**Supplementary Material**

1. **Data reduction of turbulent flow characterization**

The Reynolds averaged mean velocity components, (*x*, *y*) and (*x*, *y*), in the two orthogonal directions (*x*, *y*) are calculated using over 1500 instantaneous velocity vector fields according to the following equations:

 () = () (S1)

 () = () (S2)

where *n* is the number of image pairs and and correspond to the instantaneous velocity components in the *x*- and *y*-directions, respectively. The magnitude of the mean velocity, *U*, is obtained from:

 = . (S3)

The root-mean-square of the turbulent velocity fluctuations, and are calculated from:

 () = (S4)

 () = (S5)

 = . (S6)

Where and are the longitudinal and transverse mean velocity components, respectively. The turbulence intensity, , is defined as:

 . (S7)

The integral length scale captures the largest eddies containing most of the turbulent kinetic energy. It can be defined as:

 = (𝛿, *t*) d𝛿, (S8)

where either corresponds to the longitudinal ( or lateral ( correlation coefficients defined as:

 =  (S9)

 =  (S10)

 = (S11)

 = (S12)

where 𝛿 is the distance separating two points at which the velocity correlation is examined.

The skewness, (asymmetry), and the kurtosis, *K* (flatness) of a PDF are determined as follows:

 = (S13)

 = (S14)

 = = (S15)

 = (S16)