Comment on "Steady Wind- and Wave-Induced Currents in the Open Ocean"

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Weber (1983) concludes that when the Ekman depth is much larger than the Stokes depth, the total surface drift can be approximated by summing the classic solutions of Ekman (1905) and Stokes (1847). The method yields a drift which is approximately 3% of the wind speed at 10 m height with a *cum sole* deflection of 23–30 degrees for winds between 5 and 30 m s^{-1}. The 3% rule is consistent with other theoretical treatments and empirical evidence. However, while many studies conclude that the deflection angle is a decreasing function of the wind speed (Samuels *et al.*, 1982; Neumann, 1939; Witting, 1909) according to Weber (1983),

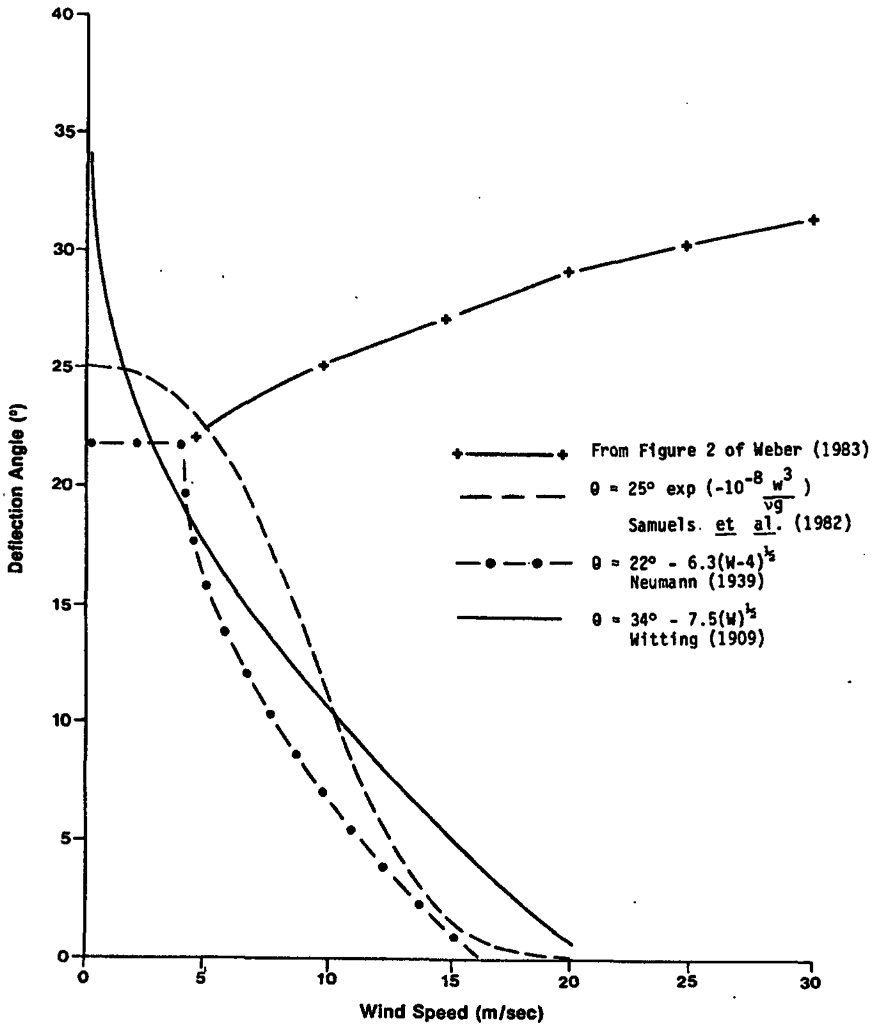

FIG. 1. Wind deflection angle as a function of wind speed for four deflection angle formulas.

the deflection angle is an increasing function of the wind speed (see Fig. 1). The deflection angle presented by Weber (1983) would seem to agree with other wind speed dependent deflection angles only near wind speeds of 5 m s^{-1}.

We think that Weber's results are at variance with those of the other investigators because Weber ignores the contribution of Langmuir circulation to the total wind-induced surface drift. The role of Langmuir circulation is summarized in the recent work by Leibovich (1983) and a treatment of the combined effects of Ekman, Stokes and Langmuir circulations is found in Huang (1979). A review of the numerous studies of wind and wave induced drift by Huang (1979) reveals the poor state of our present knowledge, despite the fact that these studies have received the attention of many distinguished investigators over more than a century.

In our efforts to calculate oil spill trajectories, we have approximated the locally induced current as being 3.5% of the wind speed with a variable deflection angle as presented in Samuels *et al.* (1982) and shown here in Fig. 1. Our work is an attempt to bridge the gap between theory and measurements, and applications. As a practical matter, the calculation of oil spill trajectories relies heavily on empirical relationships that have theoretical arguments as their basis. We recognize the need for a better understanding of the surface-drift current as it is an important factor in determining the trajectory of an oil slick.

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