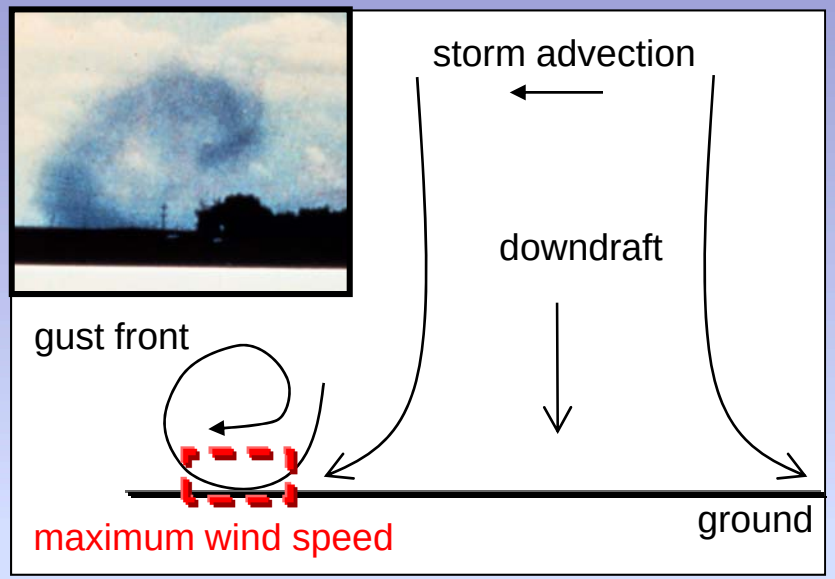
DOWNDRAFT OUTFLOW SIMULATION – MEAN WIND SPEED CHARACTERISTICS

Background

A novel experimental facility was implemented to simulate a downdraft outflow. Time-resolved wind speed was measured with HWA. Field observations of a 2002 event in Texas were provided by meteorologist colleagues.



Main features of a downdraft outflow (inset photo by B. Waranauskas)

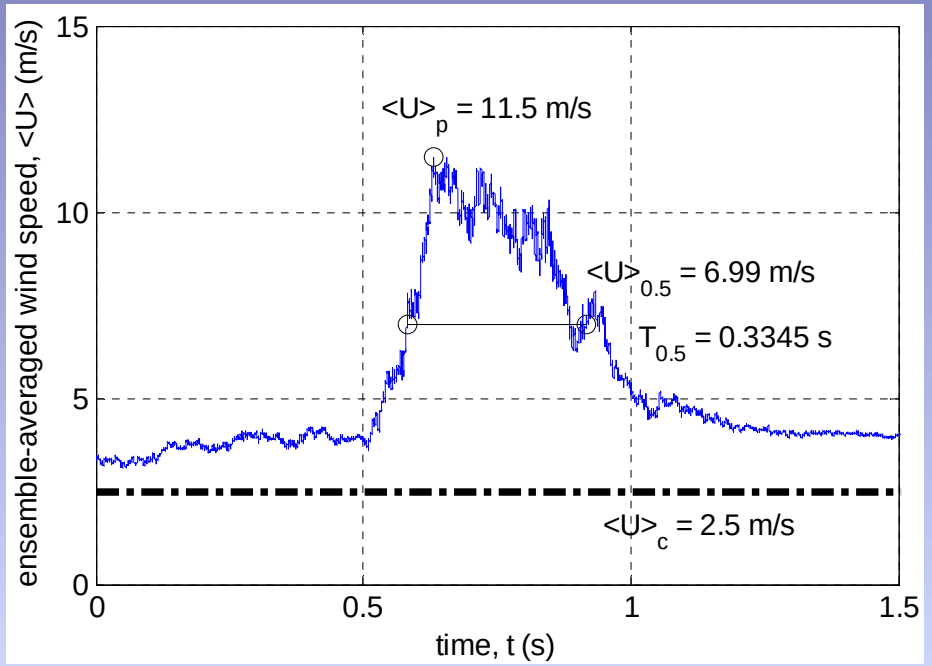
Visualization of the simulated gust front (1/15 seconds between frames)

Objective

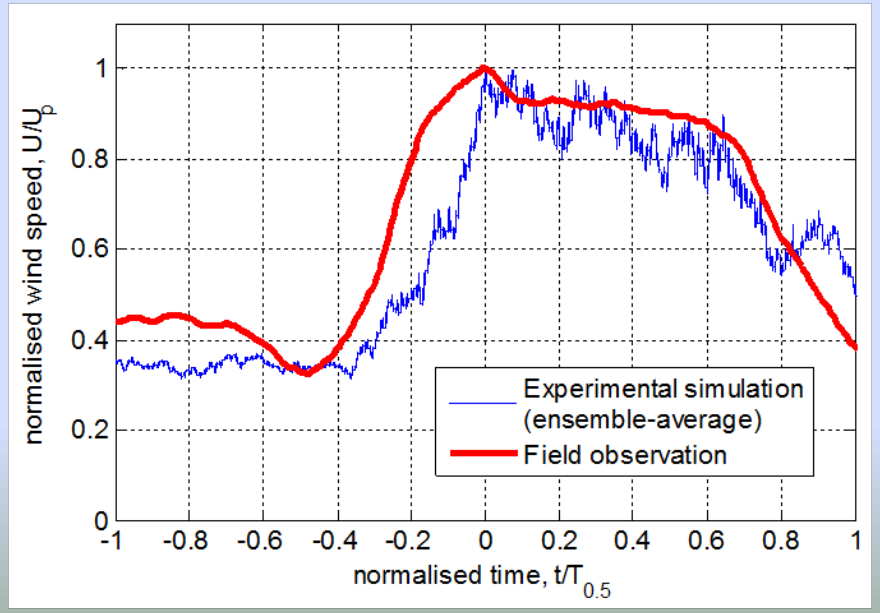
Validate simulated wind speed histories with field data. Estimate length scaling of the simulation.

Research Carried Out

Averaging is applied to the wind speed records to filter out fine scale fluctuations. A horizontal length scale is estimated from the half-duration ($T_{0.5}$) and peak velocity (U_p) of the remaining mean component.



Simulated time-varying mean wind speed



Wind speed history comparison

Key Findings

The main characteristics of a downdraft outflow are reproduced in the new lab facility. The coarse structure of the simulated flow is about 1200 times smaller than that of the 2002 Texas event.