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Approximate Stokes Drift Profiles and their use in Ocean Modelling

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Deep-water approximations to the Stokes drift velocity profile are explored as alternatives to the monochromatic profile. The alternative profiles investigated rely on the same two quantities required for the monochromatic profile, viz the Stokes transport and the surface Stokes drift velocity. Comparisons against parametric spectra and profiles under wave spectra from the ERA-Interim reanalysis and buoy observations reveal much better agreement than the monochromatic profile even for complex sea states. That the profiles give a closer match and a more correct shear has implications for ocean circulation models since the Coriolis-Stokes force depends on the magnitude and direction of the Stokes drift profile and Langmuir turbulence parameterizations depend sensitively on the shear of the profile. Of the two Stokes drift profiles explored here, the profile based on the Phillips spectrum is by far the best. In particular, the shear near the surface is almost identical to that influenced by the f^{-5} tail of spectral wave models. The NEMO general circulation ocean model was recently extended to incorporate the Stokes-Coriolis force along with two other wave-related effects. The ECWMF coupled atmosphere-wave-ocean ensemble forecast system now includes these wave effects in the ocean model component (NEMO).