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Heat transfer and stability of horizontal convection with a moving forcing boundary[1] GREGORY SHEARD, TZEKIH TSAI, WISAM HUSSAM, KEAN YUNG WONG, Dept. of Mech. and Aero. Engineering, Monash University, MARTIN KING, Uni Klima, Bjerknes Centre for Climate Research, Norway
— Horizontal convection describes a buoyancy-driven flow driven by a non-uniform supply of buoyancy across a horizontal forcing boundary achieved by a combination of heating and cooling. Horizontal convection establishes a horizontal flow in a thin boundary layer adjacent to the forcing boundary, and an overturning circulation is completed by way of a diffuse slow-moving return flow outside of the forcing boundary layer. Horizontal convection bears some similarity to global ocean currents, and so this fundamental study considers a second driving mechanism in conjunction with buoyancy, horizontal movement of the forcing boundary, as a model for wind-driven forcing on the flow. We characterize the combinations of Rayleigh number for buoyancy forcing and Reynolds number for mechanical forcing that produce three distinct regimes of behaviour: a forced-convection regime at high Reynolds numbers and low Rayleigh numbers, a mixed regime, and a free-convection regime dominated by Rayleigh number.

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