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A laboratory setup for studying surface waves in the presence of a background shear flow

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We present an experimental setup for studying wave phenomena in the presence of a sub-surface shear current. The setup consists of a pump system flowing water over a 2 x 2 meter transparent plate, where honeycomb flow-straighteners and a curved wire mesh produce a mean streamwise flow profile varying in the vertical dimension while approximately constant in the spanwise direction. A particle image velocimetry (PIV) system is used to measure the velocity profile, and waves produced by a pneumatic wavemaker are measured using a synthetic Schlieren (SS) method. The setup enables the study of the effects of shear currents on wave dispersion, in particular in situations when waves make an oblique angle to the current. We present preliminary results of measured wave phase velocities atop sub-surface shear currents, as well as examples of ship wakes and wave resistance. The results highlight the observable effects of sub-surface shear on waves and the promise for future studies of wave interactions with sheared currents, of interest in a variety of oceanographic applications.