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# Influence of Atmospheric Stratification on the Integral Scale of Turbulence and Fractal Dimension

Gregorio Maqueda (1), Manuel Tijera (2), Carlos Yagüe (3), and José L. Cano (1)

(1) Dpto. Física de la Tierra, Astronomía y Astrofísica II, Universidad Complutense de Madrid, Spain (gmaqueda@ucm.es), (2) Dpto. Matemática Aplicada (Biomatemática). Universidad Complutense de Madrid, Spain. (mtijera@fis.ucm.es ), (3) Dpto. Geofísica y Meteorología. Universidad Complutense de Madrid, Spain. (carlos@ucm.es)

In this work the relation between Fractal Dimension and Integral Scale of Turbulence and the type stratification in the flow at lower atmosphere is analysed. Integral Scale corresponds to that in which energy from larger scales with a determinist origin is incoming into turbulent regime. We search the behaviour or relationship between the Integral Scale and the Bulk Richardson number obtained from the experimental data which is one of the most widely used indicator of stability close to the ground in atmospheric boundary layer (ABL) studies. The Fractal Dimension of wind components is a characteristic of turbulent flow as it has been shown in previous works, where its relation to stability was highlighted. Now, the Integral Scale of Turbulence can add a more wide knowledge on turbulent flows. The aim of this work is to quantify the relationship between the Fractal Dimension and the Integral Scale and how this scale varies versus some of the turbulent and stability parameters which will be evaluated.

Data were recorded in the experimental campaign SABLES98 at the Research Centre for Lower Atmosphere, located in Valladolid province (Spain). The place is a terrain quite flat and homogeneous. This allows us to take the approximation of horizontally homogeneous flows, so their statistical properties are independent of horizontal position and they vary only with height and time. A period of eight consecutive days has been studied (from 14 to 21 September 1998). This period has been divided in five minute series obtained from three sonic anemometers (20 Hz) installed at 5.8, 13.5 and 32 m and where used to evaluate the integral scale, fractal dimension and some turbulent and stability parameters as Turbulent Kinetic Energy (TKE), friction velocity and Bulk Richardson number. We have calculated integral scales for horizontal ($u'$) and vertical ($w'$) velocity components where the mean wind direction has been used as framework. In order to estimate the integral scales for several stratification conditions a method has been developed. It has been used the normalized autocorrelation function and the best gaussian fit ($R^2 \geq 0.7$). The obtained values of integral length scales provide a measure of eddy scales in the $x$, or $z$ directions of these turbulent flows. The time evolution of the Integral Scale at three levels above the ground versus the Bulk Richardson number are analysed. Besides we study the behaviour of Integral Scale versus Turbulent Kinetic Energy (TKE) and friction velocity, and the relationship between Fractal Dimension and Integral Scales for different stratifications present in the ABL.