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Pattern formation in Salt Playa

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Salt Playa, or crusts, often exhibit polygonal salt-ridge patterns with a diameter of roughly 1 m. Several mechanisms, like cracking or wrinkling of the surface crust have been discussed, but none of these can explain the scale of the observed patterns. We investigate a theory where we link the crust pattern to buoyancy-driven flows in the porous ground beneath them. In this model, salinity gradients arise due to evaporation at the ground surface. These gradients lead to the formation of convection cells, much like the convection caused by temperature gradients. The spatial scaling of these convection rolls significantly depends on the evaporation rate, while the onset of convection is controlled by the permeability of the soil. Here we will show a link between surface salt patterns and subsurface dynamics. We investigate the onset of convection, the scaling of convection cells, and the formation of salt crusts in a sandy soil confined to a Hele-Shaw cell in analogue experiments and link subsurface concentration gradients to surface crust patterns by means of a field study. The aim of the experiments and the field study is to explore how porous media convection can affect salt crust patterns in arid environments.