ADV Part III. Example Velocity Record

A flume experiment is conducted to measure the impact of vegetation on the turbulence of a system. The flow rate and geometry of the flume are known, and the Reynolds number is estimated at about 4000. We want to measure the instantaneous velocity at two points – one upstream of the vegetation and one inside the vegetation – and compare the turbulence intensity at each of those points.

The ADV is set to sample at a rate of 25Hz, so this will provide an essentially instantaneous record of velocity. We take a 5-minute record at each of the points we are interested in. Data is extracted from the binary file using the 'Getvel' command. It can then be imported into a spreadsheet. We now have two velocity records, each containing 7500 data points. First, we calculate the average velocity, $\bar{u}$, simply by taking the average of the 7500 measurements:

$$\bar{u} = \frac{1}{N}\sum_{1}^{N} u_i \qquad (2)$$

where N is the total number of measurements (in this case 7500), and u_i is an individual velocity measurement. Next, we calculate u_{rms}, which is a measure of how much the individual velocity measurements fluctuate from the mean, $\bar{u}$ (u_{rms} is therefore a measurement of turbulence strength).

$$u_{rms} = \sqrt{\frac{1}{N}\sum_{1}^{N} (u_i')^2} \quad \text{where} \quad u_i' = u_i - \bar{u} \qquad (3), (4)$$

Now, we can compare the turbulence intensity, $u_{rms}/\bar{u}$, at each of the two points to get an idea of how vegetation impacts turbulence in this experiment. A sample graph of an ADV record is show in *Figure 4*.

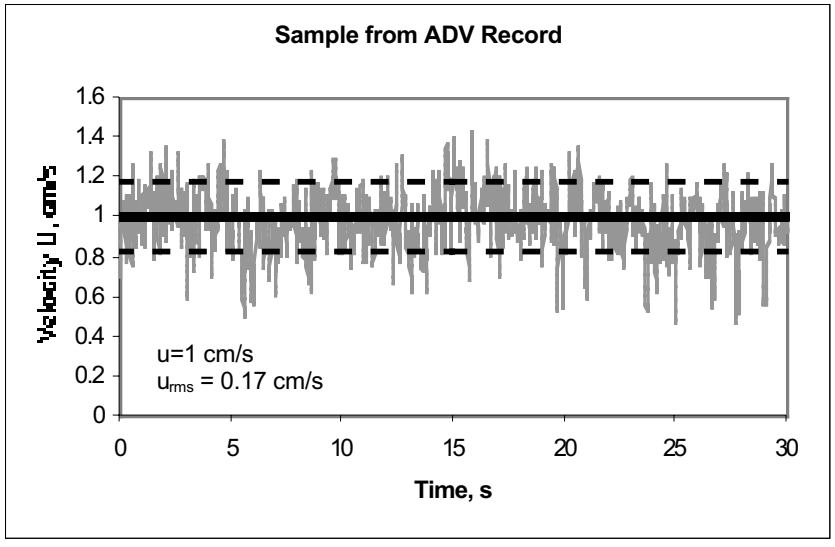

Figure 4: Sample from an ADV record. This 30-second sample from a real ADV record shows the average velocity and the root-mean-square velocity for this duration.

M. Palmer 2002