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The Relative Importance of Winds and Ocean Currents in Determining the Drift of Icebergs and Other Floating Objects[1]

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It has been known for decades that Arctic icebergs drift at approximately 2% of the wind velocity relative to the water. Unconstrained sea ice floes have been found to follow a similar 2% drift law. Oil slicks, on the other hand, have been observed to follow a 3% drift law. At a first glance the similarity of these empirical drift relationships may seem surprising, since drag coefficients, densities, and aspect ratios vary greatly between icebergs, sea ice, and oil slicks. Here, we investigate the relative roles of skin and form drag, density, and aspect ratio in determining how an object is driven by winds and ocean currents. Based on theoretical considerations, we find that there are substantial differences in the drift laws for end members of the parameter space (very thin/thick or very light/dense objects). However, for most realistic cases, we show that floating objects should be expected to drift at close to 3% of the wind velocity. This factor arises from the square root of the ratio of the density of air to that of water. Finally, we test our theoretical findings using idealized laboratory flume experiments.

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