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Scaling in concentration driven convection boundary layers with transpiration[1] VIJAYA RAMA REDDY GUDLA, Univ of Melbourne, P. J. JOSHY, Indian Institute of Technology Madras, GAYATHRI NAIR, Chennai Mathematical Institute, BABURAJ A. P., Indian Institute of Technology Madras — Concentration-driven natural convection boundary layers (NBL) on horizontal surfaces, subjected to a weak uniform blowing velocity (V_i), are studied for the dimensionless blowing parameter range $10^{-8} < J = Re^3/Gr < 10^{-5}$. Here, Re and Gr are the Reynolds number based on V_i and horizontal location x, and Grashoff number based on x and concentration difference across the boundary layer. Integral boundary layer equations are deduced under the assumption that the concentration does not drop within the species boundary layer, which is valid for weak blowing into thin species boundary layers that occur at high Schmidt numbers ($Sc \sim 600$). Numerical solution of the equations reveal that the species and velocity boundary layer thicknesses scale as, $\delta_d = 1.6x(Re/Gr)^{1/4}$ and $\delta_v = \delta_d Sc^{1/5}$. Also, the horizontally averaged dimensionless concentration profile across the boundary layer shows a $Gr_y^{2/3}$ scaling, where Gr_y is the Grashoff number based on the vertical location y. The profile matches well with the experimentally observed mean concentration within the NBL that form on a horizontal permeable membrane, when a weak flow is gravitationally forced from below the horizontal membrane that has brine above it and water below it.

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