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Determining the near-surface current profile from measurements of the wave dispersion relation BENJAMIN SMELTZER, PETER MAXWELL, EIRIK SY, SIMEN ELLINGSEN, Norwegian University of Science and Technology — The current-induced Doppler shifts of waves can yield information about the background mean flow, providing an attractive method of inferring the current profile in the upper layer of the ocean. We present measurements of waves propagating on shear currents in a laboratory water channel, as well as theoretical investigations of inversion techniques for determining the vertical current structure. Spatial and temporal measurements of the free surface profile obtained using a synthetic Schlieren method are analyzed to determine the wave dispersion relation and Doppler shifts as a function of wavelength. The vertical current profile can then be inferred from the Doppler shifts using an inversion algorithm. Most existing algorithms rely on a priori assumptions of the shape of the current profile, and developing a method that uses less stringent assumptions is a focus of this study, allowing for measurement of more general current profiles. The accuracy of current inversion algorithms are evaluated by comparison to measurements of the mean flow profile from particle image velocimetry (PIV), and a discussion of the sensitivity to errors in the Doppler shifts is presented.

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