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Dispersion relations of short surface gravity waves over vertically sheared currents from stereo-video measurements

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The stereo-video reconstuction method [Leckler et al. 2015] allows now for the full reconstruction of 3D frequency-wavenumber spectra of short waves. A new field campaign in 2013 on the Katsiveli platform (Black Sea) provided such spectra in various wind and waves conditions, and particularly a stormy event, after which very mature waves had been generated. The short waves energies are found to be mostly located around a dispersion relation of the form,

$$\omega\left(\vec{k}\right) = \sqrt{gk\tanh\left(kH\right)} + \vec{k}\cdot\vec{U}_{\text{eff}}$$

The effective advection velocity [Kirby and Chen 1989] $\vec{U}_{\text{eff}}\left(k\right)$ integrates contributions from both the Stokes drift and quasi-eulerian current [Groeneweg and Klopman 1998]. We find that the effective drift velocity has a very weak wavenumber dependancy, as a result the eulerian current must be vertically sheared. This shear is relevant to the breaking of small scale waves [Banner and Phillips 1974]. It is possible that in field conditions the wind drift is much less important than in the laboratory.

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