Geophysical Research Abstracts
Vol. 15, EGU2013-10780, 2013
EGU General Assembly 2013

Measuring Atmospheric Turbulence with Wind Profiling Radar

Christopher F Lee (1,2)

(1) Department of Meteorology, University of Reading, Reading, UK, (2) Centre for Atmospheric Science, The University of Manchester, Manchester, UK

This study uses over 30 hours of in-situ turbulence observations to validate the spectral width method of turbulence quantification with a UHF boundary layer profiler, and a Mesosphere-Stratosphere-Troposphere (MST) radar. Routine processing of Doppler spectra, used to calculate wind velocities, is found to be inadequate for turbulence quantification; instead, consecutive spectra are incoherently averaged, effectively increasing the observation time of the radar, and dramatically improving measurements where echo powers are weak.
Turbulent kinetic energies, derived from corrected radar spectral widths, are compared to instrumented aircraft and tethered balloon observations, throughout the boundary layer and free troposphere. The comparison shows that simple spectral width corrections are just as effective as the more complicated (and mathematically rigorous) approaches. Averages of corrected spectral width are shown to be representative of the wider turbulent regime, rather than just the air mass directly sampled by the radar. In the boundary layer, spectral width variations at shorter time scales are found to represent the variability of turbulence strength.
Aircraft-radar TKE correlation coefficients (and 95% confidence limits) are 0.83 (+/- 0.03) for the Facility for Ground Based Atmospheric Measurements (FGAM) boundary layer wind profiler, and 0.85 (0.50 – 0.95) for the Natural Environment Research Council (NERC) MST radar used in this study.