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The Thermal Plume above a Standing Human Body Exposed to Different Air Distribution Strategies

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The Thermal Plume above a Standing Human Body Exposed to Different Air Distribution Strategies

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A breathing thermal manikin was placed in a full-scale test room. Long-time average air velocity profiles at locations closely above the manikin were taken to identify the wandering thermal plume with different ventilation conditions.

Key findings

- The plume is more concentrated without ventilation. The plume shows more wandering with mixing ventilation.
- The plume strength is much weaker with displacement ventilation.

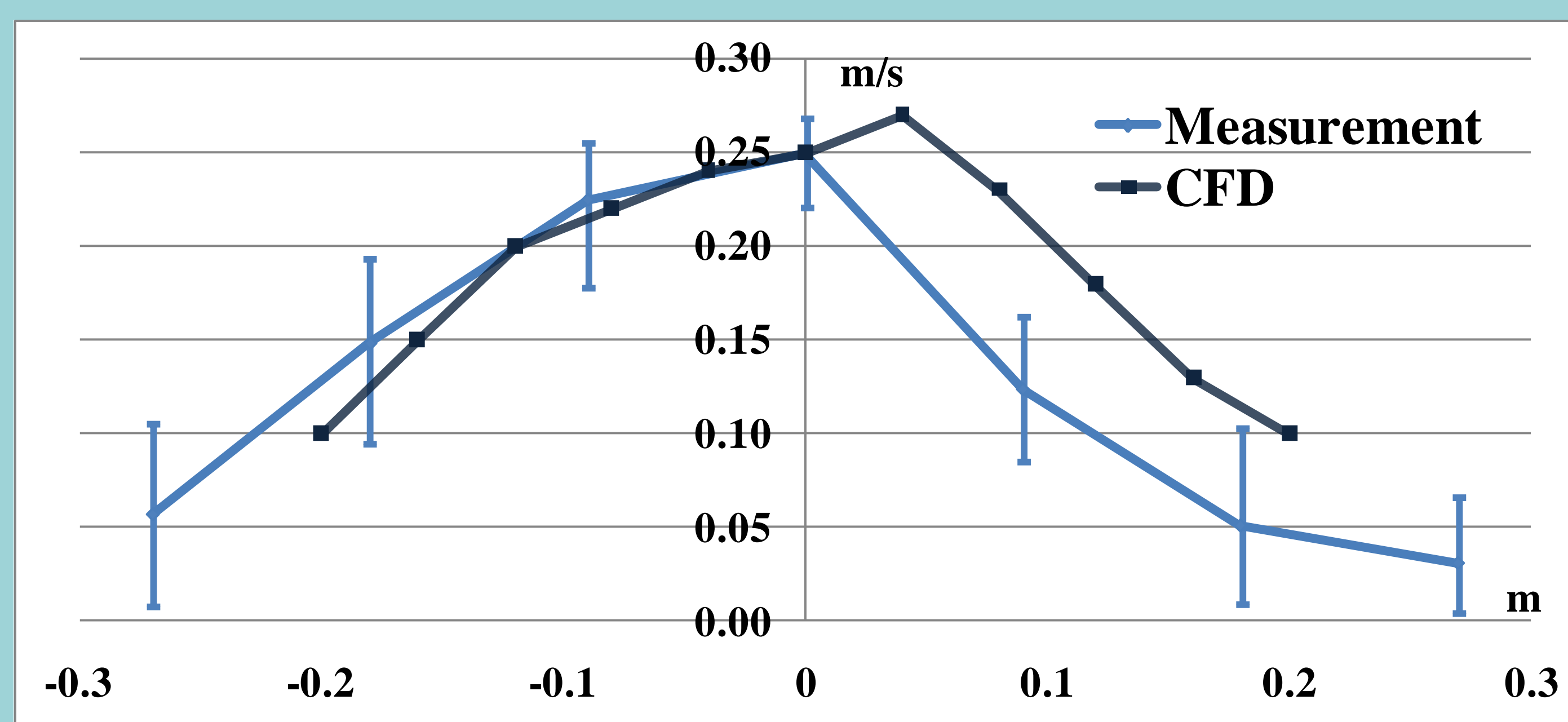


Full-scale test room
3.17 m (L) × 2.64 m (W) × 2.93 m (H)



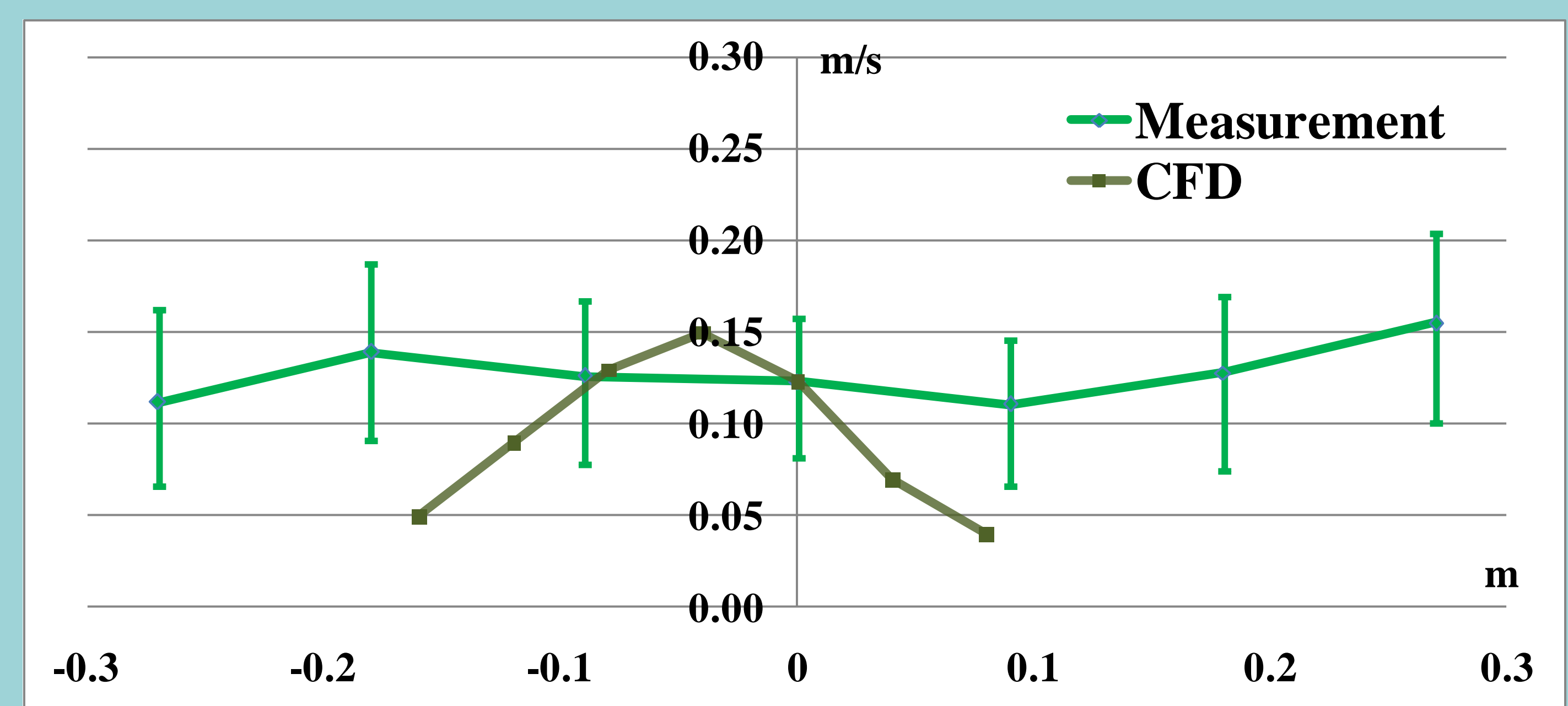
Breathing thermal manikin and
location of sensors

No ventilation



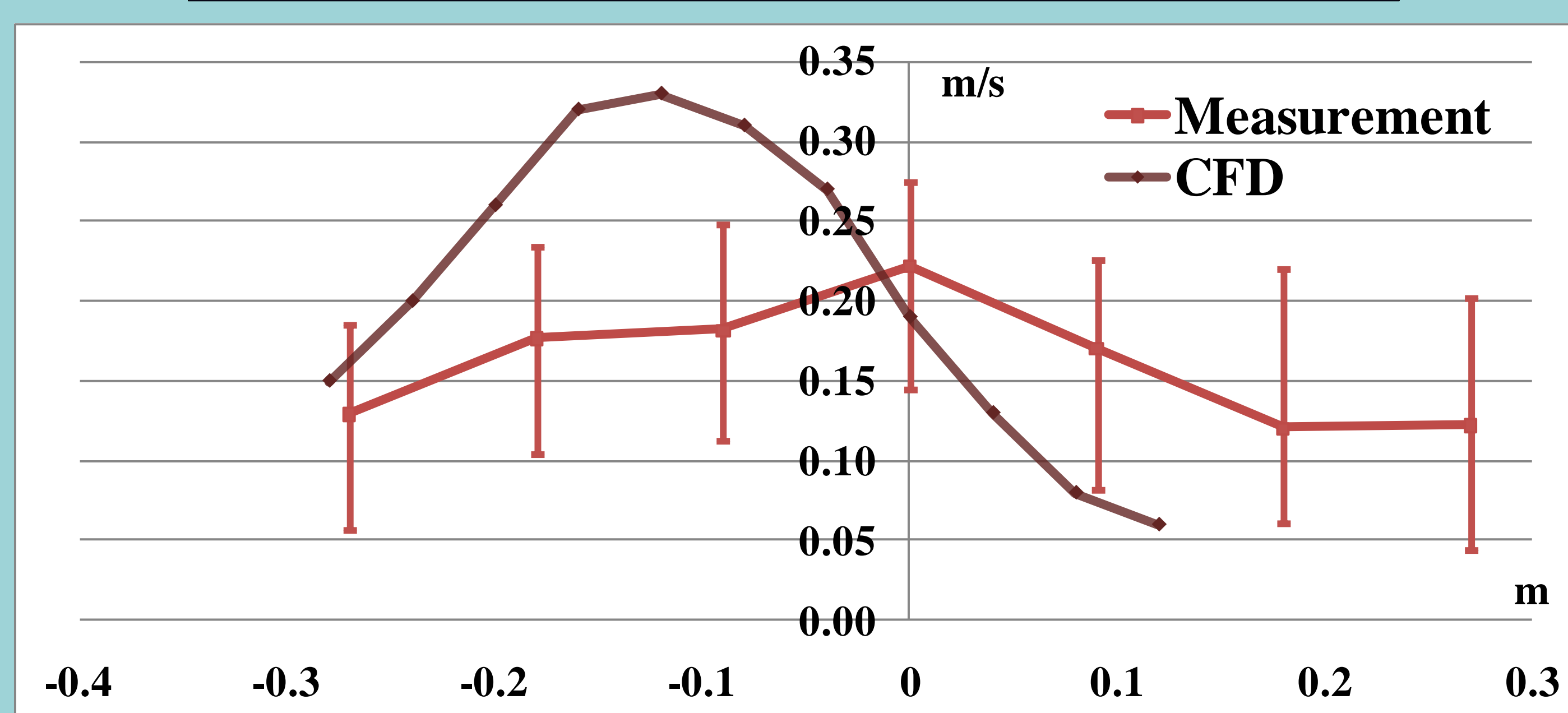
With no ventilation, the temperature in the room was 22 °C. The maximum velocity is 0.25 m/s above head. The standard deviation profile indicate s that the plume far away from the center is quite weak, due to plume wandering.

Displacement ventilation



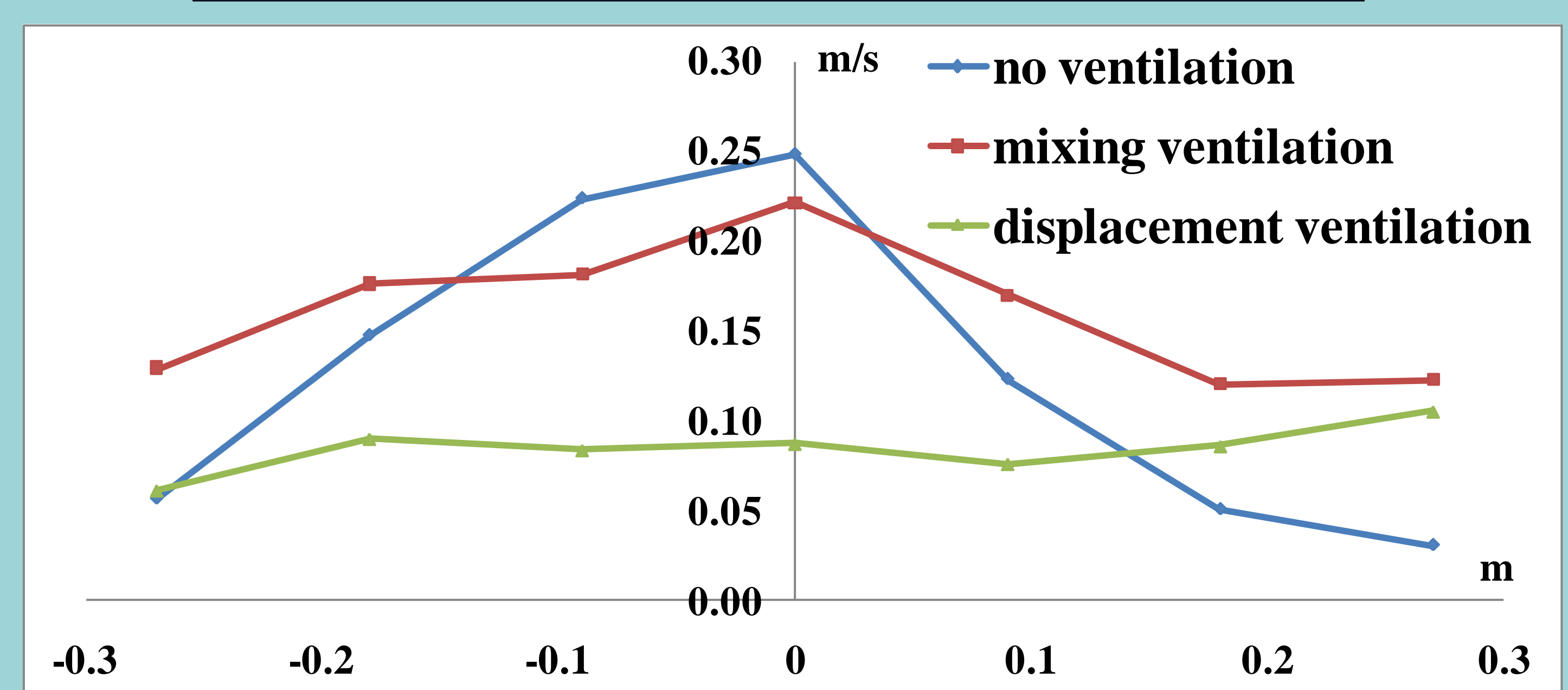
With displacement ventilation, the temperature difference between floor and ceiling was 5.3 °C. The velocities are almost constant (0.13 m/s) at all locations, about a half of the measured peak velocity in other two situations.

Mixing ventilation



With mixing ventilation, the mean temperature was 20.8 °C. The maximum velocity is 0.22 m/s and occurred above head. The standard deviation is nearly the same for all locations.

Comparison



The average velocities at every location with different ventilation systems