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Novel approaches to estimate turbulent kinetic energy dissipation rate from low and moderate resolution velocity fluctuation time series

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Evaluation of turbulent kinetic energy (TKE) dissipation rate (ϵ) from the low- and moderate-resolution *in situ* airborne measurements is problematic and scarce. Due to various problems related to e.g. inhomogeneity of turbulence along the aircraft and artifacts related to inevitable aerodynamic problems, estimation of ϵ using the traditional methods such as power spectra or structure functions are complex and far from being standardized. Therefore, we try to introduce alternative methods to increase robustness of ϵ retrievals from such low-resolution airborne measurements. In this study we propose two approaches to estimate ϵ based on the zero-crossing method by Sreenivasan *et al.* (1983). The original formulation requires a fine resolution of the measured signal, down to the smallest dissipative scales. However, due to finite sampling frequency, as well as measurement errors, velocity time series obtained from airborne experiments are characterized by the presence of effective spectral cut-offs. In contrast to the original formulation the proposed approaches are suitable for use with signals originated from such experiments. The fittingness of the new approaches is tested using measurement data obtained during the Physics of Stratocumulus Top (POST) airborne research campaign.

Sreenivasan K., Prabhu A. and Narasimha R., 1983: Zero-crossings in turbulent signals, J. Fluid Mech., 137, 251–272.