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Droplet Depinning on Inclined Surfaces at High Reynolds Numbers[1] EDWARD WHITE, Texas AM University, NATASHA SINGH, Indian Institute of Technology, Kanpur, SUNGYON LEE, University of Minnesota — Contact angle hysteresis enables a sessile liquid drop to adhere to a solid surface when the surface is inclined, the drop is exposed to gas-phase flow, or the drop is exposed to both forcing modalities. Previous work by Schmucker and White (2012.DFD.M4.6) identified critical depinning Weber numbers for water drops subject to gravity- and wind-dominated forcing. This work extends the Schmucker and White data and finds the critical depinning Weber number obeys a two-slope linear model. Under pure wind forcing at Reynolds numbers above 1500 and with zero surface inclination, $We_{\text{crit}} = 8.0$. For non-zero inclinations, α, We_{crit} decreases proportionally to $A\,Bo\,\sin\alpha$ where A is the drop aspect ratio and Bo is its Bond number. The same relationship holds for $\alpha < 0$ when gravity resists depinning by wind. Above $We \approx 4$, depinning is dominated by wind forcing; at $We < 4$, depinning is gravity dominated. While We_{crit} depends linearly on $A\,Bo\,\sin\alpha$ in both forcing regimes, the slopes of the the limit lines depend on the forcing regime. The difference is attributed to different drop shapes and contact angle distributions that arise depending on whether wind or gravity dominates the depinning behavior.

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Edward White
Texas A
M University

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