Modelling Wind Tunnel Drift Measurements

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Abstract

Wind tunnels have been used by a number of researchers to evaluate the risk of pesticide drift contamination from boom sprayers (eg Walklate et al 2000, Buttler Ellis and Bradley 2002, Taylor 2002). These typically determine the vertical drift distribution at a distance of 2m downwind of a single nozzle operated at controlled conditions and the horizontal drift distribution from 2m to 7m downwind. Spray drift is often collected on 2mm diameter polythene lines. A typical layout is shown in Figure 1.

A droplet trajectory model of the wind tunnel drift measurements is currently being developed based on the ballistic model used by Mokeba (1997) and Cox (2000). A sample of the graphical output from the preliminary model is shown in Figure 2. It is proposed that the model will eventually incorporate factors such as the initial droplet size and velocity, entrained air, vortex generated by the spray plume, boundary effects due to the wind tunnel, droplet evaporation and wind tunnel characteristics.

Drift was measured in the 1.75 m wide, 1.75m high and 10m long working section of the wind tunnel located at the University of Queensland, Gatton Campus and the results compared to the preliminary model predictions.

Drift values predicted by the preliminary model for 2m downwind from the nozzle is similar to experimental measurements, particularly with 11003 nozzle (Figure 3). There is however a tendency for the preliminary model to slightly over predict the deposit close to the wind tunnel floor and under predict the deposit at heights close to the nozzle height. The small droplets also tend to remain in a relatively narrow core near the centre of the wind tunnel. The influence of spray induced vortices, based on the approach used by Parkin (1996), is currently being added to improve the preliminary model. Further experimental work is also planned to validate the assumptions used in the vortex model component.

References

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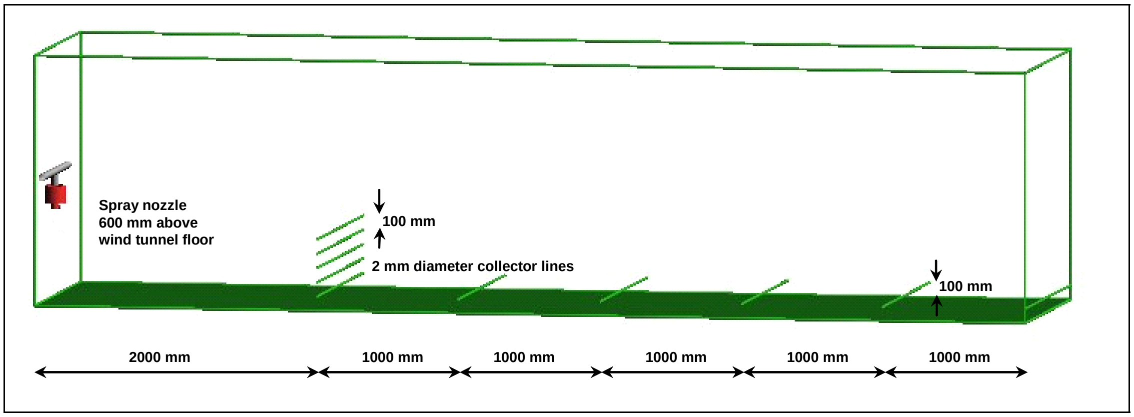

Figure 1. Wind tunnel layout for drift measurement.

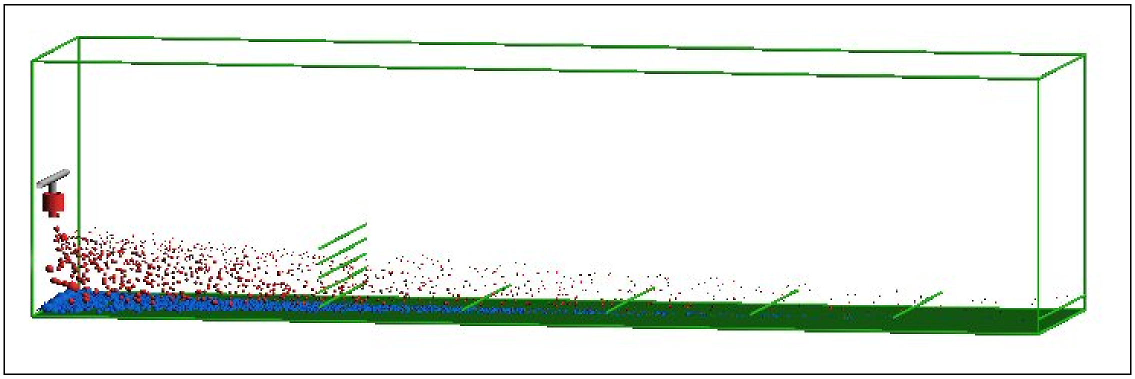

Figure 2. Graphical model output showing droplet trajectory.

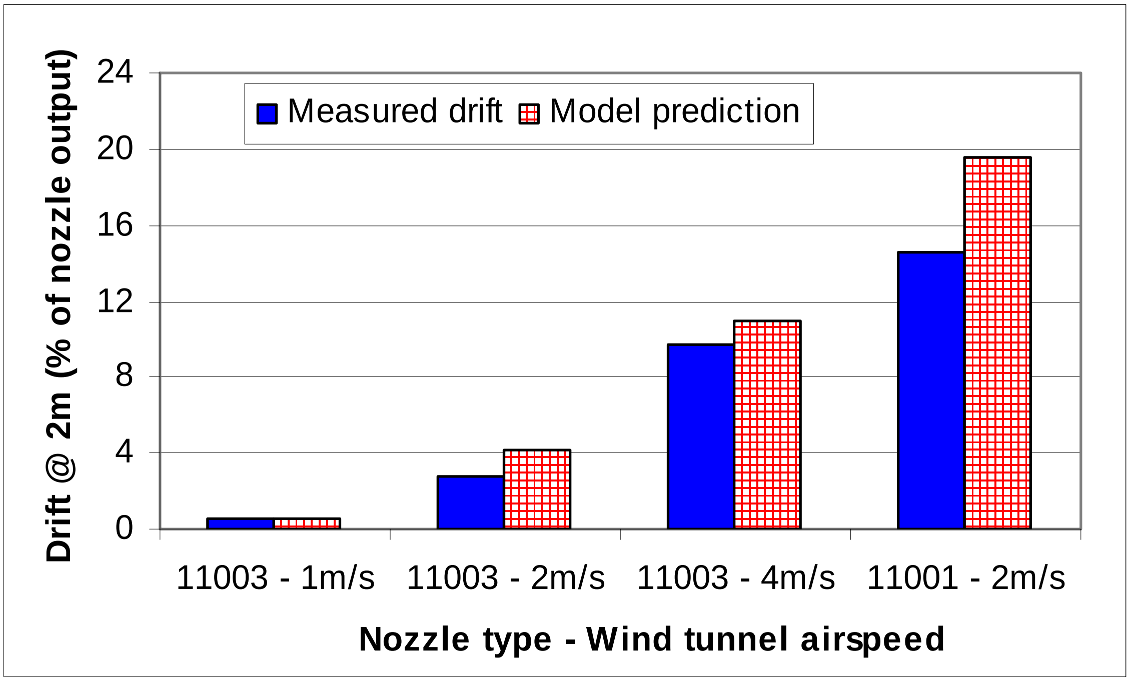

Figure 3. Comparison of wind tunnel measurements and preliminary model prediction of drift 2m downwind from a single stationary nozzle.