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# Convection in Salt Lakes

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Salt lakes occur worldwide in arid environments and are spectacular geological features, displaying breath-taking patterns on their surface. In these lakes, the only outflow of fluid is due to evaporation and dissolved salts in the groundwater precipitate at the surface, leading to the growth of a salt crust. Under the right conditions, ridges can be observed in the crust, resulting in a remarkable polygonal pattern. Understanding the formation of these distinct polygonal patterns is key to monitoring the dust emission potential of salt lakes. We model salt lakes using a 3D porous medium which is subject to a uniform through-flow, parameterised by the Rayleigh number and the lake depth. This leads to a base state characterised by exponentially-distributed salinity that is unstable for large enough Rayleigh numbers and whose instability leads to buoyancy-driven convection supported by salinity plumes. We simulate the dynamics numerically and analyse the sequential stages of the instability using characteristic properties of the system (e.g. average salinity fluxes, average and dominant pattern wavenumbers). Initially, linear growth away from the base state develops and patterns emerge in the surface flux of salinity. As nonlinearity becomes important, a net transport of salinity away from the surface builds. Eventually, plumes penetrate deep into the domain and the dynamics approach a chaotic but statistically-steady end-state, characterised by patterns which are strikingly similar to those observed in situ.

## Participation

In-Person

## References

J. Lasser, J. M. Nield, M. Ernst, K. Volker, G. F. S. Wiggs, M. R. Threadgold, C. Beaume and L. Goehring 2022 Salt Polygons and Porous Media Convection, arXiv: https://arxiv.org/abs/1902.03600
M. R. Threadgold, C. Beaume, L. Goehring and S. M. Tobias 2023 (in preparation)

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