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Measuring turbulent dissipation in the surface boundary layer using a tethered ADCP

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Vertical exchange driven by turbulent mixing is a key process in determining momentum and heat fluxes and material transport pathways in the marine environment. Ability to measure the rate of dissipation of turbulent kinetic energy, (a proxy for mixing), has led to major advances in our understanding of the vertical exchange processes and their parameterization (Burchard et al. 1998; MacKinnon and Gregg 2003; Sharples et al. 2001; Simpson et al. 1996). These advances have largely been based on profile measurements made using free-falling micro-structure profilers. The major drawback of measurements of this kind is that they are labour intensive, require a dedicated vessel and are unable to profile the top of the oceanic boundary layer due to interference from ship wake.

In recent years, acoustic Doppler current profilers (ADCPs) have been increasingly applied to the measurement of turbulent parameters. In this study the structure function method, previously validated for measurements from seabed fixed mounts (Wiles et al. 2006), is applied to measure dissipation in mid-water from an ADCP operating in pulse-pulse coherent mode, mounted below a tethered buoy.

In this configuration the instrument will move around in the flow and experience relative motions which could contaminate the Structure Function. We hypothesise that these flow components should not seriously interfere with the turbulence information. This hypothesis is tested by comparing a series of dissipation measurements from a tethered ADCP with those from a free-falling microstructure shear probe deployed from a nearby research vessel in the Clyde Sea, September 2011, after the passage of a storm. This contribution presents our findings.

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