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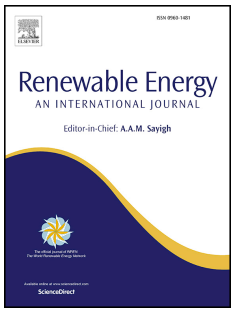

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Rachel M. Horwitz, Alex E. Hay

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Turbulence Dissipation Rates from Horizontal Velocity Profiles at Mid-depth in Fast Tidal Flows

Rachel M. Horwitz[a,*], Alex E. Hay[a]

[a] *Dept. of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada*

Abstract

This study characterizes the turbulence in a 3.6 m s^{-1} tidal channel in the Bay of Fundy, Nova Scotia that has been identified for development as a tidal power resource. A horizontally aimed fast-sampling single beam acoustic Doppler profiler was deployed on a subsurface buoy, and the flow-aligned profile is used to test the cross-spectral (Garbini 1982a,b) and the spatial structure function methods for estimating dissipation rates of turbulent kinetic energy.

Second and third order structure functions computed over separation distances in the mean flow direction vary with spatial scale as predicted by the Kolmogorov hypotheses. Cross-spectra from adjacent spatial bins have a noise floor an order of magnitude lower than the corresponding auto-spectra and phase lags over increasing spatial ranges demonstrate the advection of coherent structures by the mean flow. The spectral and structure function estimates of dissipation rate vary linearly with U^3 and agree to within a factor of 2.5 on ebb and 6 on flood, the spectral estimates being larger. Dissipation rates are an order of magnitude higher on ebb than flood tide, likely due to

*Corresponding author
Email address: rachel.horwitz@dal.ca (Rachel M. Horwitz)