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The intermediate regime of convection across a permeable membrane VIJAYA RAMA REDDY GUDLA, BHEL Corporate R&D, Hyderabad, India, B.A. PUTHENVEETTIL, Dept. of Applied Mechanics, IIT Madras, Chennai, India — In an arrangement of brine over water across a horizontal permeable membrane, where the unstable density difference across the membrane initiates convection, we discover a new convection regime where the Sherwood number scales approximately as the Rayleigh number. Inferring from the planforms of plume pattern and the estimates of velocity through the membrane, we show that such a regime occurs when advection balances diffusion in the membrane pore. Utilizing mass balance and symmetry assumptions in the top and bottom fluids, convection-diffusion equation for the membrane pore is solved to obtain concentration drops across and in the boundary layers above and below the membrane. With the observation that the normalized net flux is constant in the new regime, an expression for the flux scaling in the new regime is derived. The scaling matches with the experiments and has correct asymptotes in the advection and diffusion regimes (Puthenveettil & Arakeri, JFM, V542, 2005; V609, 2008). The plume spacings in the new regime are distributed lognormally, and their mean follow the trend in the advection regime.

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