The simulation of non synoptic effects for wind damage studies

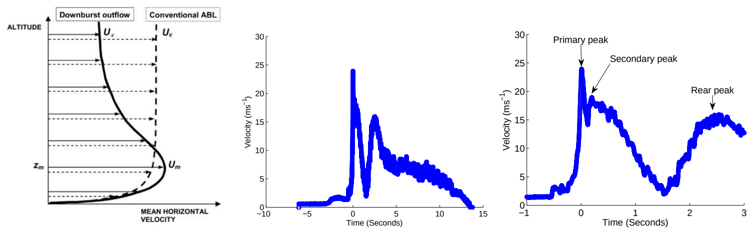
Matthew Haines, Mark Sterling, Andrew Quinn

School of Civil Engineering, University of Birmingham, Edgbaston, Birmingham, UK, B15 2TT

1 Background

It is now an accepted fact that the disruption and economic losses arising as a result of extreme storms are increasing at a significant rate , (ABI, 2005). There is also tentative evidence to suggest that these storms are increasing in frequency and magnitude due primarily to climate change effects, although it is acknowledged that such evidence is far from conclusive, (Kasperki, 1998). In European terms, it is predicted that by 2080, there will be an increase in "wind-related insured losses from extreme European storms by at least....€25-30bn", (ABI, 2005) . It is perhaps worth noting that these estimates do not take into account society's increasing exposure to extreme storms.

Within the last few years, thunderstorm downburst type events have received considerable interest (Chay and Letchford (2002), Lin and Savory (2006), McConville et al. (2009)). Figure 1a illustrates that severe thunderstorms can produce a streamwise velocity distribution which differs from the typical boundary layer flow used for existing building codes.



(a) Vertical downburst profile (b) Full velocity-time history (c) Looking at peaks in more detail

2 Work to be presented

McConville et al. (2009) used the Birmingham simulator to primarily look at the structure of a downburst produced by a stationary impinging jet. Probes were also attached to a translating rig to approximate a translating impinging jet set up. It was found that the translating probe set up produced results more closely corresponding to a real world downburst event. However, results from the translating rig experiments were limited, the current work builds on those experiments.

The full paper will examine the velocity flow field of the thunderstorm downburst simulator, primarily in the streamwise direction of the flow. Figure 1b illustrates a snapshot of data collected at the centre of the impingement zone. The results show a reasonable similarity to the Andrew's air force base downburst event, (Fujita, 1985), including a secondary peak immediately proceeding the primary peak which is illustrated in figure 1c. A hypothesis behind the formation of this secondary peak will also be presented with data from the simulator helping to reinforce this idea.

In addition, the results of a pressure tapped $20mm \times 20mm \times 250mm$ "high rise" building placed in the downburst flow will be examined. This structure outlined will have an array of at least twenty pressure taps situated around the structure to collect data on the pressure field around a high rise building during a downburst event. These will then be used to calculate potential wind loadings on the structure which will then be compared with expected values from an atmospheric boundary layer case.

References

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