Summary

Evaporation from porous media affects many natural processes. In my work, I focused on the second evaporation phase, calculating the evaporation rate using Fick's law based on air temperature and air humidity above the surface, the water-vapor permeability of the porous material, and the evaporation front depth below the surface. To determine this depth, I used the uranine-probe method using sodium fluorescein. The work aimed to calculate the evaporation rate using Fick's law and values of the evaporation front depth determined by the uranine-probe, for 6 sandy soil samples and 3 types of rocks. A sub-goal was to verify the applicability of the uranine-probe for determining the depth of the evaporation front in sandy soil and in 12 different rock samples.

Results show successful determination of evaporation front depth for both sand and rocks. The uranine-probe method's accuracy averaged 2.0 mm for sand. The difference in the values determined by the uranine-probe method compared to another, independent method (detection of the evaporation front from the color change of the fluorescein solution) in the sand was on average 1.7 mm, but I did not study this for the rock samples. All evaporation experiments confirmed that the evaporation rate, both measured and calculated, decrease with increasing depth of the evaporation front. For sand, the calculated evaporation rates underestimate measurements by 83 % of the time, with a relative error of 23 % on average (difference between calculations and measurements averaging 0.12 mm/day). For rocks, this underestimation was in 100 % of cases, with an average relative error of 193 % (difference between calculations and measurements averaging 0.28 mm/day). This lower agreement in rocks is probably related to the reduced accuracy of uranine-probe method at low moisture in rocks. Fick's law and the uranine-probe method combination have a drawback in shallow zones below the surface, where measurement errors of the evaporation front depth significantly affect the calculated evaporation rates. The constant measurement error of the uranine-probe is reflected in the uncertainty of the calculated evaporation rate nonlinearly depending on the depth of the evaporation front.

Keywords: uranine-probe method, evaporation, vaporization plane, evaporation rate, evaporation phases, sodium fluorescein, uranine, wet cup