Field measurements of turbulence properties over an algal reef

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Field observations of turbulence in a tidal current bottom boundary layer (BBL) over an algal reef under the influence of onshore spectral waves are presented. Waves and flow velocities were measured by pressure sensors and by an array of acoustic Doppler velocimetries. The observed alongshore shear stress is consistent with the quadratic drag law; the estimated drag coefficient, however, is a factor of 2 to 5 larger than the previous observations over sandy bottom sites. The observed turbulent dissipation rate (TDR) is larger than the recently reported values over sandy bottoms and is comparable to that over coral reefs. The observed TDR does not follow the BBL scaling, and exhibits an absence of local equilibrium with the shear production rate. The observed shear production, however, approximates the BBL scaling, indicating an excess of TDR. In particular, the results reveal that the onshore spectral waves enhance the momentum flux and affect the turbulence properties of the BBL. The differences between the turbulence spectra, cospectra, and ogive curves in the present shallow marine BBL and the atmosphere boundary layer are discussed.