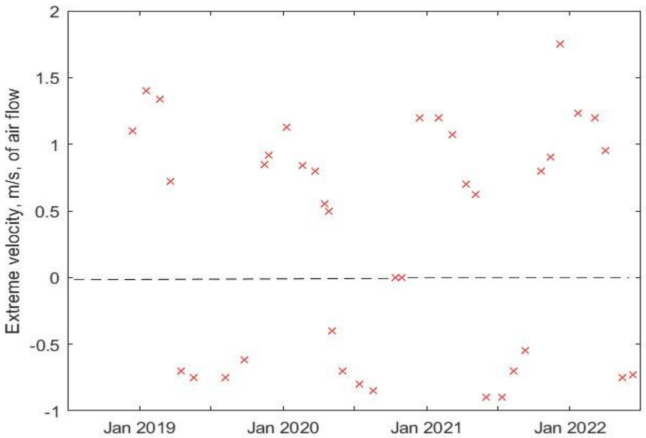


This case treated in XXIV NHC in Denmark 2006.

In summer the infiltrating water takes air with it into soil

Air velocity measurements at the mouth of hole under the stone.

Outflow is positive.



$A=0.1\ m^2$

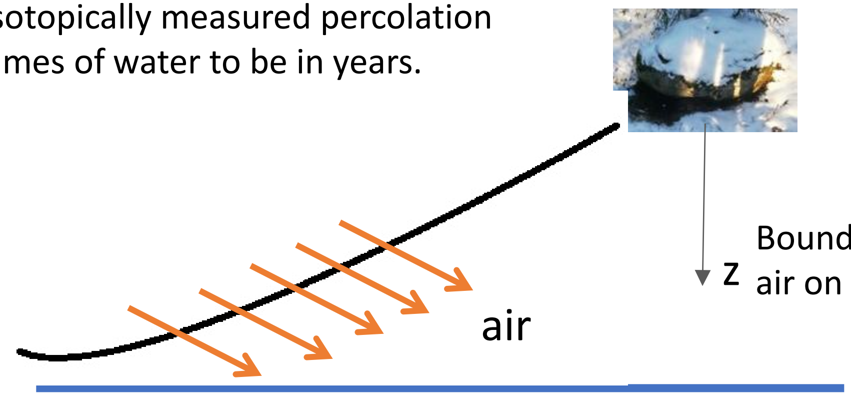
In winter the temperature of air outflows varied between + 5.3 …11.1 °C, the mean 7.3 °C. Mainly its humidity was 100 %.

Is the up-coming air-flow common in soils in winter?

In winter the maximum outflow velocities varied 0.50…1.75 m/s. Typical air outflow is 300 m^3/h, with H_2O content 2.5 kg/h.

Soil material of the esker seems to be till. Saxena and Dressie (5. NRBS, Finland, Vierumäki, 1984) isotopically measured percolation times of water to be in years.

MODELLING



groundwater

Boundary condition of air on the groudwater?

It is important to consider air in hydrological models of the unsaturated zone. (Hubert Morel-Seytoux)

There he has Darcy's equation for the flow current

$$\boldsymbol{q_i} = -\frac{k_i}{\mu_i}\nabla p_i + \frac{k_i}{\mu_i}\rho_i g\, \boldsymbol{e}_z,$$

with i = w or = a, is for both water and air. air is compressible. k is permeability, μ viscosity, ρ density and p pressure. $\boldsymbol{e}_z$ is unit vector in the direction down.

The ice deposit in summer in the middle of hill must be modelled too.

Tanaka, Nohara and Yokoi (2000, J. of Meteorological Society of Japan 78(5), 611) have similar observations as above and they have a model, too.