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On vertical structure of wind-driven sea surface currents

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Results of experimentally study of wind-driven current in the upper 5m sea layer are reported. As found, velocity gradients in the upper layer is much weaker then anticipated from the wall boundary layer analogy. Surface wind drift (identified with the artificial slick drift) in respect to 5 m depth is about 1.5% of the wind speed that is less then expected. In order to interpret the measurements, a model describing effect of wave breaking on wind driven current and turbulence is proposed. The model is based on suggestion on direct injection of turbulence from wave breaking into the near surface layer. Generation of turbulence by wave breaking of different scales (including small-scale breaking) is taken into account through a “volume source” in the TKE balance equation. Momentum losing by wave breaking is accounted for in the momentum conservation equation for wind driven currents. No “artificial” definition of the sea surface roughness scale has introduced. Instead, the subsurface molecular layer is included. The model is consistent with reported and other available experimental data.