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The $k_h^{-5/3}$ energy spectrum in the open ocean: a new interpretation

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Previously, the kinetic and potential energy spectra in the open ocean on horizontal scales of roughly 100m to 10's of km's have usually been interpreted in terms of inertial internal gravity waves following Garrett-Munk scaling. In particular, many spectra display an approximately $k_h^{-5/3}$ dependence on the horizontal wave number k_h. Based upon theoretical arguments[1,2] and numerical simulations[1,3], we present an alternative interpretation. It is postulated that, under the low Froude number, and high or order unity Rossby number conditions generally holding at these scales, there is a forward cascade of energy to smaller scales, leading to local turbulent patches at scales where the local Froude number is order 1. Using Kolmogorov-like arguments, this leads to horizontal kinetic and potential energy spectra, analogous to the Kolmogorov and Obukhov-Corrsin spectra,

$$E_k(h_k) = C_1 \epsilon_k^{2/3} k_h^{-5/3}, \quad E_p(k_h) = C_2 \epsilon_p \epsilon_k^{-1/3} k_h^{-5/3},$$

where ϵ_k and ϵ_p are the dissipation rates of kinetic and potential energy, respectively. We also present a review of field data, from the early sixties till recent times, to support this hypothesis.

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[2]E.Lindborg, 2006, *J.Fluid Mech.*, In press

[3]J.J.Riley & S.M.deBruynKops, 2003, *Phys.Fluids*, **15**, 2047.