Abstract View

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Steady Wind- and Wave-Induced Currents in the Open Ocean

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ABSTRACT

Steady wind-drift currents in a deep viscous rotating ocean are studied theoretically. The analysis is based on the Lagrangian description of motion.

A mean wind-stress at the surface yields the traditional Ekman current. In addition, the wind-stress is assumed to contain a fluctuating part which transfers energy to the surface waves and compensates for loss due to viscous dissipation. The induced drift due to such waves is investigated. The wave-drift depends on the eddy viscosity as well as the earth's rotation.

We assume a fully developed sea, and take the eddy viscosity to be proportional to the friction velocity times a characteristic depth. Hence the total current (Ekman current plus wave-induced current) can be expressed as functions of the wind speed. The results show that the magnitude of the total surface current lies between 3.1 and 3.4% of the wind speed at 10 m height for winds between 5 and 30 m s^{-1}. The deflection angle away from the wind direction varies from 23 to 30° in this range of wind speeds.