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Impact of slope inclination on salt accumulation

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Field measurements indicated on high variability in salt accumulation along natural and cultivated slopes, even for relatively homogeneous soil conditions. It was hypothesised that slope inclination has an impact on the location of salt accumulation along the slope. A set of laboratory experiments and numerical models were used to explore the impact of slope inclination on salt accumulation. It was shown, experimentally, that for conditions of saline water source at the lower boundary of the slope - salt accumulates in low concentrations and homogeneously along the entire slope, for moderate slopes. However, as inclination increases high salt concentrations were observed at the upper parts of the slope, leaving the lower parts of the slope relatively free of salt.
The traditional flow and transport models did not predict the experimental observations as they indicated also for the moderate slopes on salt accumulation in the elevated parts of the slope, away of the saline water source. Consequently – a conceptual model was raised to explain the laboratory observations. It was suggested that the interactions between slope angle, evaporation rates, hydraulic conductivity of the medium and distribution of wetness along the slope affect the saline water flow path through the medium. This lead to preferential flow path close to the soil-atmosphere interface for the steep slopes, which leads to constant wash of the salts from the evaporation front upward towards the slope upper parts, whereas for the moderate slopes, flow path is below the soil-atmosphere interface, therefore salt that accumulates at the evaporation front is not being transported upward. Understanding of salt dynamics along slopes is important for agricultural and natural environments, as well as for civil engineering purposes. Better understanding of the salt transport processes along slopes will improve our ability to minimize and to cope with soil salinization processes. The laboratory experiments and the new conceptual model fit the field observations and may explain the high variability of salt accumulation along slopes as observed in the field.